The Beacon Hill Institute

Zero Massachusetts $C0_2$ Emissions by 2050? Rethinking Climate Policy in the Bay State

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EXECUTIVE SUMMARY

The Massachusetts legislature is focused on eliminating carbon dioxide emissions as fast as possible. One piece of legislation, S.2995, *An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy*, provides a blueprint for achieving net-zero emissions for the Commonwealth by 2050. Accompanying this bill is the Clean Energy and Climate Plan (CECP), which specifies emissions reduction targets, reevaluated in five-year increments, specifically, that by 2030, emissions in Massachusetts are to be 50 percent below 1990 emissions levels, by 2040, 75 percent below 1990 levels, and by 2050, at net-zero status. [1]

Achieving this would require that six high-priority sectors-namely, electric power, transportation, commercial and industrial heating and cooling, residential heating and cooling, industrial processes, and natural gas distribution and service eliminate emissions. S.2995 was pocket-vetoed by Governor Charlie Baker at the last minute, citing "incomplete language." It is currently under consideration for revisions.

In this study, we conclude that this legislation is misconceived. The "absolute zero" approach embodied by the legislation would be economically ruinous. It would increase costs to the average Massachusetts household to unacceptable levels. Lacking a global focus, it would also be ineffectual for any hope of ameliorating climate change. Finally, it would fail to price carbon emissions at a level that reflects their harm to the climate. The most appropriate form of pricing would be in the form of a carbon tax that produces the needed reduction in emissions at the lowest cost to society. S.2995 satisfies none of these criteria.

INTRODUCTION

What is the greatest example from history of a country's futile attempt to ban the consumption of some product? Most would say the Prohibition in the United States in 1920.

Promoting and protecting the well-being and health of Americans was the ostensible rationale behind banning alcohol. Proponents of prohibition argued that alcohol had become the ruin of male breadwinners and their families. Prohibition was also a religious crusade, led by Protestant Americans against the wishes of Catholic Irish, Italian, and German immigrants.

As we all know, the effort failed from the start, as speakeasies opened across the country and the family breadwinner turned to homebrew as a substitute for conventional drink. The Prohibition period was marked by widespread criminality as well as the darker forces of anti-immigrant nativism until its repeal with the 21st amendment in 1933.

[1] Executive Office of Energy and Environmental Affairs, "Clean Energy and Climate Plan for 2020," https://www.mass.gov/service-details/clean-energy-and-climate-plan-for-2020.

Yet, it appears that we have learned nothing from this experience. The movement to eliminate carbon emissions fuels is today being conducted with the zealotry of a hatchet-wielding Carry Nation. It is fair to say that today's proponents of zero-carbon policies are the new prohibitionists. A New York Times writer puts it bluntly: "To stop global warming, we'll need to zero out greenhouse gas emissions from billions of different sources worldwide: every coal plant in China, every steel mill in Europe, every car and truck on American highways."

This sentiment is echoed at the highest level of government. One of President Joe Biden's "cornerstone objectives" is to "ensure the U.S. achieves a 100% clean energy economy and reaches net-zero emissions no later than 2050."[2]

Like Prohibition, the idea of zeroing out the consumption of fossil fuels by 2050 enjoys widespread popularity. The popularity of ideas, however, does not prove their feasibility. Setting a goal of net-zero emissions by 2050 is unrealistic and attempting, through government mandate, to achieve it is a fool's errand.

HISTORY OF LEGISLATION

The Massachusetts legislature recently introduced its own zero-carbon goal. Senate Bill 2995, *An Act Creating A Next-Generation Roadmap for Massachusetts Climate Policy*[3], provides a blueprint for achieving net-zero greenhouse gas emissions by 2050. This is mandated with a heavy dose of ideological zealotry. There is talk about "environmental justice" for populations that are affected by the climate crisis or damage related to fossil fuel production. These are "principles that support protection from environmental pollution and the ability to live in and enjoy a clean and healthy environment." Such principles demand an effort to provide for the "equitable distribution of energy and environmental benefits and environmental burdens" as the Commonwealth seeks to bolster the diversity of its energy portfolio.[4] This will be accompanied by a separate roadmap that targets the economic, environmental, and public health concerns of low and moderate-income individuals.

S.2995 increases the Commonwealth's offshore wind energy procurement quota by 2,400 megawatts and mandates that utility companies source a statewide total of 5,600 megawatts to boost demand and improve cost-effectiveness. The Commonwealth's energy portfolio must also be renewably sourced for 40 percent of total energy.

S.2995 was pocket vetoed by Governor Charlie Baker on January 14, 2021. Baker's decision to pocket veto the bill cited concerns over incomplete language on funding and a lack of

[2] Brad Plummer, "How do we stop fossil fuel emissions," *New York Times,* (April 14, 2020), https://www.nytimes.com/interactive/2020/04/19/climate/climate-crash-course-4.html.
[3] Massachusetts Legislature, Bill S.2995: *An Act Creating A Next-Generation Roadmap for Massachusetts Climate Policy*, https://malegislature.gov/Bills/191/S2995.
[4] Ibid.

mitigation strategies for dealing with the impacts of climate change across the state. Baker also worried that the bill would inhibit progress on the recent passage of the "Housing Choice" proposal.

The matter is set to be under debate for the foreseeable future. Governor Baker made that clear in a statement to lawmakers explaining his veto, in which he wrote, "while the administration wholeheartedly supports the environmental justice goals of this bill, intent without the tools to address those issues are empty promises." Baker submitted his own amendments to the bill for review.[5]

The administration remains focused on creating an "opt-in municipal stretch energy code, the 2030 greenhouse gas emissions reduction target, and the sector-specific emission reduction sublimits," previously proposed by lawmakers.

In the meantime, the administration is currently working from the Decarbonization Roadmap, released by the Executive Office of Energy and Environmental Affairs to meet the interim 2030 goal of reaching a 45 percent reduction in carbon dioxide emissions.[6] This strategy is to ensure that future climate goals are met while considering the potential loss of economic opportunity due to carbon cuts.

THE DOWNWARD TREND IN CO2 EMISSIONS

For the eighth consecutive year, The American Council for an Energy-Efficient Economy ranked Massachusetts as the #1 state for energy-efficient buildings and recently approved the state for the latest Energy Efficiency plans (2019-2021). The plans are a part of the 2008 Global Warming Solutions Act (GWSA) and are focused on "maintaining nation-leading saving levels while transitioning to a more holistic approach to energy efficiency, demand management, and strategic electrification and ensuring [the] continued growth of energy efficiency and economic benefits in the Commonwealth".[7]

Despite a 13 percent growth in population and a 24 percent growth in vehicle miles traveled, Massachusetts decreased greenhouse gas (GHG) emissions in the same period through its mitigation efforts. Emissions reductions have also been achieved from Massachusetts becoming the first state to implement a local option stretch energy code, extending the covenants of standard building energy codes and emphasizing performance instead of prescriptive requirements. The efforts of the electric sector and more stringent vehicle standards at the state

[5] Steph Solis, "Massachusetts Gov. Charlie Baker Vetoes Climate Bill That Sets Carbon Emissions Targets Ahead of 2050", *Mass Live,* https://tinyurl.com/djpx66x8.
[6] Commonwealth of Massachusetts, *MA Decarbonization Roadmap.* (December 2020) https://www.mass.gov/doc/ma-2050-decarbonization-roadmap/download.
[7] Massachusetts Legislature, Session Laws: *An Act Establishing the Global Warming Solutions Act,* 2008, https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter298.

and national levels have rewarded the state with a significant reduction in GHG emissions since 2005, indicating that climate mitigation policies are working.

The GWSA mandated a 25 percent reduction in GHG emissions, when compared to 1990 emissions levels, by 2020 and at least an 80 percent reduction by 2050. The most recent 2017 report, released by The Massachusetts Department of Environmental Protection estimates that Commonwealth GHG emissions are 22.4 percent below the 1990 baseline.[8] As of 2020, Massachusetts is ranked fifth in the country for per capita CO2 emissions.

One can chalk up a portion of the Commonwealth's success by this metric to the professional service structure of the economy. Slightly more than fifty percent of the state's GDP is generated by low-carbon industries such as finance, publishing, real estate, rental and leasing; professional and business services; state and local governments; and publishing, broadcasting, data processing, and information services (EIA). The state's economy is not heavily reliant on energy-intensive industries such as transportation or manufacturing and benefits from both the economic and environmental advantages of a low carbon intensity economy. Additionally, despite not having any natural gas reserves or in-state production facilities, natural gas currently accounts for two-thirds of the state's total net electricity generation and approximately half of the consumption in New England, up significantly from the 1990s.

The question, therefore, arises whether Massachusetts needs to further steps to reduce its carbon emissions.

THE BENEFITS OF CARBON PRICING

Governor Baker reasons that S.2995 is not yet ready to be enacted into policy without the mechanisms and regulations in place to make it feasible, amidst a flurry of other economic development initiatives and a pandemic. "The bill does not have the language or funding to address the ongoing impacts of climate change" and "without the tools to address those issues are empty promises," he wrote in rejecting the bill.[9]

One tool, however, that is widely advocated by economists is a carbon tax. Under a carbon tax, the government sets a price that emitters must pay per ton of GHG emitted. This pushes the market to regulate itself as the profits of emitters are bound to the price of carbon. In other words: you emit what you can afford. Keep following the logic and you find that carbon-intensive fuel sources, like coal-powered plants, shut down for lack of profit.

[8] Commonwealth of Massachusetts, (2017). Global Warming Solutions Act 10-Year Progress Report. Retrieved 2021, from https://www.mass.gov/doc/gwsa-10-year-progress-report/download.
[9] Steph Solis, "Massachusetts Gov. Charlie Baker Vetoes Climate Bill That Sets Carbon Emissions Targets Ahead of 2050", *Mass Live,* https://tinyurl.com/djpx66x8.

At the other end of the equation, we would find that alternative fuels become relatively cheaper. Hence, demand ticks upward for less carbon-intensive energy sources such as natural gas or renewables as the market adjusts to reflect a less carbon-intensive grid. The tax would also provide an opportunity to increase government revenues that help to offset the costs of implementation on the economy.

For comparison, it is useful to examine the results of other carbon pricing schemes to approximate revenue generation abilities. For example, cap-and-trade programs. A 2011 CBO study found that a cap-and-trade program, at a price of $20 per ton emitted of CO2 (and a 5.6 percent increase in price per year) would raise nearly $1.2 trillion in the first decade. Additionally, U.S. emissions would be 8 percent lower had the policy been enacted.[10]

So why hasn't the Massachusetts legislature considered a carbon tax or cap-and-trade approach? In fact, it has. In January 2019, State Representative Jennifer E. Benson filed H.2810, *An Act to Promote Green Infrastructure and Reduce Carbon Emissions,* which would impose a tax on state carbon emissions. Under this bill, the tax rate would be $20 per metric ton (slightly more than 2,000 pounds) of carbon dioxide to start and then rise in $5 increments until it reached $40 per metric ton. The Beacon Hill Institute critiqued this bill, concluding that the carbon tax would achieve only a negligible reduction in global carbon emissions while inflicting substantial harm on the state economy.[11]The Beacon Hill Institute study found that the average Massachusetts household would see a tax increase of $755 in 2022 had the bill been enacted, in 2026 estimates reached $1,263 per household.[12]

The worldwide emissions reductions from a Massachusetts carbon tax would be negligible. The entire United States, for instance, accounts for only 15% of global emissions.[13] Yet, the economic view is correct: A carbon tax assures that emission reductions will be accomplished at the lowest possible social cost. If the United States adopted a carbon tax and if it secured the participation of other countries in a similar effort, it could bring about a substantial reduction in global emissions. Whether that would confer net benefits on the global economy is another matter to be determined.

A zero-carbon goal, however, possesses a uniquely detrimental attribute: It removes from consideration any thought of a less extreme, intermediate solution while presenting itself as a social necessity. Massachusetts voters should wonder why their legislative leaders have shifted their attention from the idea of a carbon tax to that of a zero-carbon goal. It is easy to figure out

[10] United States Congress, Congressional Budget Office. *Reducing the Deficit: Spending and Revenue Options.* https://www.cbo.gov/publication/22043.
[11] David Tuerck, "The Proposed Massachusetts Carbon Tax: A High-Cost, Low-Benefit Policy," Beacon Hill Institute, https://tinyurl.com/y82f9ub9.
[12] Ibid.
[13] Ibid.

why: If they proposed a tax high enough to reach the same goal, the voters would recoil in horror.

Note that a tax of this size would yield no revenue since it would reduce the tax base (carbon emissions) to zero. To get an idea of how large the tax would have to be, we can consider what our study of the proposed carbon tax showed. A $20 tax on a metric ton of carbon emissions from gasoline would, we found, raise the price of a gallon of gasoline by about 18 cents and by doing so reduce carbon emissions from gasoline by 1.2%. A much smaller number than you would expect.[14]

So, let us see what the numbers would be if we sought to reduce emissions by 100%. The answer is that the price of a gallon of gasoline would have to rise by $14.10 and the tax per metric ton of gasoline emissions would have to be $1,585! Understand that these numbers would apply if we wanted to eliminate gasoline consumption now. No doubt defenders of the zero-carbon goal would argue that the technology of 2050 will much reduce these numbers. But no one knows by how much because no one knows what the future technology will look like. The point is that proponents of the zero-emissions goal do not bother to think through the improvements in technology that their ideas would necessitate – improvements that are far beyond our imagination now.

And there is another point: technology can improve when it comes to fossil fuels as well. Consider the reduction in emissions made possible by the improvement in technology that made cheaper natural gas possible. The tax needed to eliminate low-carbon natural gas would be all the higher because natural gas has become so cheap a fuel source over the last few years.

THE ECONOMICS OF A ZERO CARBON POLICY

The road to absolute decarbonization will require monumentally historic levels of spending and investment, a shift in consumer demand and preferences, and advancements in technological capabilities that we are currently uncertain of. The Breakthrough Institute, a global research firm that focuses on technological solutions for environmental applications have identified the twenties as "a critical time in which we need to both accelerate the deployment of existing clean energy technologies *and* heavily invest in R&D for maturing and improving a range of technologies that will be needed longer-term — such as advanced nuclear, gas with carbon capture and storage, enhanced geothermal, blue/green hydrogen, and direct air capture."[15]

[14]Ibid.

[15] Zeke Hausfather and Erik Olson, "What New Net-Zero Studies Tells Us About Electricity Decarbonization." The Breakthrough Institute, (February 22, 2021), http://thebreakthrough.org/issues/energy/new-net-zero-studies-on-electricity-decarbonization.

The most important feature of the carbon tax, which thereby determines its overall effectiveness, is that it must be coordinated and implemented at the global level. The tax cannot be too high as to irrationally stifle output and reduce economic growth to a detrimental point, but it also cannot be too low where emitters find it cheaper to just pay the tax to continue emitting because the fees are still cheaper than the cost of switching and adapting to new technology. As producers begin to adjust to the market, we can anticipate that some will adapt to new technology whereas others will be forced to exit the market. So, *what happens if some exit but most stay?* Similarly, we may want to ask ourselves: *Can the benefits of emissions reduction be realized if there are only some participants?* In a similar fashion with fuel economy standards, the true effectiveness of a carbon tax will be maximized when deployed at a national or, optimally, the global level. If Massachusetts becomes the only state to enact a carbon tax, what stops consumers from driving over state lines to consume cheaper fuel?

It provides few benefits for Massachusetts, whose emissions have been trending downward since 2005, to continue to push higher costs onto individual households when surrounding states and countries will not. The state has been one of the most diligent in reducing emissions with schemes such as CECP and the 2008 GWSA, which utilizes the Energy and Environmental Affairs (EEA) "2050 Roadmap" as a blueprint.

In essence, the efforts of the Commonwealth to reduce GHG emissions would be eroded by the lack of effort by other jurisdictions. The state would be the second to undertake such a policy, resulting in Massachusetts households paying a much higher price at the pump when compared to its constituents and receiving little social benefit or alleviation of social costs in return.

It is not to say that the state should not pursue any policy that mitigates the consequences of climate change but rather, should first focus on understanding the costs and innovation associated with absolute carbon sequestration and decarbonization of the economy. Whilst the dangers and costs of climate change are acknowledged and remain critical, we must not put the cart before the horse. The quest to achieve carbon neutrality should not come at a cost to individuals and the economy by ensuring that any tax policy is designed to be revenue-neutral and protects consumers.

When deciding how best to evaluate the effectiveness of a carbon tax in its ability to reduce GHG emissions, we must consider the costs associated with such a policy. The pricing mechanisms and behavior of the market thereafter follow basic economic principles, enabling us to assess the case for a carbon tax.

A. COSTS TO THE ECONOMY

The costs to the broader economy will materialize in the form of lost output – or the shrinkage of economic growth, particularly in carbon-intensive industries. At face value and without accounting for how the tax revenue would be injected

back into other parts of the economy, the tax would harm a fossil-fuel-dependent economy. The carbon tax, however, is the *best* tool we have available that correctly utilizes market forces to regulate emissions and if reimbursed properly, will be effective. This strategy also reduces the speculative nature of technology by incentivizing R&D and innovation in the marketplace, further reducing costs in the long run.

The Congressional Budget Office explains it as such: "The higher prices it caused would diminish the purchasing power of people's earnings, effectively reducing their real (inflation-adjusted) wages. Lower real wages would have the net effect of reducing the number of hours that people worked, thus decreasing the overall supply of labor. Investment would also decline, further reducing the economy's total output."[16]

The risk is creating an unevenly distributed burden amongst Massachusetts households as low-income consumers are more likely to consume higher carbon-intensive goods and work in more carbon-intense industries, despite emitting the least as a subgroup. This will leave them to absorb most of the costs associated with the tax whilst higher-income households and firms are shielded from the effects of their decreased demand for carbon-intensive products and sectors.

As the economy adapts to the tax and revenue it generates, the real effectiveness and ultimate impact of the tax will be determined by lawmakers' choices, in that this new stream of revenue could considerably alleviate other areas of pressure points for public spending. The goal of the tax's revenue must then be to decrease the total costs to the economy and as per the CBO, could be effectively used to reduce deficits or cut marginal tax rates. The former would spur an increase in spending and investment and lead to long-run increased output where the latter may reduce the overall supply of labor and capital but could be remedied through a tax swap, thereby reducing the existing marginal tax rate on income.

A 2011 CBO study estimated that setting a price of $20 per metric ton on GHG emissions with a price increase of 5.6 percent annually would yield a total of $1.2 trillion in revenues in the period measured 2012-2021 where 96 percent of revenues would be captured by the charge levied particularly onto carbon dioxide emissions.[17]

[16] United States Congress, Congressional Budget Office. *Effects of a Carbon Tax on the Economy and the Environment,* (May 22, 2013), https://www.cbo.gov/publication/44223.
[17] United States Congress, Congressional Budget Office. *Reducing the Deficit: Spending and Revenue Options.* (March 10, 2011), https://www.cbo.gov/publication/22043.

Indeed, the price point of the tax itself is important as it will dictate the level at which the market operates and produces output, but the choices of policymakers will ultimately determine the overall benefits received by the economy that are yielded by the tax.

B. COSTS TO BUSINESSES

According to the Deep Decarbonization Pathways Project, an international collaboration of energy research teams, estimates that cleaning up U.S. industries to get to carbon neutral by 2050 would require more than $1 trillion in annual investment and spending.[18] The transportation, agricultural, and energy sector would be the hardest hit by a zero-carbon goal and, according to a BNEF study, would cost roughly $980 billion annually to achieve the goals of the proposed Green New Deal. [19] Achieving this would essentially require a radical ban on things such as automobiles, planes, buildings, and even cows. According to Alex Trembath of the Breakthrough Institute – the 2030 goal is "functionally impossible" and 2050 is "a reach, but perfectly feasible in terms of technological innovation and scaling." And that, too, could be pure wishful thinking.

The power grid will be instrumental in cleaning up American industries as the sustainability and design of it will ultimately determine the way forward. The power grid will need to be transformed to expand and accommodate renewable technology, better battery storage, and the commercialization of new technologies in the wind, solar, hydrogen, and nuclear space.

Residential and commercial buildings account for 27 percent of statewide greenhouse gas emissions and are heavily reliant on the combustion and support of fossil fuels. These sectors will require that their end-user electricity sources be renewable to further reduce limit emissions. The same BHI study also found that the imposition of the tax would result in the loss of 11,090 private-sector jobs in Massachusetts in 2022. This means that the adoption of new technology, like the heat pump, will have to be imminent if competitiveness remains in Massachusetts. [20]

[18] James Williams, et al., "Pathways to Deep Decarbonization in the United States," (November 2014, updated November 2015), http://usddpp.org/downloads/2014-technical-report.pdf.
[19] Ari Natter. "Making America Carbon Neutral Could Cost $1 Trillion a Year." *Bloomberg.com,* (May 13, 2019), https://www.bloomberg.com/news/articles/2019-05-13/making-america-carbon-neutral-could-cost-1-trillion-a-year?sref=3lIKaIWi
[20] Tuerck, "The Proposed Massachusetts Carbon Tax: A High-Cost, Low-Benefit Policy."

C. COSTS TO HOUSEHOLDS

The consumer will undoubtedly experience some economic change because of the tax, whether the tax is absorbed by producers, passed onto consumers, or returned in the form of a tax credit or deduction. This issue represents the difficult balancing act of political ideology and technology as individual competing interests must decide who should bear the tax.

Policymakers must agree on what and who to tax because "the higher prices resulting from a carbon tax would tend to be regressive—that is, they would impose a larger burden (relative to income) on low-income households than on high-income households. The reason is that low-income households spend a larger share of their income on goods and services whose prices would increase the most, such as electricity and transportation".[21]

An earlier CBO analysis compared the increase in costs in after-tax income for the average household in the lowest quintile vs that of the average household in the highest quintile. A policy where the price was set at $28 per metric ton of carbon dioxide emissions would increase costs by 2.5 percent for the lowest one fifth compared to less than 1 percent for the highest fifth. In other words, carbon taxes are regressive in nature.

That being said, it is critical that lawmakers are redistributing these burdens and not pushing an unfair responsibility onto households and regular consumers. Governor Baker criticized his administration's Undersecretary for Climate Change, David Ismay this month for comments that suggested an unfair burden on consumers. The environmental secretariat was caught saying that "Sixty percent of our emissions come from residential heating and passenger vehicles." He continued to berate households by saying that emissions "need to be reduced because they come from you, the person (inaudible) the street, the senior on fixed income." He finished by saying that "there is no bad guy left, at least in Massachusetts…to break their will so they stop emitting. That's you, we have to break your will."

Comments like these highlight the pitfall with absolutism in our quest to reduce emissions. It is difficult to imagine the practical functioning of a decarbonized economy when the technology does not yet exist, coupled with the challenge of syncing political ideologies on an issue that requires global cooperation. State action is simply not enough. Baker's veto response reflects the fact that legislation has not adequately considered the feasibility of such a transition.

[21] United States Congress, Congressional Budget Office. *Effects of a Carbon Tax on the Economy and the Environment,* (May 22, 2013) https://www.cbo.gov/publication/44223.

A LESSON FROM TEXAS

The recent Texas Energy Crisis caused by a vicious cold snap left more than four million Americans without power. Are we even more vulnerable in our much colder climate? Maybe not. The Texas energy grid and supporting infrastructure was simply not designed to operate outside under such volatile conditions. This does not, however, eliminate the need to examine what went wrong in the Lone Star State and what implications it has (if any) for the Bay State's climate policy.

The record low temperatures took nearly one-fifth of U.S. oil refining capacity offline whilst stalling almost all oil and natural gas production in western Texas. The North American Electric Reliability Corporation (NERC) 2020-2021 winter reliability report discusses the key challenge for electric systems. An emphasis was placed on the risk of "increased demand caused by frigid temperatures, higher generator forced outage rates, and derated output of some generation resources in susceptible areas" that "could create conditions that lead system operators to take emergency operating actions that may result in energy emergencies." [22]

The Texas Energy Crisis can be explained thusly: the cold temperatures caused demand to spike for both electricity and natural gas in a season when the grid faced conditions it was not designed to sustain. This led to a rapid spike in spot electricity prices - a common way that many Texan consumers pay for energy, and a shortage in supply. This forced suppliers to start rolling blackouts to decrease consumption.

The question now becomes one of both philosophy and technology: What lessons can Massachusetts power planners and legislatures learn from the Texas Energy Crisis and how do we avoid it? Additionally - what implication does this have on Commonwealth power planning as policymakers chase the 2050 carbon-neutral target? We find that the energy supply issue in Texas last week was a "perfect storm" event where unexpected weather, peak electricity demand, and ill-equipped technology culminated itself into a Force Majeure disaster. The most notable reason cited for the persistent outages can be attributed to the fact that 90 percent of the state's grid is not federally regulated. During the outages, The Electric Reliability Council of Texas, or ERCOT representatives said that 45,000 MW were offline. Of which,15,000 MW were wind and 30,000 were from natural gas and coal. This totaled a supply shortage of 34,000 MW.

Unlike Texas, Massachusetts is susceptible to a higher probability of an extreme cold weather event that could threaten the power supply and could lead us to find ourselves in a similar predicament if energy sources are not properly diversified. To protect the Commonwealth against a similar fate, Governor Baker proactively signed a comprehensive energy diversity

[22] North American Reliability Corporation, "2020-2021 Winter Reliability Assessment," (November 2020), https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_WRA_2020_2021.pdf

legislation into law in 2016, entitled *An Act Relative to Energy Diversity* (H.4568).[23] The bill focuses on "establishing stabilized electric rates, ensuring a diversified energy portfolio for the Commonwealth, and embrace advanced technologies".[24]

The key to the bill is ensuring that utility companies can competitively solicit and obtain contracts while also understanding that too much procurement and reliance on any one source could perhaps put the state in the same situation as Texas. Like the carbon tax and other energy efficiency efforts, this strategy emphasizes performance instead of prescriptive requirements.

CONCLUSION

This study examined the current legislative environment of the Commonwealth of Massachusetts and in the context of economics, considered the possible outcomes and pathways to achieving a zero-carbon scenario in 2050. Reducing carbon dioxide emissions is a long-running policy battle that has been met with a myriad of strategies on how best to move forward. In this battle, however, there is the task of determining what the optimal level of carbon may be. It will not be zero, but let us assume that it is less than our current output. We find that legislation requires a solution from both economists and engineers as the issue is one of both cost minimization and technological feasibility. Particularly at the state level and regarding the preservation of its economy.

Many of the existing legislative and policy attempts at emissions reductions that have been favored have enforced prescriptive requirements rather than performance-based metrics. This only impedes technological development because it lacks proper economic incentives to invest in improvement towards price parity. The issues that we find with these approaches is that they lack the language to dictate or rationally incentivize the necessary transformations in the marketplace. This is what will ultimately facilitate the cost-effectiveness needed at the consumer level. The most notably absent from any legislative framework is a carbon pricing scheme, primarily a carbon tax. Thus far, the Commonwealth has demonstrated that emission mitigation policies are working, evident in the downward trend in carbon emissions since 2005. The last decade saw a complete overhaul of highly carbon-intensive sectors and the implementation of energy efficiency standards, underscoring the future possibilities for other states. Without a carbon pricing mechanism, however, technological development only goes so far, and this is the decade that must go the furthest.

At this point, it becomes nonsensical to enact a carbon reduction plan if it is not being implemented at the global level. Even if the US were to reduce emissions to zero, it would only lower emissions by 15 percent. This absolutist approach would not be favorable for an economy

[23] Massachusetts Legislature, Bill H.4568: *An Act to Promote Energy Diversity,* (2016), https://malegislature.gov/Bills/189/House/H4568
[24] Ibid.

that has already greatly reduced its emissions because it would continue to levy higher prices onto Massachusetts households at an emissions reduction level that is not relatively beneficial without larger participation.

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