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ABSTRACT

Massachusetts is one of the US states at the forefront of carbon emission reduction policy, and has the potential to model success to the rest of the country. The state’s Global Warming Solutions Act (GWSA) passed in 2008, two years before federal climate legislation floundered in the U.S. Senate. This legislation committed the state to reducing carbon emissions 25% below 1990 levels by 2020 and 80% by 2050. However, progress toward these targets has been uneven, particularly when it comes to transportation and land use. Despite aggressive goals, the number of vehicle trips, the number of vehicle miles traveled (VMT), and the carbon emissions from passenger vehicle trips are all projected to increase over the next several decades.

What will it take to put Massachusetts on track to meet its vehicle emission reductions targets? Many of the state’s environmental advocates are uniting behind a potential new policy, a revenue-neutral carbon tax or carbon fee. This policy would levy an additional fee on fossil fuel consumption, but would distribute the revenue back to the state’s residents instead of adding it to the state budget. This thesis explores the political, technical, and equity-based considerations that must be addressed to make this policy framework a success. Through spatial analysis of passenger vehicle driving patterns in the state of Massachusetts, a case study of British Columbia’s successful revenue-neutral carbon tax, and analysis of the current political landscape in Massachusetts, I conclude that environmental advocates should reconsider their decision to advocate for a state level revenue-neutral carbon tax. At first glance, this policy seems elegantly workable—economist-approved, politically savvy, and equity-conscious. A closer look, however, reveals some serious flaws that are likely to render it at best a huge expense of political capital for limited results. Worse, this policy might actually undermine the case for a nationwide carbon tax.

Thesis Supervisor: Judith Layzer, Professor of Environmental Policy
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INTRODUCTION

The last few years have taught environmental advocates just how challenging enacting effective climate policy can be. In the aftermath of a failed national climate bill, journalists, academics, and members of the environmental movement have covered reams of paper with buckets of ink, documenting and debating the failures of the environmental movement’s political and outreach strategies, the dysfunction of federal legislative bodies, and the technical inadequacy of proposed policies to reach emissions reduction targets. Many of the main proponents of federal climate legislation have re-focused their attention on regional, state, and local policy arenas, in the hopes of building momentum for national action.

Massachusetts is one of the states at the forefront of carbon emission reduction policy and has the potential to model success to the rest of the country. The state’s Global Warming Solutions Act (GWSA) passed in 2008, two years before federal climate legislation floundered in the U.S. Senate. The new state law committed the state to reducing carbon emissions 25 percent below 1990 levels by 2020 and 80 percent by 2050. Five years into the implementation of the GWSA, however, progress toward these goals has been uneven, particularly when it comes to transportation and land use. The number of vehicle trips, the number of vehicle miles traveled (VMT), and the carbon emissions from passenger vehicle trips are all projected to increase over the next several decades, as the Boston metro region continues to attract employment and new residents. At a recent public meeting on the next 30-year regional Long-Range Transportation Plan, the head of the technical staff of Boston’s Metropolitan Planning Organization commented that given current development
plans and demographic information, they project four new car trips in the metro region for every one new non-motorized trip (Quackenbush, 2015).

All the data demonstrate that existing efforts to curb those emissions are insufficient and new policy that targets driver behavior is necessary. But if technical understanding of carbon emission trends were sufficient to identify viable policy solutions, we would already have federal climate legislation. Given this reality, what kind of policy can put Massachusetts on track to meet its vehicle emission reductions targets? This is the central question motivating this thesis, and a current urgent topic of conversation among environmental advocates and their allies in the state legislature.

I argue that a workable policy as one that has three attributes. First, it must be effective—it must make a significant contribution to carbon emission reductions in the transportation sector, ideally between 1 and 2.6 million metric tons. Second, it must be practical—able to be enacted and implemented before 2020, the year of the first major GWSA deadline. And third, it must be equitable—sensitive to potential disproportionate impacts on the state’s low-income residents, especially those who live in car-dependent suburban and rural areas. A framework that is fair and technically-sound is only an academic exercise if it can’t be implemented. Likewise, a policy that is effective and easily implemented but ignores its impact on marginalized communities is not only unethical but also fundamentally unsustainable in the long run. And a policy that is politically expedient and equitable but technically inadequate is at best symbolic and at worst a waste of precious time and resources.

Although there are many potential policy approaches to addressing this problem, one particular framework has significant and increasing support from the state’s major
environmental organizations: a revenue-neutral carbon tax. This policy would levy an economy-wide additional fee on fossil fuel consumption, but would distribute the revenue back to the state’s residents instead of adding it to the state budget. While a carbon tax would impact all fossil fuel consumption, not just gasoline use, for the purpose of this thesis I will focus on its potential effects on VMT and the transportation-related political and equity considerations and challenges associated with this type of policy.

One of the critical design parameters of the revenue-neutral carbon tax is the structure of the rebate. Should the revenue be distributed equally among all the state’s households? Are there some people who should receive more money than others, based on income or location? These choices could have significant, and sometimes conflicting impacts on the dimensions of workability. I examine three possible rebate designs from a spatial perspective to highlight and compare these impacts. Building on this spatial analysis, a case study of the only successful implementation of this policy so far (in British Columbia), and analysis of the current political landscape in Massachusetts I conclude that environmental advocates should reconsider their decision to advocate for a state level revenue-neutral carbon tax. At first glance, this policy seems elegantly workable—economist-approved, politically savvy, and equity-conscious. A closer look, however, reveals some serious flaws that are likely to render it at best a huge expense of political capital for limited results. Worse, this policy might actually undermine the case for a nationwide carbon tax.

All too often, the competing actors in policy debates focus on different dimensions of workability, and people and groups who could be allies end up talking past one another. Advocates accuse academics of ignoring the realities of the political climate. Academics and
left-wing environmentalists dismiss the outcomes of political compromise as, at best, half measures or symbolic victories. Marginalized communities, if they can even make themselves heard in these conversations, point out how the political and technical calculus overlooks the ways in which proposed policies perpetuate a long history of systemic oppression. Such arguments are not unique to environmental issues. A secondary goal of this thesis, then, is to conduct a more holistic type of policy analysis that gives equal emphasis to technical effectiveness, political feasibility, and social justice in the hopes of arriving at more creative and workable policy proposals in a more transparent way.

THE CASE FOR ACTION: VEHICLE EMISSION TRENDS IN MASSACHUSETTS

In 2010, the average car registered in the state of Massachusetts covered 10,500 miles, more than it would take to travel from Boston to Anchorage, Alaska and back (Metropolitan Area Planning Council 2014). According to the Massachusetts Department of Environmental Resources, the transportation sector as a whole produced 30 million metric tons of carbon dioxide (CO2), making it the state’s largest source of carbon emissions. The strategies for meeting the 2020 targets in the Massachusetts Global Warming Solutions Act include reducing carbon emissions from transportation by 7.4 million metric tons, 29 percent of total planned emission reductions (see Figure 1).

As is apparent in Figure 2 below, nearly half of the planned reductions in transportation emissions come from new federal fuel economy standards for passenger cars and medium- and heavy-duty vehicles, policies that the state has no control over or role in implementing. The plan also includes planned reductions from a federal renewable fuel standard and a regional low-carbon fuel standard. The five-year progress report
acknowledges that the essentially free emissions reductions from the fuel economy standards are the "primary success story in this sector to date" (Massachusetts Executive Office of Environmental Affairs 2014, 57). The report also acknowledges the danger of relying on reductions from policies at higher levels of government, as renewable fuel policies at the federal level and through the Northeast States for Coordinated Air Use Management (NESCAUM) have stalled.¹

Figure 1. Strategies for Reducing Massachusetts GHG Emissions by 2020

2020 GHG Emission Reduction Targets


¹ Plans for an 11-state Northeast and Mid-Atlantic Low Carbon Fuel Standard began in 2009 but have been on hold since 2011, after a change in political leadership of several NESCAUM states (Pennsylvania, Maine and New Jersey). The emission-reduction potential of biofuels in general has become increasingly uncertain given ongoing technological and financing challenges preventing cellulosic biofuel facilities from producing at scale.
Figure 2. Emission Reduction Targets in the Transportation Sector

2020 GHG Emission Reduction Targets:
Transportation and Smart Growth/Land Use

<table>
<thead>
<tr>
<th>Target Description</th>
<th>CO2e (MMT)</th>
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<tr>
<td>2020 GHG Emission Reduction Targets:</td>
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<td>Transportation and Smart Growth/Land Use</td>
<td>0.3811</td>
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<td>Smart Growth Package</td>
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<td>Federal Renewable Fuel Standard (RFS)</td>
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<td>Federal Emission Standards and Fuel Efficiency Standards for Medium and Heavy-Duty Vehicles</td>
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<td>Clean Car Consumer Incentives</td>
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The other state-level initiatives that were part of the GWSA's original implementation strategy have been slow to get off the ground or have been abandoned altogether. The Clean Car Consumer Incentives have made the most progress. There are two programs currently operating, the Mass Electric Vehicle Incentive Program (EVIP) program, which provides incentives for municipalities and workplaces to install electric vehicle charging stations, and the Massachusetts Offers Rebates for Electric Vehicles (MOR-EV) program, which offers rebates to consumers who purchase electric vehicles (Massachusetts Executive Office of Environmental Affairs, 2014). The Smart Growth Package involves updating statewide planning and zoning statutes to encourage more
compact development. Legislation to reform these statewide policies has yet to make it through the Massachusetts legislature.

Green DOT, the main sustainability initiative of the Massachusetts Department of Transportation (MassDOT), is similarly in early phases of implementation.\(^2\) As MassDOT administers the funding for the state's transportation construction projects, it has the ability to incorporate sustainable road design practices into its plans and prioritize transportation investments that reduce carbon emissions from transportation. GreenDOT launched in 2010, less than a year after the formation of the department, and its priority level has fluctuated based on the attention of the MassDOT secretary. The outgoing secretary of transportation, Richard Davey, set a goal of tripling the number of miles traveled by bike, transit, and walking (from 2 billion to 6 billion) by the year 2030 (Jessen, 2012), but it remains to be seen whether the new administration will continue those goals.

The biggest setback to the original implementation plan of the GWSA is the failure of the Pay as You Drive Auto Insurance program. This initiative, which would have involved working with insurance companies to charge drivers insurance premiums depending on the number of miles driven, was supposed to account for nearly one million metric tons of carbon emission reductions by 2020, and even more significant reductions by 2050. However, this program ran into legal challenges and never got off the ground.

In addition to the failure of several state-level programs to deliver projected emission reductions, there are a number of demographic and development trends that are likely to erode the “free” gains from federal fuel economy standards. Some of this increase

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\(^2\) MassDOT itself is a fairly new state agency created from combining the office of Transportation and Public Works, the Massachusetts Turnpike Authority, the Massachusetts Highway Department, the Registry of Motor Vehicles, and the Massachusetts Aeronautics Commission.
in VMT is driven by the fuel economy standards themselves, through the so-called “rebound effect,” in which money saved through paying less per mile results in people driving more miles than they otherwise would have. The magnitude of the fuel efficiency rebound effect remains the topic of intense scholarly debate, with estimates ranging between a 0.1 and a 0.8 percent increase in miles traveled for each 1 percent increase in fuel efficiency (Linn, 2013).

Even under land use scenarios that anticipate new compact development in metro Boston as opposed to greenfield suburban development patterns, VMT and carbon emissions are anticipated to increase above 2005 levels, let alone 1990 levels. A recent study attributed this growth to migration to the region from outside the state and to the fact that the densest parts of the region with the lowest average VMT have limited potential for new development (Ferreira, Diao, & Xu, 2013). The authors concluded that “urban growth management alone will most probably not save enough [greenhouse gas] emissions to assist the state in meeting its emission reduction targets” (658).

In addition, the resurgence in popularity of city living is a double-edged sword with respect to vehicle ownership and vehicle emissions. While people living in dense urban areas are less likely to drive long distances, increased housing prices in center cities are putting pressure on low-income households to move increasing distances from the city center. Although a recent analysis of Metro Boston’s poverty rates determined that the majority of poor residents still live in the region’s definitively urban municipalities, there has been a shift in urban poverty from the densest, most urbanized communities to the near-in “predominantly urban” streetcar suburbs and sub-regional urban centers (Reardon, 2013)
Even if the suburbanization of poverty isn't yet a critical concern, the influx of higher income people to transit-accessible urban areas may not have the dramatic impact VMT that transit-oriented development advocates hope it will. MAPC analysis of 2010 census data (figure 3) reveals that 90 percent of non-low income urban households in the Boston metro region have at least one car, compared to less than half the extremely low income urban households. In fact, on average, middle class and wealthy urban households own more cars than extremely low- and very low-income suburban households. A 2010 report from the Dukakis Center found that vehicle ownership in transit-rich neighborhoods increased as median household income increased, and at much higher rates than in the city as a whole (Pollack, Bluestone, & Billingham, 2010). These statistics suggest that if current trends continue, not only are average miles traveled likely to increase in cities, but increasing numbers of low-income households are likely to locate farther from public transportation and bear burdensome transportation costs.

Figure 3. Vehicle Ownership by Income and Rural/Suburban Town Type for Households in Metro Boston

Source: Metropolitan Area Planning Council. (N.d.) Analysis of 2010 Census Public Use Microdata Sample.
The combination of the fuel efficiency rebound effect, slow progress on state-level transportation emission reduction policies, and regional population and development trends means that additional policy is desperately needed if Massachusetts wants to meet the GWSA targets. In order to be technically effective, this policy should deliver a minimum of 1 million metric tons of CO2 equivalent emission reductions. This level of emissions reduction would counterbalance the abandoned Pay as You Drive program, the single-largest chunk of GWSA implementation that has not gone according to plan.

Given the well-documented link between suburban sprawl and vehicle use, it is tempting to conclude that the state should double down on land use policies that increase denser development patterns. Unfortunately, the state government has only limited power to influence land use and development patterns. What power it does have mostly involves enabling and encouraging municipalities to take action. Massachusetts has already updated road design guidelines to encourage “complete streets” and administers a Safe Routes to School program aimed at helping municipalities to increase active transportation among school-age children. While there is certainly much more that municipalities can do to improve non-motorized accessibility, it is not clear what new state level initiatives in addition to the smart growth would be particularly effective.

There is a role, however, for state policy that directly targets vehicle ownership and driving behavior. The scale of necessary emission reductions means that drivers across the state need to reduce their VMT. Even if the city of Boston cut its aggregate VMT in half, it would only reduce annual CO2 emissions by 400,000 metric tons. It would take the same magnitude of reductions in VMT in each of the state’s 10 most populous towns to break 1 million metric tons of emission reductions.
A POLICY SOLUTION (AND ITS DISCONTENTS)

“Everyone always says if you have 100 economists in a room, you’ve got 100 different opinions about what policymakers should do. A carbon tax is the one issue we all agree on, and everybody ignores us.” – Chris Knittel, MIT economist (Armstrong, Barrett, & Knittel, 2015)

Ask the next economist you meet what the best policy to reduce automobile use is and he or she will almost certainly tell you to raise the gas tax or implement a carbon tax. There are no shortage of white papers, blog posts, and articles by economists criticizing recent rounds of fuel economy standards on the grounds that such regulations are costly, indirect, inefficient, and insuffficiently transparent when compared to a carbon tax (Dolan, 2011; Gillingham 2013; Parry, Evans, & Oates, 2010; Porter, 2012 to name a few).

Economists argue that gas taxes and carbon taxes address the problem of extravagant fuel consumption in an efficient and systemic way by targeting the actual source of negative externalities and giving consumers a range of possible responses. A driver facing an increase in the price of gas can purchase a more efficient vehicle, carpool with family and coworkers, move to a transit-accessible neighborhood, or commute on foot or by bicycle, depending on the individual’s utility functions. A behavioral economist would add that the extraordinary salience of gas prices (what other commodity’s price screams from enormous signs on every major roadway and is the subject of regular national headline news?) distorts people’s perceptions of the magnitude of a gas tax, causing them to make an even greater effort to reduce fuel consumption (Li, Linn, & Muehlegger, 2012).

There is a substantial amount of empirical data to back up economist’s claims that changing the price of gasoline has a big impact on fuel consumption and VMT. According to a survey of 100 studies, 10 percent increase in the price of gasoline results in a 2.5 percent
decrease in fuel consumption within a year and a 6 percent decrease after 5 years (Goodwin, Dargay, & Hanly, 2004). Reduction in VMT is only one piece of that reduction in gasoline use (the same meta-analysis found that traffic volume falls by 1 percent in a year and 3% within 5 years), since consumers may decide to invest in more fuel-efficient vehicles instead of driving less.

However, consumers may also behave in ways that blunt or complicate the impact of a carbon tax. If gas prices are substantially cheaper nearby, (New Hampshire, for example) drivers may simply purchase their fuel elsewhere. In addition, wealthier households are more sensitive to changes in the price of gasoline than poorer households, though the wealthiest households (those making more than $125,000 per year) are less responsive than those with $75,000 to $100,000 per year (Gillingham, 2014). Low-income households tend to be the least sensitive to increases in gas prices, presumably because they do comparatively little discretionary driving. As with most consumption-based taxes, a carbon tax has the potential to be regressive, disproportionately impacting people who are the least able to change their behavior.

Much of the economics literature on gas and carbon taxes is suffused with a mix of willful disregard for and barely-disguised exasperation with the policy’s bad politics. Usually the authors will include a sentence that acknowledges the political landscape, like “the prospects for serious consideration of a new tax are poor” (Paltsev et al., 2014) or “a new higher gas tax may be politically unlikely” (Feng, Fullerton, & Gan, 2005) before returning to full-throated advocacy of said tax. Despite widespread support for a carbon tax in the environmental movement, many federal environmental policy advocates will privately concede that a federal carbon tax on fuel is politically dead on arrival in the
current political climate and view each new report quantifying the superiority of these policies as hopelessly naïve and potentially dangerous. It’s little wonder they have this reaction, when opponents of any form of climate change policy focus on economists’ criticisms of fuel economy standards and cap-and-trade systems and ignore the fact that they're usually criticizing them in comparison to a carbon tax. Gas taxes face similar political challenges and policymaker aversion. In Massachusetts, public figures with long histories of advocating for increasing gas taxes, like former state secretary of transportation Jim Aloisi now say that these policies are “politically poisonous” (Lyndon, 2015).

These reactions illustrate the fact that technical efficiency alone is insufficient to implement workable policy. As MIT economist Chris Knittel observes, “We’ve known how to do this since 1920” (Knittel, 2015). Clearly, advocates need to build a more compelling political case for action in order for a carbon tax to be feasible, and to demonstrate to policymakers that supporting an increase in the price of gas isn’t political suicide.

**BRITISH COLUMBIA’S CARBON TAX: THE EXCEPTION, OR THE FUTURE?**

Is the conventional wisdom about the politics of charging a tax on carbon correct? Under what conditions might this kind of policy succeed? Certainly there are many examples of failures, in which bills languish and expire legislative session after legislative session. However, in 2008 the Canadian province of British Columbia (B.C.) implemented a

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3 In February 2014, a year before California’s carbon cap and trade system was set to start applying to vehicles, a state senate pro tem Darrell Steinberg introduced a proposal to replace that provision with a carbon tax, then hastily withdrew it, after the only people willing to say anything nice about it turned out to be the Western States Petroleum Association, the most strident opponent to the state’s regulation of carbon emissions.
variation on the carbon tax that has become a widely publicized success story and a model that environmental advocates are actively working to imitate in other jurisdictions, including Massachusetts.

The most critical difference between B.C.’s carbon tax and the classical model favored by economists is that it was designed to be revenue-neutral, which means that none of the revenue collected by the tax is used to fund transportation infrastructure or any other government operations. Instead, the revenue is returned to the citizens and businesses of British Columbia in the form of tax cuts. The amount of the tax increased at a rate of 4 cents per gallon per year from approximately 10 cents per gallon in 2008 to twenty-five cents per gallon in 2012, where it has remained ever since. Recent analyses demonstrate that the tax has had a measurable impact on driver behavior, and more encouragingly has had a 7 times larger impact on consumer behavior than a commensurate increase in the price of gasoline (Rivers & Schaufele, 2014). This finding helps provide some evidence that people aren’t using their rebates to purchase more gasoline, in a variation on the fuel efficiency rebate effect. More shockingly, the policy is popular. In polls, a majority of respondents indicate support for the tax, since it has the perceived impact of lowering income and business taxes to some of the lowest in Canada. It’s also sticky, since repealing the tax would result in the government needing to find new revenue, most likely in the form of repealing the tax cuts.

It’s little wonder then, that advocates in other states and provinces are looking to adapt this policy. The Massachusetts Department of Environmental Resources (DOER) conducted an exploratory study of the technical details of a revenue-neutral gas tax in the fall of 2014. In January, state senator Michael Barrett introduced legislation that would
impose a carbon fee not only on vehicle fuels but on all “carbon-based fuels,” including oil, coal, natural gas, and renewable biomass, with carbon prices and an increase schedule virtually identical to the British Columbia tax (Barrett, 2015). This bill has attracted the support of many of the state’s leading environmental organizations. Climate X-Change, the coordinated outreach effort in support of Barrett’s bill, counts among its partner organizations many powerful and effective environmental groups, including the Massachusetts chapters of the Sierra Club and the League of Women Voters and has on its board the former director of Environment America’s Get off Oil program (climate-xchange.org, n.d.).

What can advocates for a carbon tax in Massachusetts learn from British Columbia’s success? Clean Energy Canada conducted in-depth interviews of 13 of the people most involved in designing British Columbia’s policy and published their findings, including a list of the top ten lessons for other jurisdictions in a 2015 report (Demerse, 2015). Of those, five relate to political circumstances that, based on analysis of recent events and conversations with several key policymakers and experts on transportation policy in Massachusetts, appear to be quite different in the commonwealth.

1. Presence of Strong Political Leadership

Every account of the B.C. carbon tax attributes an enormous part of the policy’s success to the leadership of the premier, Gordon Campbell. Campbell led the province’s center-right Liberal Party, and made combatting climate change a priority of his government. His advocacy of the carbon tax was unwavering, and he made it publicly known that he was willing to stake his political career on the policy. His personal
conviction had the added benefit of being good political strategy. As an OECD report about the policy notes, the lack of an electoral challenge from the right made it advantageous to find a way to attract some left-leaning voters from their biggest competitor party, the left-wing New Democratic Party (NDP) (Harrison, 2013).

The NDP, in turn, opposed the tax on the grounds that it was unfair, particularly to those in rural areas. While their Axe the Tax campaign gained traction among rural voters, the NDP managed to alienate environmental groups they had historically counted on for support. The NDP’s strategy might have prevailed, but by the time the election rolled around the global financial crisis was a far greater concern for voters (Harrison, 2013). The Liberal Party won re-election on voters’ perception of the party as good for the economy, and therefore remained in power long enough for voters to accept the tax and for the NDP to reverse its position in an effort to win back environmental support.

The most obvious difference between the Massachusetts and B.C. context is the governance structure. No single political official can enact policy without attracting a significant number of allies in other branches of government. Unlike the parliamentary system, there is no guarantee that the governor will have the advantage of his party being in the majority in the legislative body. In fact, in the most recent election in Massachusetts, Republican candidate Charlie Baker won the governorship, while the vast majority of the state’s legislators are Democrats. Aside from structural differences, Baker has shown no indication that he would be supportive of a carbon tax on gasoline, even a revenue-neutral one. He actively campaigned against 2014 legislation that indexed the state’s gas tax to inflation and supported a ballot initiative that successfully repealed the policy. He also took a pledge not to implement any new taxes.
The champion of the proposed policy has been Senator Michael Barrett, whose district lies in the wealthy northwestern suburbs of Boston (including Lexington, Concord, Carlisle, Chelmsford, Lincoln, Weston, Bedford, Sudbury, and Weston). Although elected to his current term in 2012, he previously served 4 terms in the state Senate between 1987 and 1995, served in the state House of Representatives from 1979 to 1985, and unsuccessfully ran for the U.S. House of Representatives and governor in the mid-1980s and mid-1990s, respectively. The senator, therefore, is highly attuned to state politics and has a reputation among other policy makers as a smart and thoughtful lawmaker. For example, the version of B.C.’s carbon tax that he introduced is not actually a tax, but a fee, so that Baker wouldn’t have to abandon his “no new tax” pledge to support it. He has been very engaged with the issue, and has stated that he wants to pass a carbon tax within the next eight years (Armstrong, Barrett, & Knittel, 2015). He was instrumental in pressing the outgoing Patrick administration to conduct a study of the impact of a gas tax in Massachusetts and attending discussions about the study personally.

Even if Barrett were willing to risk his political career on a carbon tax, however, he doesn’t have the kind of statewide public stature to advance this policy by himself. He would need allies in the legislature and in the executive branch willing to stand up to substantial public pushback. Barrett’s current strategy seems to be trying to convince the governor that taking leadership on the issue would set him up well to run for national office as a moderate Republican. (He offers the dubious examples of Romney and Nixon as politicians Baker could emulate. (Armstrong, Barrett, & Knittel, 2015) Whereas the financial crisis may have distracted B.C. voters during the debate over the carbon tax there,
U.S. carbon tax proponents cannot count on any type of major intervening issues to come to their rescue.

2. Policy Simplicity

Interviews conducted by Clean Energy Canada revealed that the simplicity of the carbon tax was a major selling point among B.C. policymakers. The policy built on existing taxation and revenue disbursement frameworks, reducing administrative costs. Policy designers also opted to avoid exempting particular industries or households from the tax, further reducing administrative expenses and keeping the policy relatively easy to understand and communicate.

The policy proposed by Senator Barrett is similar to the B.C. policy and shares most of its design simplicity. However, instead of returning the proceeds of the tax through income tax rate reduction, Barrett’s bill proposes a cash rebate to all individuals in the state. Unlike the B.C. policy which started out with a simple, across-the-board tax cut, Barrett’s bill provides an additional refund to people living in “rural” areas, which he defines as municipalities with average per-household VMT that is greater than 130 percent of the state average VMT per household. This measure is clearly an attempt to defuse political opposition to the policy on equity grounds. Barrett has also been careful to mention that based on DOER analysis the poorest quintile of the population pays substantially less of the carbon fee than the richest (Breslow, Hamel, Lucklow, & Nystrom, 2014). However, calculating those thresholds will require either assuming that towns will have similar reductions in average VMT per household or updating the vehicle census dataset annually, a task that requires the coordination of several agencies and a significant
amount of data processing.\textsuperscript{4} In addition, they make the tax more challenging to explain succinctly. However, the additional administrative burden imposed by data-driven, responsive policy is counterbalanced by the potential for increased competition between cities and towns and an adaptable incentive structure that changes over time as development patterns and vehicle use change.

3. Politics of Price Schedule Increases

B.C.'s policymakers also agreed that the strategy of setting a low initial price that increased at a specified rate was important for reducing initial opposition while still making progress towards a more stringent tax in a relatively short time. The B.C. business community appreciated the regulatory certainty that the policy provided, as it allowed them to make long-term investments in reducing carbon emissions. One informant also observed that scheduling tax rate increases allowed the government to make progress towards climate goals without having to expend additional political capital every year to raise rates (Demerse, 2015). The importance of setting a long-term ramp is perhaps best illustrated by the fact that legislators have been unable to implement any increases in the tax since the ramp reached its legislated peak in 2012. In addition, the value of the tax has eroded over time due to inflation. One of the “practical tips” Clean Energy Canada offers is to index the tax to inflation (Demerse, 2015).

Although Barrett’s bill has a price schedule nearly identical to the successful B.C. policy, there’s some evidence that such a policy may not be nearly as effective at neutralizing public opposition in Massachusetts as it was in Canada. The prime argument

\textsuperscript{4} Data processing steps include geocoding millions of address records, formatting data, and using a relational database to convert individual odometer readings into mileage estimates between inspection records. Despite significant automation, the process still takes several days to complete.
made by opponents of the legislated increases to the state’s gas tax was not that the gas tax increases were themselves bad (in fact, they did not even try to repeal the 3 cent base increase in the gas tax), but that setting the tax to rise with inflation was a form of “taxation without representation” (Pfeiffer, 2014). This argument is obviously a more resonant one in the United States than in Canada. Opponents of the tax capitalized on the antipathy toward taxes that is the legacy of the more recent Tea Party movement, as well as perceptions of wasteful, out-of-touch spending by the state’s legislators.

Environmental groups as well as transportation advocates and social justice organizations all opposed the repeal and mounted a campaign of their own. However, not only did the ballot initiative to repeal the gas tax pass, it passed by a wider margin than the hotly contested governor’s race. Only 6 percent (14/232) of towns where Governor Baker won rejected the repeal of the gas tax index, while almost a quarter of the towns where Baker lost supported the repeal (“PD43+ Massachusetts Election Statistics,” 2014). While voters might not react the same way to a carbon tax schedule as they did to the proposed gas tax increase, the outcome of this ballot initiative should give legislators and advocates pause. Advocates will need to come up with a more compelling rebuttal to claims of “taxation without representation.”

4. Revenue-neutrality as a Selling Point

Since the revenue-neutral feature of this policy is what is particularly innovative about British Columbia’s policy, one might expect it to be a major selling point and an important factor in its implementation. However, many of the stakeholders Energy Canada interviewed were ambivalent. The two main advantages they identified were that it helped moderate opposition from the business community, and it made the policy extremely
“sticky” by implementing tax cuts that a dismantler of the program would have to take the heat for repealing (Demerse, 2015).

Energy Canada’s informants did not perceive revenue-neutrality as softening initial voter opposition, at least partially because voters were confused about what the term “revenue-neutral” meant. Many thought revenue-neutral meant the tax would be revenue-neutral for them, personally, instead of not providing additional revenue to the government. They were confused about why the government would implement a pollution tax that gave money right back to polluters. Others, encouragingly for behavioral economists, didn’t believe they would get the money back and didn’t value $100 saved on income taxes the way they valued additional money spent on gas taxes. Interestingly, advocates in B.C. are now discussing ways they might change the tax now that people are accustomed to it, and use some of the revenue to invest in public transit. (Such a shift would validate suspicions that the government never intended the tax to be permanently revenue-neutral.)

There’s some indication that the revenue-neutral piece of the tax might actually be more powerful in the Massachusetts context than in B.C., given the resonance of the argument that the state already squanders too much money. Additionally, Barrett’s bill distributes rebates not through tax refunds but through a per-person rebate, which may increase the salience of revenue-neutrality. The decision to do a per-person rebate was one motivated by equity concerns; the DOER study found that low-income families don’t pay enough sales, income and property tax combined for a rebate to fully compensate them for carbon tax payments (Breslow, Hamel, Lucklow, & Nystrom, 2014). However, even among political elites there is confusion and skepticism about the effectiveness of implementing a
revenue-neutral tax. Some mentioned being unconvinced by claims that people wouldn’t spend their rebates on gas and significantly weaken the policy, while others questioned the wisdom of expending significant political capital on a policy that wouldn’t provide any revenue for the state’s aging public transportation system. The MBTA’s repeated breakdowns during a winter of record-breaking snowfall have focused political attention and ire, and public transit advocates have been focused on making the case for increased investment in public transit and pushing back against allegations of mismanagement and wasteful spending.

5. Importance of Engaged Allies, Communication in the Face of Determined Opposition

Policymakers in British Columbia noted that backlash against the carbon tax was not immediate but built over the months following the implementation of the tax as gas prices started to rise. Opposition mainly came from rural areas where people believed they were disproportionately harmed by the tax. Several of the interview subjects expressed frustration that all the technical analysis demonstrated that rural households didn’t actually spend more on fossil fuels, but that “public commentary was captured by personal circumstances of ‘losers.’” The government eventually implemented a rural tax break to soften opposition.

A carbon tax proposal in Massachusetts is likely to run into the same kind of rural-based opposition that B.C. policymakers experienced. There is a long history of resentment of transportation dollars flowing into Boston from the rest of the state, and rural residents would undoubtedly perceive the tax as unfair. Evidence of this nascent opposition can again be found in the results of the 2014 gas tax increase vote. Although there was support
for the gas tax in the western part of the state (see figure 4), they also voted for the
democratic candidate, Martha Coakley, by large margins.

Figure 4. Gas Tax Repeal Margin of Victory

![Map showing the gas tax repeal margin of victory](image)

**Source:** PD43+ Massachusetts Election Statistics. (2014). 2014 General Election Results: Governor and Ballot Questions [Data File]. Retrieved from [http://electionstats.state.ma.us/elections/view/35901](http://electionstats.state.ma.us/elections/view/35901). Red areas rejected indexing the tax to inflation (a yes vote), while blue areas supported indexing the tax to inflation (a no vote).

Figure 5. Difference between Baker and Ballot Question 1 Margin of Victory

![Map showing the difference between Baker and Ballot Question 1 margin of victory](image)

**Source:** PD43+ Massachusetts Election Statistics. (2014). 2014 General Election Results: Governor and Ballot Questions [Data File]. Retrieved from [http://electionstats.state.ma.us/elections/view/35901](http://electionstats.state.ma.us/elections/view/35901). Yellow areas supported the gas tax indexing repeal more than they supported Governor Baker, while green areas supported the repeal less than they supported Baker.
The margins of support for the gas tax increase were substantially smaller than the margins by which Coakley won these areas (see Figure 5). It’s clear that many western and central Massachusetts are not enthusiastic about a gas tax, which explains why Barrett’s bill specifically calls out rural areas for additional rebates.

6. Other Political Considerations

Advocates of a revenue-neutral carbon tax in Massachusetts have learned from the B.C. experience and made initial efforts to reach out to a broader community of potential allies before officially proposing legislation. The DOER hired the Consensus Building Institute to help make their study participatory and inclusive. The study’s timeline was dictated by the electoral cycle, since Deval Patrick was not running for re-election. The study focused on technical details, modeling emissions reductions, economic impacts, and the distributional impacts of the tax based on different methods of rebate.

Some of those involved in the study mentioned that the study felt rushed (it took place over three months) and did not include as robust a stakeholder engagement process as they might have liked, but they did mention that it raised some key concerns and identified potential allies. For example, some of those representing business interests mentioned that they were not against the tax proposal in theory but would need the tax to partially or completely replace other energy efficiency regulations.

One specific challenge that has emerged in the Massachusetts context that didn’t get much attention in analyses of the B.C. tax is the concurrent fight over public transportation finance. Enthusiasm for the carbon tax is mostly coming from environmental advocates mainly concerned with climate change. Transportation professionals, even (and perhaps especially) those who are strong advocates of alternative modes of transportation are
much more skeptical of policy that will encourage more people to take transit without making any effort to improve the transit infrastructure. In mid-April, Climate X-Change hosted a panel discussion in support of the carbon fee that featured Senator Barrett, Chris Knittel, and representatives from the B.C. government. The conversation was singularly focused on climate policy. Many of the attendees also represented climate organizations, and the Q-and-A session quickly turned to discussions of carbon offsets and to local versions of the program that might complement a state level carbon tax and help build political momentum. Perhaps the separation between climate policy and transportation policy was intentional, a strategy for avoiding getting mired in an ongoing political controversy; perhaps it was an effort to avoid allowing action on public transit finance to sap momentum from taking action on a carbon tax. Senator Barrett lamented the fact that “We muster up the energy to focus on a major question, we take one big step, and then we leave it for five years” (Armstrong, Barrett, & Knittel, 2015)

**TAX POLICY DESIGN BY THE NUMBERS**

While B.C.’s experience implementing a carbon tax surfaces potential conflicts between political feasibility, equity concerns, and technical effectiveness in the abstract, the details of the rebate design are where tradeoffs become concrete. The effectiveness of potential policy design hinges on the question of whether vehicle miles traveled are a function primarily of personal decisions, which a well-designed policy can influence relatively easily, or spatial characteristics that are more difficult to change, at least in the short run. Political problems result when residents and their elected officials start to crunch the numbers to figure out if their family or town is a winner or a loser. And equity
questions come into focus when vehicle ownership and use patterns are overlaid with income data.

We are fortunate in Massachusetts to know a great deal about VMT and how it varies across the state. We owe this knowledge to odometer readings collected by the Registry of Motor Vehicles during annual vehicle inspections and vehicle registration data. The data services department of the Metropolitan Area Planning Council (MAPC) transformed the odometer readings from 2008 to 2011 into mileage estimates and estimates of carbon emissions based on miles driven and vehicle fuel economy. After taking steps to preserve the anonymity of individual drivers, the MAPC released two public datasets at an astonishing level of spatial disaggregation: one with unique combinations of vehicle, owner, zip code, and inspection record and one with average vehicle miles traveled, counts of vehicles, and carbon emissions for 375,000 250-meter grid cells across the entire state. This dataset provides a way to model the impact of different policy designs and in some cases might play a role in administering the policy itself. It also would, presumably, be used to assess the effectiveness of any VMT reduction policy that is implemented.
Figure 6 Average Daily Vehicle Miles Traveled at the 250-Meter Grid Cell


Figure 7 Average Vehicles per Household (2010) at the 250-Meter Grid Cell

As Figures 6 and 7 make clear, VMT in Massachusetts follows expected spatial patterns. The dense urban areas of the state are immediately identifiable as the green areas on the map, while Boston’s suburbs have substantially higher levels of driving. However, these maps, as well as basic statistical analysis reveal an extremely strong correlation between VMT and vehicles per household. Incredibly, over 88 percent of the variation in VMT can be explained by variation in the number of vehicles per household, while miles traveled per vehicle (as opposed to miles traveled per household) is surprisingly consistent across the state. In other words, suburban families aren’t necessarily driving their cars farther, they’re driving more cars the same distance. This information suggests that reducing vehicle ownership is a crucial part of reducing vehicle miles traveled.

While the disaggregate data at the grid cell and individual vehicle level provide valuable insight into driving patterns in Massachusetts, there’s good reason for policymakers to focus on VMT trends at the town level. First, the disaggregate data, which includes more than 16 million vehicle records and 375,000 grid cells, is overwhelming to analyze, much less communicate. (One of the chief software designers behind the PostgreSQL database software pgAdmin said of million-row datasets, “How can anyone realistically examine that much data?” (Page, 2014).) Aggregating to the town level provides a more manageable and easily communicated unit of analysis for policy evaluation purposes, while preserving substantial variation in average vehicle miles traveled.

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5 \( r = 0.94 \)

6 There are a number of vehicles and grid cells with values that deviate substantially from the mean, but many of these records are unrealistic (e.g.: cars driving an average of 1000 miles a day) and are likely the result of short inspection periods (e.g.: a vehicle that was inspected, sold, and driven to the opposite end of the state before being re-inspected on the same day by the new owner) or data entry errors in the odometer readings. Similarly, there are some grid cells with unrealistically high rates of vehicle ownership, which may be due to the fact that the address on record for leased vehicles is frequently the auto dealership and not the address where the vehicle is actually garaged.
traveled. From a political perspective, municipal governments are likely to play an important role in influencing policy design as politicians and residents look to see whether their town is a "winner" or a "loser."

Figure 8. Average VMT per Household (2010) by Town


From the perspective of state-level policymakers, it makes sense to aggregate still further and group towns based on shared characteristics, particularly those characteristics that might cause town officials to band together to oppose or support potential VMT policy. In 2008 the Metropolitan Area Planning Council developed a typology of all the state's towns to facilitate this type of analysis. They divided the state's cities and towns into five community types, which further break down into nine subtypes, based on residential and commercial density, available developable land, and recent population growth and
development patterns (MAPC 2008, see figure 9). No transportation factors are used to define their typology, so it works well for examining how VMT varies spatially.

Figure 9. MAPC Community Subtypes

As it turns out, the type of town with the most vehicle miles traveled is the "country suburb," which MAPC notes is a "low density communit[y] with no significant town center and no compact neighborhoods" that is "generally growing rapidly" (MAPC 2008). The VMT per household in such towns is significantly greater than in the other low-density town types—Rural Towns, Maturing New England Towns, and Established Towns and Cape Cod Suburbs. The variation in average VMT between these other three town types is not
statistically significant. At the low end of the spectrum, Metro Boston’s inner core communities have by far the lowest average VMT, while the farther out streetcar suburbs and major regional urban centers have similar average VMT. (See Figure 10, Appendix for Anova test results and charts of average VMT per household by community type.)

Figure 10. Box Plot of Average VMT per Household by MAPC Community Subtype

This analysis indicates that a major priority of policy should be to reduce average VMT in country suburbs. It also provides some evidence that rural areas do not have inherently higher VMT than suburban towns, though as policymakers in British Columbia discovered, perceived burden is at least as important as, if not more important than, actual burden when designing public policy.

One problem with focusing on these higher levels of aggregation is that concerns about economic inequity disappear from the discussion. Part of the problem is that there’s never just one dimension of equity to be considered, and the scale of analysis directs the conversation toward some equity-related questions and away from others. Town and town

type analysis highlights questions of spatial equity (i.e., is it fair for people who live places where they have to drive everywhere to pay more for their daily activities?) instead of questions of individual cost burden (i.e., how will a gas price increase affect low income people?). Of course, both types of questions and objections are likely to feature prominently in public debate over this type of policy. It’s important to spend some time looking at more disaggregate data on the relationship between driving, income, and gas tax burden to be conscious of the impact of policy on the state’s low income drivers.

In Massachusetts, one way to assess the burden that fuel costs currently impose on low-income households is to estimate the percent of median household income spent on gas at the block group level. As the data on poverty concentration in metro Boston suggests, many of the lowest-income block groups are located in transit accessible, dense neighborhoods, but residents of low-income block groups still drive and spend a comparatively high portion of their income doing so. Figure 11 shows that households that make up to approximately the state median household income ($63,000) spend a much higher portion of their income on gasoline. Many of the very lowest income block groups that are spending disproportionate amounts of their income on gas are not in metro Boston’s inner core or streetcar suburbs, but in regional centers like Worcester, Lawrence, and Springfield. Another area to note is northern-central Massachusetts, where median household income is on par with the state as a whole, but residents drive much farther per household than the state average.

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7 These figures were calculated by multiplying the average annual VMT/household at the block group level by the average gallons-per-mile fuel efficiency of the block group’s vehicles, multiplying by $2.80, the average gas price in 2010, and then dividing by median household income.
Figure 11. Percent of Households in Block Groups by Median Household Income and Percent Household Income Spent on Gas (2010)

Keeping these considerations in mind complicates the task of designing a workable policy, particularly a workable rebate scheme. Based on 2010 vehicle data, a 10-cent per gallon tax (the first year of the policy) would raise approximately $195 million in revenue. With a flat per-person rebate, each person in the state would get a rebate of $28.63. Those living in urban areas, including regional urban centers, end up receiving significantly more in rebate than they pay in, with the average resident of the Boston area receiving a net subsidy of $10 to $20 (see Figure 13). Those who will see the biggest gain are carless households, which are likely to be low income. Meanwhile, unless they change their behavior, most of central Massachusetts comes out behind, getting back less than half of what they paid in carbon fees.
From a policy effectiveness perspective, this is precisely the kind of price signal economists favor, as households who drive a lot will feel significant pressure to reduce their mileage. In the long term, parts of the state with better access to alternatives to public transit may become more desirable places for people to live. Applying the findings of the studies on demand elasticity for gasoline and the analysis of British Columbia's policy, the final year of the scheduled tax increases (40 cents/gallon) could result in a reduction of gasoline demand of between 5 percent and 12.5 percent or between 0.865 and 2.163 million metric tons of CO2 equivalent, enough to offset at the pay-as-you-drive insurance program. It's also very simple to explain and communicate, one of the major recommendations that emerged from the B.C. case.
However, this strategy seems destined to create political problems. The first and most obvious is one of numbers. The number of towns that are “losers” under this strategy dwarfs the number of winners, even if the population in places like Boston is far greater. While urban areas may be able to run up the tally in statewide elections, the officials from all of the towns that stand to lose more than they gain are likely to work behind the scenes to stop this type of policy from ever reaching the ballot box. In addition, this policy would play into a longstanding perception that the rest of the state puts money into infrastructure and social service provision in Boston. Finally, if substantial numbers of people try to reduce their VMT by moving to areas where walking, biking and transit are viable options absent substantial investment in new transportation infrastructure, this policy might exacerbate gentrification and displacement in transit-accessible urban communities. This last outcome seems unlikely at the 10-25 cent level of carbon tax under discussion, and given the relatively less expensive options that higher income individuals have to change their driving patterns, but it is likely to be a concern of neighborhood associations and other advocates for low-income, inner-city households.

The political problems with the pure “flat rebate” explain why Senator Barrett’s bill contains additional built-in revenue for residents of high-mileage towns. Applying the “rural” threshold from Barrett’s bill, the distribution of revenue changes. Residents of rural towns would receive $34.80, while non-rural town residents would receive $26.77. The state average per household VMT is approximately 35 miles per day. There are 167 towns in Massachusetts with an average per-household VMT of more than 46 (130 percent of the average), just under half of all the towns in the state (see Figure 14). The reason so many towns qualify is that the statewide average is heavily weighted by the people in the dense,
populous areas of the state that have relatively low VMT. The 167 towns eligible for the additional rural rebate have less than a quarter of the state's population.

Figure 14. Towns Receiving Rural Subsidies and MAPC Community Subtype


However, high mileage is not restricted to rural areas alone. In fact, slightly more than half of MAPC's rural towns have per household VMT of greater than 46, while all but one of the fast-growing Country Suburbs fall into this category. The equity argument undergirding the additional rural rebate is that residents of rural areas have no choice but to drive everywhere because car-dependent infrastructure is locked into place. But country suburbs and maturing New England towns are the fastest growing types of towns and have the most developable land, and therefore from a climate perspective are the type of town where changing the incentives driving sprawling development patterns is most important. However, there are 6 towns with an average per household VMT of 51.67 where the rural subsidy changes the tax from a net income outflow to a net income inflow, and all are
developing suburbs. Conversely, there are 4 towns with an average per household VMT of 33.5 where the difference between the flat rebate and the non-rural rebate changes the tax from a net income inflow to a net income outflow. Two of these (Beverly and Southbridge) are subregional urban centers, one (Melrose) is a streetcar suburb, and one (Florida) is a rural town (See Figure 15). Not only do residents in these towns drive less, but they are arguably much more locked into their current infrastructure patterns than the residents of developing suburbs. For these towns there’s actually a perverse incentive for people to increase their VMT, and a disincentive for developing suburbs to invest in more compact types of development that would cut down on car ownership. This policy would be much more technically effective if it included a phaseout over time of the additional rural rebate. In contrast to the flat rebate, this policy design is more complicated, and requires more timely information about VMT at the town level.

Figure 15 Net Impact of Per Person Rebate, Including 30% Rural Subsidy


8 Paxton, West Boylston, Lancaster, Shirley, Norfolk, Middleton, Hamilton.
A third option is to collect and rebate tax revenue to towns by their MAPC community type. In some ways, this is an extreme version of the 30 percent rural subsidy, but instead of categorizing based on driving behavior (the variable the policy is trying to affect) this design would categorize towns based on the spatial characteristics that might influence driving behavior. This would mean determining how much of the carbon fee revenue was generated by drivers in different types of towns, and then dividing that revenue by the number of people living in those towns. This option rewards the residents of towns that have significantly lower VMT than average after controlling for large differences in density and developable land. In essence, this strategy encourages municipalities to compete against similar communities, effectively addressing complaints that the carbon fee unfairly targets rural communities. In addition this policy may encourage even people living in dense places to reduce their driving, since their behavior is being compared against the residents of other dense municipalities.
Figure 16. Net Impact of a Community Subtype Based Per-Person Rebate

As Figure 16 makes clear, the incentives generated by this policy look very different from the first two rebate designs. The biggest winners are low-mileage, developing suburbs and rural towns in western Massachusetts.

This strategy has some important political advantages. Several of the Massachusetts transportation experts I interviewed suggested that encouraging towns to compete against similar rivals might take attention away from the tax itself and improve its chances of implementation. Finally, this option creates a broader base of potential “winners” who might support the tax. However, it also dilutes the advantage of the densest parts of the state where the majority of the state’s poorest residents live. As a result, low-income transit-dependent households will receive smaller rebates than they would if their driving patterns were being compared with those of wealthy suburban residents. In addition, the
fact that summer vacation areas in western Massachusetts and Nantucket do so well may fuel a perception that this tax benefits the wealthy at the expense of low-income families living in the inner city.

One way of addressing such concerns would be to take a hybrid approach that distributes part of the revenue of the tax evenly among all the state’s households and part proportionally to the amount collected in each community type. Another option would be to return a portion of the revenue from the tax not to individuals, but to the municipal governments, which might provide both incentive and resources to implement local policies to reduce VMT. The major drawback of this third strategy is its complexity. Not only will the nuances of the policy be much more difficult to communicate to policymakers and the public, but the policy design implementation requires more granular and more frequent data collection than other options.

Diving into the technical details of policy design brings the critical tradeoffs inherent in a carbon tax/rebate scheme into focus. The simple, clear design of a flat, per-person rebate makes it the best choice from a policy effectiveness standpoint as well as from the perspective of those concerned with economic inequality. It seems likely to flounder on the same political challenges that doomed the gas tax increase, however, including strenuous opposition from rural communities with their own perspective on what equity means. The version currently proposed in Senator Barrett’s bill helps to address the concerns of those who argue that residents of less dense parts of the state have no choice but to drive longer distances. However, by basing the additional subsidy on the same behavior the policy is trying to change, Barrett’s version significantly undermines technical effectiveness. The third design uses spatial categorization to make the policy more fair to towns with car-
dependent infrastructure but siphons money away from the state’s densest and most low-income areas.

**THE ROAD AHEAD**

I began this project excited to dive into the technical, political, and equity dimensions of a revenue-neutral carbon tax. I firmly expected that with enough creative tinkering, this policy design could be that rare instrument that scores high marks in all three areas. The more I waded into those details, however, the more convinced I became that policy advocates are headed toward a time consuming and resource-intensive dead end. A successful campaign to implement a carbon tax would require sustained pressure from determined advocates, enough pressure to activate a high-profile champion within government willing to stake a political career on the policy. The current governor, having campaigned against a gas tax increase, is unlikely to play this role without a major shift in public opinion. Therefore, advocates of a carbon tax would a great deal more groundwork to do to create the kind of shift in public opinion that would be necessary to force state-level politicians to act. Given that the governor is unlikely to be motivated based solely on climate change (as Gordon Campbell was in B.C.), advocates need to find a way to broaden the coalition of support beyond the most committed climate activists.

The most logical source of allies is the public transit advocacy community. But revenue-neutrality severely limits the enthusiasm with which that group can advocate for a carbon tax, preoccupied as they are with the state’s very serious transit funding issues. Also, in the long term, a carbon tax that isn’t accompanied by investment in affordable and reliable public transportation infrastructure seems doomed to failure.
From the perspective of social justice groups and other potential allies primarily approaching the issue of climate change and mobility framing, a revenue-neutral carbon tax again seems like a weak solution to pressing problems. The current framing of fairness as compensating people in sprawling new subdivisions at the expense of those in urban areas where poverty is still concentrated (and where people are most dependent on aging public transit) loses sight of who is really contributing disproportionately to climate change and who is likely to be disproportionately impacted. But even if the rebate did function as a policy for redistribution of wealth from high-mileage areas to dense urban neighborhoods, it’s a clunky tool for that purpose without enough income-based granularity. And any policy involving redistribution of wealth is likely to face political opposition at least as strong as the invective directed at policies that accrue more revenue for government function.

More prosaically, Massachusetts is just too small a state with too much trans-boundary traffic to make a state-level carbon tax viable. A regional carbon tax might be more effective, but is very likely to meet the same fate as NESCAUM’s stalled Regional Clean Fuel Standard. And while polarization of the national political conversation around climate change makes it tempting to seize on the strategy of state-level policy that provides a model for federal action, there is nothing that would be more damaging to the prospects of a nation-wide carbon tax than the failure of a carbon tax at the state level.

Advocates need to start a broader conversation in the state about what a statewide strategy for reducing vehicle emissions might look like and how to balance conflicting issues of spatial and economic equity. The study organized by the Department of Energy Resources is a first step but a next step needs to include not just representatives from
environmental groups and business associations but also residents from different parts of the state and different types of communities. In particular, it will be important to reach out to organizations working in low-income communities in the state’s regional urban centers, as well as people living in the north-central part of the state. One potential alternative policy to consider would be something more akin to a congestion charging scheme in Metro Boston that particularly targets areas with large amounts of discretionary driving. In other words, the people who have viable alternatives to long drives in personal vehicles but who drive anyways should contribute to the development of new alternatives in places where people would like to reduce their car and gas expenses, but can’t.

Regardless of the type of policy that is eventually implemented, Massachusetts has the opportunity to contribute significantly to our understanding of behavioral economics and the relative effect of taxes and rebates on driving behavior at a disaggregate scale. The data that Massachusetts has on VMT and the amount of technical and academic expertise in the state provides an opportunity to analyze how people in rural and urban places respond to changes in carbon tax policy and help build the case for a carbon tax or another innovative climate policy to be enacted at a more effective scale, the nation as a whole.
REFERENCES


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### APPENDICES

**Appendix 1. Results of Anova Tests of Average VMT per Household by Community Type**

<table>
<thead>
<tr>
<th>Community Subtypes</th>
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<td>Streetcar Suburbs and Major Regional Urban Centers</td>
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<td>Major Regional Urban Centers and Metro Core Communities</td>
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Significance level: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ',' 1
Appendix 2. Detailed Charts of Average VMT Per Household By Community Type

Metro Core Communities

MALDEN
EVERETT
REVERE
SOMERVILLE
CHELSEA
BOSTON
CAMBRIDGE

Household Miles Per Day
grouped by community type

Household Miles Per Day
0 10 20 30 40 50 60 70

Streetcar Suburbs

NEWTON
MELROSE
BELMONT
WALTHAM
ARLINGTON
MEDFORD
WINHROP
WATERTOWN
BROOKLINE

Household Miles Per Day
grouped by community type

Household Miles Per Day
0 10 20 30 40 50 60 70
Household Miles Per Day
grouped by community type

Mature Suburban Towns
LONGMEADOW
MAYNARD
BURLINGTON
READING
NEEDHAM
AVON
RANDOLPH
STOGHTON
WINCHESTER
NATICK
HOLBROOK
WAKEFIELD
HULL
BRAINTREE
DANVERS
DEDHAM
SAUGUS
WEYMOUTH
NAHANT
STONEHAM
MARBLEHEAD
SWAMPSCOTT

0 10 20 30 40 50 60 70
Household Miles Per Day
Household Miles Per Day
grouped by community type

Established Suburbs and Cape Cod Towns

DUXBURY
MEDFIELD
GROVELAND
SOUTHBOROUGH
SUDBURY
PEMBROKE
MARSHFIELD
SANDWICH
MANSFIELD
ACTON
SHARON
WILMINGTON
TEWKSBURY
NORTH READING
BILLERICA
CHELMSFORD
SCITUATE
LYNNFIELD
WAYLAND
WESTON
WELLFLEET
BOURNE
EASTHAM
LINCOLN
HINGHAM
ASHLAND
WESTWOOD
BREWSTER
CONCORD
BEDFORD
MASHPEE
LEXINGTON
WELLESLEY
CANTON
CHATHAM
FALMOUTH
ORLEANS
MILTON
DENNIS
BARNSTABLE
YARMOUTH

Household Miles Per Day

0 10 20 30 40 50 60 70

Household Miles Per Day
Household Miles Per Day grouped by community type
Household Miles Per Day
grouped by community type