



Comments on Massachusetts Decarbonization Roadmap

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Applied Economics Clinic

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Executive Summary

In February 2020, the Massachusetts Executive Office of Energy and Environmental Affairs released a “Draft Letter of Determination” requesting public feedback on proposed language to set a 2050 emissions limit that will achieve the Commonwealth’s 2050 goal of net-zero emissions. On behalf of Conservation Law Foundation, this Applied Economics Clinic white paper provides eight recommendations for the Commonwealth as it works to set its 2050 emission targets (see Figure ES-1 below). We argue that Massachusetts should set an ambitious 2050 emissions reductions target that builds in flexibility to account for truly recalcitrant emissions via carbon sinks, distinguishes the state as a national leader on climate, clearly defines and limits the use of carbon sinks until the Commonwealth approaches full decarbonization in 2050, considers the context of global climate change and local impacts, is in line with the best available science, and uses modeling tools that are able to consider a full range of emission reduction technologies..

Figure ES-1. Guidelines for setting Massachusetts 2050 emission reduction goals

1.	Massachusetts should continue to lead the nation by aiming for full decarbonization by 2050.
2.	Any emissions “netting” that is permitted must include clear regulation of appropriate allowable sinks.
3.	Any allowable sinks must be real, verified, permanent and additional.
4.	Permitted netting should not exceed the size of the allowable sinks.
5.	No netting should be permitted in the 2030 and 2040 targets.
6.	The level of netting permitted should be considered in terms of its impact on global climate change.
7.	Massachusetts’ carbon sinks should be fostered: they have an important role to play in slowing global climate change.
8.	Massachusetts’ Decarbonization Roadmap modeling tools should be capable of modeling sub-state level impacts and cutting-edge technologies.



Table of Contents

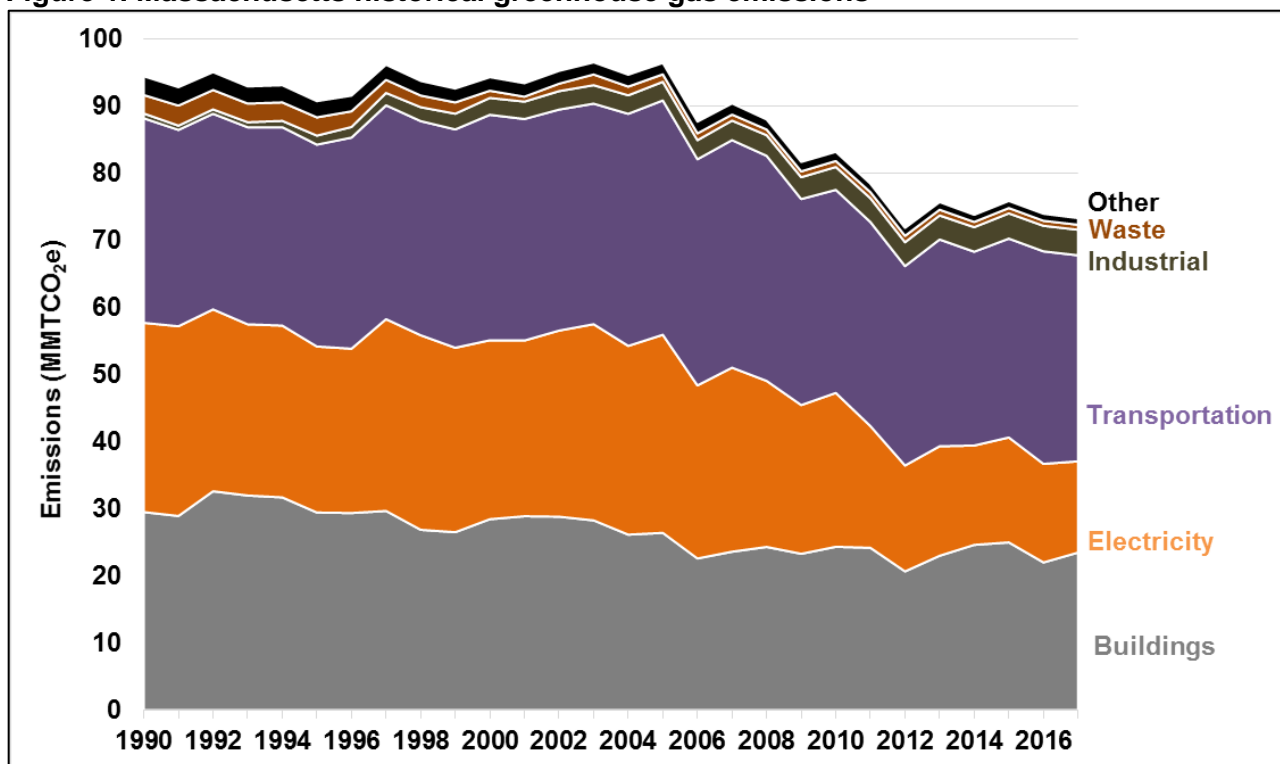
Executive Summary.....	1
Table of Contents	2
Background	3
1. Massachusetts should continue to lead the nation by aiming for full decarbonization by 2050 ...	5
2. Any emissions “netting” that is permitted must include clear regulation of appropriate allowable sinks	6
3. Any allowable sinks must be real, verified, permanent and additional	8
4. Permitted netting should not exceed the size of the allowable sinks	10
5. No netting should be permitted in the 2030 and 2040 targets	11
6. The level of netting permitted should be considered in terms of its impact on global climate change.....	12
7. Massachusetts’ carbon sinks should be fostered: they have an important role to play in slowing global climate change	13
8. Massachusetts’ Decarbonization Roadmap modeling tools should be capable of modeling sub-state level impacts and cutting-edge technologies	16
Conclusion.....	17

Background

In 2008, Massachusetts enacted the Global Warming Solutions Act (GWSA),¹ which set statewide greenhouse gas emissions reduction targets, including a goal to reach “at least”² an 80 percent reduction by 2050 (from a 1990 baseline). GWSA also mandates 2020 emissions reductions (set at 25 percent below 1990 levels) and interim emission reduction targets be set for 2030 and 2040 that “maximize the ability of the Commonwealth to meet the 2050 emissions limit”.³

The Commonwealth’s 2020 target limits greenhouse gas emissions to 70.8 million metric tons (MMT) of carbon-dioxide equivalent (CO₂e) in the present year. While we do not yet know whether Massachusetts has achieved this goal, the most recent full year of available emissions data—from 2017—shows emissions at 22.4 percent (21.2 MMT) below 1990 levels (see Figure 1).

Figure 1. Massachusetts historical greenhouse gas emissions



Data source: MA DEP. 2018. *Greenhouse Gas Emissions Reporting Program, Appendix C*. Available at: <https://www.mass.gov/doc/appendix-c-massachusetts-annual-greenhouse-gas-emissions-inventory-1990-2017-with-partial-2018/download>.

¹ Commonwealth of Massachusetts. 2008. An Act establishing the Global Warming Solutions Act. The 191st General Court. Chapter 298. Available at: <https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter298>.

² Ibid. Section 3(a).

³ Ibid.

On January 21, 2020, during his State of the Commonwealth address, Governor Baker announced Massachusetts' commitment to achieve net-zero emissions by 2050.⁴ In February 2020, the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) released a "Draft Letter of Determination"⁵ with proposed language to set a 2050 emissions limit that will achieve the Commonwealth's 2050 goal of net-zero emissions:

A level of statewide greenhouse gas emissions that is equal in quantity to the amount of carbon dioxide or its equivalent that is removed from the atmosphere and stored annually by, or attributable to, the Commonwealth; provided, however, that in no event shall the level of emissions be greater than a level that is [80, 85, 90]% below the 1990 level.⁶*

The emission target options presented in the Draft Letter of Determination include 80, 85 and 90 percent emissions reductions together with net zero emissions. Residual emissions—or the difference between the emissions target set and a 100 percent emission reduction—would be eligible for "netting" using one or both types of emission "sinks": 1) emission offsets (paying for the right to claim an emission reduction that happens elsewhere), and/or; 2) in-state carbon sequestration (measures that remove more carbon than they create, like forest restoration, changing farming practices, direct air capture, carbon storage and biochar).⁷ Depending on what emission reduction target is chosen, in 2050 emissions sinks (offsets, in-state carbon sequestration) could net out between 10 and 20 percent of total 1990 emissions levels (or 9 to 18 MMT CO₂e).

This white paper argues that the Commonwealth should set a clear, ambitious 2050 target to: build in flexibility to account for truly recalcitrant emissions via carbon sinks, distinguish the state as a national leader on climate, clearly define and limit the use of carbon sinks until the Commonwealth approaches full decarbonization in 2050, and consider the target in the context of global climate change, local impacts, and the best available science. This target should be backed up by modeling that uses tools that are able to consider a full range of emission reduction technologies.

⁴ Solis, S. January 22, 2020. "Gov. Charlie Baker, lawmakers commit to net-zero emissions goal by 2050 for Massachusetts". Mass Live. Available at: <https://www.masslive.com/politics/2020/01/gov-charlie-baker-lawmakers-commit-to-net-zero-emissions-goal-by-2050-for-massachusetts.html>.

⁵ Executive Office of Energy and Environmental Affairs. February 26, 2020. Request for comments: Opportunities for Public Comment re: Net-Zero Determination. Commonwealth of Massachusetts. Available at: <https://www.mass.gov/doc/draft-letter-of-determination-on-the-2050-emissions-limit-revised-342020/download>.

⁶ Ibid.

⁷ World Resources Institute. No date. "Carbon Removal". Available at: <https://www.wri.org/our-work/project/carbon-removal>.

1. Massachusetts should continue to lead the nation by aiming for full decarbonization by 2050

Eight states now share Massachusetts' goal to reduce 2050 emissions by 80 percent: Connecticut, Florida, Maine, Minnesota, New Hampshire, New Jersey, Pennsylvania and Rhode Island.⁸ Colorado has set a 90 percent emission reduction target for 2050.⁹ Another three states (California, New York and Hawaii) plus the District of Columbia, have gone further still and set either 100 percent emission reduction goals and/or net zero targets in 2050 (see Figure 2).¹⁰

For Massachusetts to continue to lead on climate solutions in the United States, its 2050 emissions limit should be on par with states with the most ambitious commitments to slowing global climate change: 100 percent emissions reduction and net zero targets. Committing to “net” zero builds in the necessary flexibility to address a small amount of emissions that may still be too difficult or costly to completely eliminate in 2050. Some concern is warranted, however, regarding the dangers of overcommitting to the use of sinks to “net out” emissions three decades from now. The practice of netting emissions with sinks should be limited to emissions that are truly recalcitrant in 2050—but what kind and how much of our emissions will turn out to be truly recalcitrant is impossible to know today. That is why the states currently leading on climate are setting very high emission reduction targets *and* allowing for the possibility of net zero: that way,

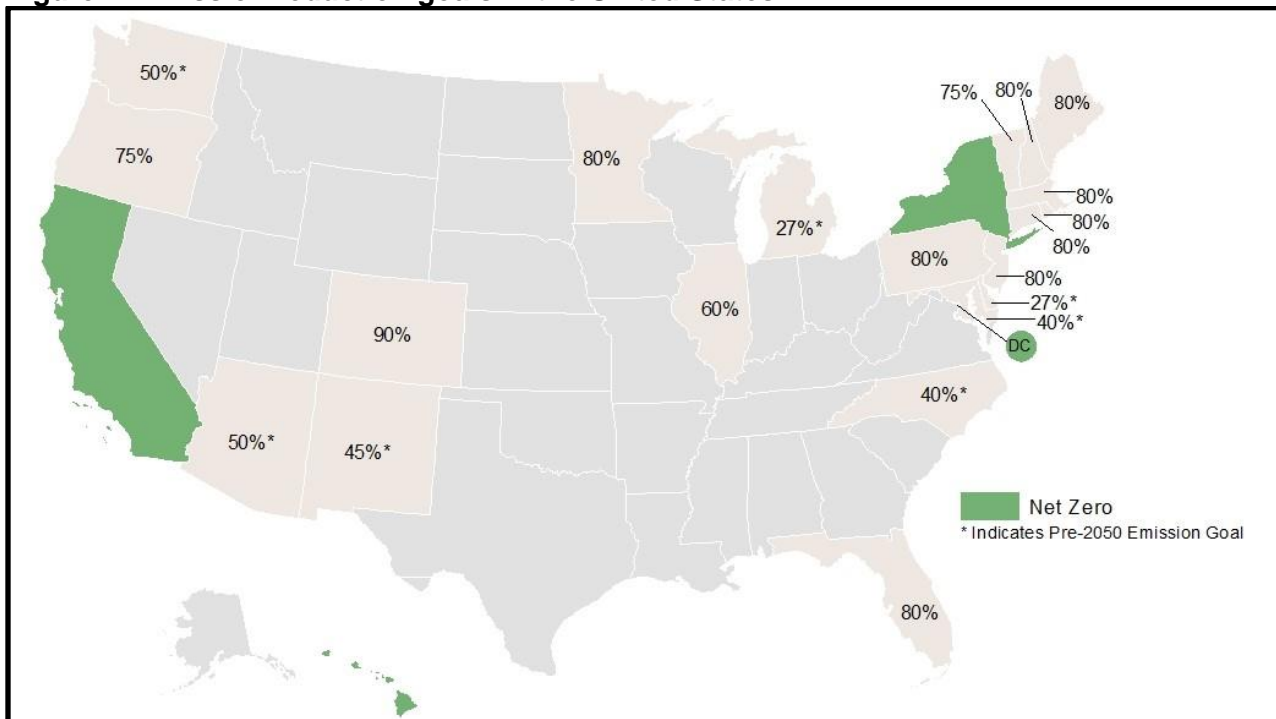
⁸ 1) Commonwealth of Massachusetts. 2008. *An Act establishing the Global Warming Solutions Act*. The 191st General Court. Chapter 298. Available at: <https://malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter298>; 2) State of Connecticut. June 2, 2008. *An Act concerning Connecticut global warming solutions*. HB 5600. Public Act No. 08-98. Available at: <https://www.cga.ct.gov/2008/ACT/PA/2008PA-00098-R00HB-05600-PA.htm>; 3) State of Florida. 2007. *Establishing the Florida Governor's Action Team on Energy and Climate Change*. Executive Order No. 07-128. Available at: <http://www.fsec.ucf.edu/en/media/enews/2007/pdf/07-128-actionteam.pdf>; 4) Minnesota Legislature. 2019. *Greenhouse gas emissions control*. 216H.02. Available at: <https://www.revisor.mn.gov/statutes/cite/216H.02>; 5) New Hampshire Climate Change Policy Task Force. March 2009. *The New Hampshire Climate Action Plan*. NH Department of Environmental Services. Available at: https://www.des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/documents/nhcap_final.pdf; 6) Corzine, JS. 2010. *Executive order 54*. State of New Jersey. Available at: <https://nj.gov/infobank/circular/eojsc54.htm>; 7) Wolf, T. January 8, 2019. *Commonwealth Leadership in Addressing Climate Change and Promoting Energy Conservation and Sustainable Governance*. Commonwealth of Pennsylvania. Executive order No. 2019-01. Available at: <https://www.oa.pa.gov/Policies/eo/Documents/2019-01.pdf>; 8) State of Rhode Island. December 2016. *Rhode Island Greenhouse Gas Emissions Reduction Plan*. RIGL 46-6.2-2. Available at: <http://climatechange.ri.gov/state-actions/reducing-emissions.php>.

⁹ State of Colorado. 2019. *An Act concerning the reduction of greenhouse gas pollution*. House Bill 19-1261. Available at: http://leg.colorado.gov/sites/default/files/2019a_1261_signed.pdf

¹⁰ 1) Brown JR, EG. September 10, 2018. *Executive Order B-55-18 to achieve carbon neutrality*. Executive Department of the State of California. Available at: <https://californiabiodiversityinitiative.org/pdf/executive-order-b-55-18.pdf>; 2) State of New York. June 18, 2019. An Act to amend the environmental conservation law. S.6599. A.8429. Available at: <https://legislation.nysenate.gov/pdf/bills/2019/S6599>; 3) State of Hawaii. 2018. Zero emissions clean economy target. 225p-5. Vol. 04, Ch. 0201-0257. Available at: https://www.capitol.hawaii.gov/hrscurrent/Vol04_Ch0201-0257/HRS0225P/HRS_0225P-0005.htm

emissions netting is embraced as a last recourse, and never as an excuse to continue to emit easily mitigated greenhouse gases.

Figure 2. Emission reduction goals in the United States



Note: Data compiled by AEC from relevant state agency websites.

2. Any emissions “netting” that is permitted must include clear regulation of appropriate allowable sinks

Recent research at the Lancaster Environment Centre points out some problematic side effects of combining emissions reductions and negative emissions together into a single target of reaching “net-zero”.¹¹ Such an approach could include interactive effects, double counting, delayed emissions cuts, and insufficient focus on developing negative emissions technologies.¹² A better approach—they suggest—would be to first reduce emissions as much as possible using one inventory and then, to match remaining recalcitrant emissions to carbon sinks using a separate

¹¹ McLaren, DP., et. al. August 21, 2019. *Beyond “Net-Zero”: A Case for Separate Targets for Emissions Reduction and Negative Emissions*. Lancaster Environment Centre. Available at: <https://www.frontiersin.org/articles/10.3389/fclim.2019.00004/full>.

¹² McLaren, DP. September 30, 2019. Guest post: *The problem with net-zero emissions targets*. Carbon Brief. Available at: <https://www.carbonbrief.org/guest-post-the-problem-with-net-zero-emissions-targets>.

inventory.¹³

From the documentation publicly available on Massachusetts' Decarbonization Roadmap website,¹⁴ it is unclear whether carbon offsets, in-state sequestration measures, or both, will be permitted to count towards the Commonwealth's calculations of "net zero" emissions in 2050. Carbon removal measures have a vital role to play in terms of providing the state with some flexibility to balance out any emissions that are still too difficult or too costly to eliminate in 2050. Nevertheless, it is very important that the Commonwealth set clear standards regarding:

- Criteria for classifying emissions as recalcitrant;
- Criteria for allowing specific carbon sinks to be permitted to net out these recalcitrant emissions;
- Criteria for ensuring that environmental justice communities do not bear the brunt of recalcitrant emissions; and
- A "polluter pays principle": Assignment of responsibility to the recalcitrant emitter for securing carbon sinks equivalent to the level of recalcitrant emissions.

Together, these standards will ensure the proper signal is being sent to those with the agency to reduce emissions, purchase offsets, and/or to enhance carbon removal.

California, for example, allows both in-state carbon sequestration and offsets to count towards its emission reduction goals. While the state has not yet provided guidance regarding negative emissions since it is still busy pursuing emission reductions, emission offsets are currently used. Under California's climate law, entities that are legally bound to reduce their emissions, including those in the electric, industrial and fuel supply sectors, must purchase emission allowances equal to their level of emissions—but they may also achieve up to eight percent of their compliance via offsets,¹⁵ by investing in qualifying afforestation, urban forest, livestock, ozone depleting substance, methane capture and rice cultivation programs.¹⁶ The responsibility for securing sinks lies with the source of the emissions that exceed the allowance.

In 2019, Hawaii passed HB 2182, which set a carbon neutral target for 2045 that permits netting

¹³ McLaren, DP., et. al. August 21, 2019. *Beyond "Net-Zero": A Case for Separate Targets for Emissions Reduction and Negative Emissions*. Lancaster Environment Centre. Available at: <https://www.frontiersin.org/articles/10.3389/fclim.2019.00004/full>.

¹⁴ Executive Office of Energy and Environmental Affairs. No date. "MA Decarbonization Roadmap". Commonwealth of Massachusetts. Available at: <https://www.mass.gov/info-details/ma-decarbonization-roadmap>.

¹⁵ California Air Resources Board. February 2015. *California Air Resources Board Offset Credit Regulatory Conformance and Invalidation Guidance*. State of California. Available at: https://ww3.arb.ca.gov/cc/capandtrade/offsets/arboc_guide_regul_conform_invalidation.pdf.

¹⁶ California Air Resources Board. April 8, 2020. "Compliance Offset Program". State of California. Available at: <https://ww3.arb.ca.gov/cc/capandtrade/offsets/offsets.htm>.

from carbon sinks¹⁷ including reforestation, carbon farming,¹⁸ and urban trees.¹⁹ In New York, the Climate Leadership and Community Protection Act directs the state’s climate action council to assess reforestation, land restoration, greening infrastructure, urban forests, carbon capture and sequestration, and other carbon sink options that are “verifiable, enforceable, and permanent” to count towards greenhouse gas emission offset projects.²⁰ The Act stipulates that offsets may not count for more than 15 percent of total emission reductions, offsets “shall not result in disadvantaged communities having to bear a disproportionate burden of environmental impacts,” and that offset projects should be prioritized when they create “localized benefits in disadvantaged communities”.²¹ Possible equity burdens include emitting larger quantities of harmful co-pollutants in a disadvantaged neighborhood that are then offset by carbon sinks implemented in elsewhere.

3. Any allowable sinks must be real, verified, permanent and additional

It is difficult to secure proven sinks that inspire the public’s trust and provide real climate benefits. Even well-established carbon offset programs, like the United Nations’ Reducing Emissions from Deforestation and Forest Degradation (REDD+) program and the Kyoto Protocol’s Clean Development Mechanism (CDM), have had a poor track record of meaningful reductions in emissions.²² For example, the REDD+ program has been active in the Amazon. However, independent reporting has exposed carbon offsets purchases in the REDD+ Amazon program that did not result in the carbon sequestration they were supposed to, were not accurately measured, or brought gains that were later reversed via deforestation.²³ A 2016 study of the CDM by the Institute for Applied Ecology found that “[i]t is likely that the large majority of the projects registered and [Certified Emission Reductions] issued under the CDM are not providing real, measurable and

¹⁷ Gebers, S. June 4, 2018. “Hawaii sets ambitious goal: Carbon neutral by 2045”. Hawaii News Now. Available at: <https://www.hawaiinewsnow.com/story/38346913/hawaii-sets-ambitious-goal-carbon-neutral-by-2045/>.

¹⁸ Ibid.

¹⁹ Ige, DY., Anderson, BS. March 6, 2019. “State on target to beat 2020 greenhouse gas emissions goal”. State of Hawaii Department of Health. Docket 19-013. Available at: <https://health.hawaii.gov/news/files/2019/03/19-013-State-on-target-to-beat-2020-greenhouse-gas-emission-goal.pdf>.

²⁰ State of New York. June 18, 2019. *AN ACT to amend the environmental conservation law*. S.6599. A.8429. p.12. Available at: <https://legislation.nysenate.gov/pdf/bills/2019/S6599>.

²¹ Ibid.

²² Irfan, U. February 27, 2020. “Can you really negate your carbon emissions? Carbon offsets, explained”. Vox. Available at: <https://www.vox.com/2020/2/27/20994118/carbon-offset-climate-change-net-zero-neutral-emissions>.

²³ Song, L., Moura, P. May 22, 2019. “An even more inconvenient truth”. ProPublica. Available at: <https://features.propublica.org/brazil-carbon-offsets/inconvenient-truth-carbon-credits-dont-work-deforestation-redd-acre-cambodia/>.

additional emission reductions.”²⁴

In the United States, many states depend on the EPA’s State Inventory Tool (SIT) to measure their statewide emissions. The SIT calculates greenhouse gas emissions by sector using state-level data.²⁵ Some states, like Connecticut and Rhode Island, do not use SIT data on land use, land use change, and forestry because they have found it to be “unreliable”.^{26,27} Recent research by the ClimateWorks Foundation on the accuracy and quality of the National Greenhouse Gas Inventory²⁸ found that it is important to fill data gaps for land use activities where data are too incomplete for accurate emission estimation methodologies to be developed²⁹ and that there is a need to improve field measurements and data quality,³⁰ particularly as they relate to emissions and sequestration from rural and urban forests and soils.³¹

Ultimately, carbon sinks (both offsets and in-state carbon sequestration measures) are only truly beneficial for the climate when they are:

- Real—meaning that carbon sequestration has actually occurred;
- Verified—meaning that carbon sinks are recorded, monitored and tracked by a reputable, impartial entity;
- Permanent—meaning the carbon that is sequestered does not get re-released into the atmosphere later (for example, if you plant a tree, it should not be later cut down); and
- Additional—meaning that the carbon being sequestered would not have been stored without the incentive provided to enact this measure.

This last criterion—additionality—is of particular concern in any plan to address recalcitrant in-state emissions using land use carbon sequestration. If the carbon being sequestered via land use

²⁴ Cames, M., et. al. March 2016. *How additional is the Clean Development Mechanism?* Oko Institute. Available at: https://ec.europa.eu/clima/sites/clima/files/ets/docs/clean_dev_mechanism_en.pdf.

²⁵ Connecticut Department of Energy and Environmental Protection. 2020. *2017 Connecticut Greenhouse Gas Emissions Inventory*. Available at: https://portal.ct.gov/-/media/DEEP/climatechange/2017_GHG_Inventory/2017_GHG_Inventory.pdf?la=en. P. 1

²⁶ Ibid.

²⁷ Ibid.

²⁸ McGlynn, Emily, et al. 2019. “Reducing climate policy risk: Improving certainty and accuracy in the U.S. land use, land use change, and forestry greenhouse gas inventory.” *ClimateWorks Foundation*. Available at: https://www.researchgate.net/publication/338710564_Reducing_climate_policy_risk_Improving_certainty_and_accuracy_in_the_US_land_use_land_use_change_and_forestry_greenhouse_gas_inventory. P. 15.

²⁹ U.S Environmental Protection Agency. 2020. *Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks 2990-2018*. EPA 430-P-20-001. Available at: <https://www.epa.gov/sites/production/files/2020-02/documents/us-ghg-inventory-2020-main-text.pdf>. p. 1-24.

³⁰ Ibid. p. 12.

³¹ Ibid. p. 39.

measures (to offset in-state emissions) is not limited to additional (new) sinks, it will not represent a change in emissions from 1990 (the baseline for emissions comparison under GWSA).

4. Permitted netting should not exceed the size of the allowable sinks

In order to determine the appropriate amount of emission netting, Massachusetts must first assess how many tons of emissions will need to be netted out given an 80, 85, 90 or greater than 90 percent emission reduction goal (see Table 1). The emissions reduction goal will determine what amount of negative emissions (and/or offsets) will be necessary to hit net zero.

Table 1. Future emission scenarios for Massachusetts

	Total annual emissions (MMT CO ₂ e)	% reduction from 1990 levels	Equal to emissions from (million cars)
1990	94.5	N/A	20.5
2017	73.3	22%	15.9
2050	18.9	80%	4.1
	14.2	85%	3.1
	9.4	90%	2.1

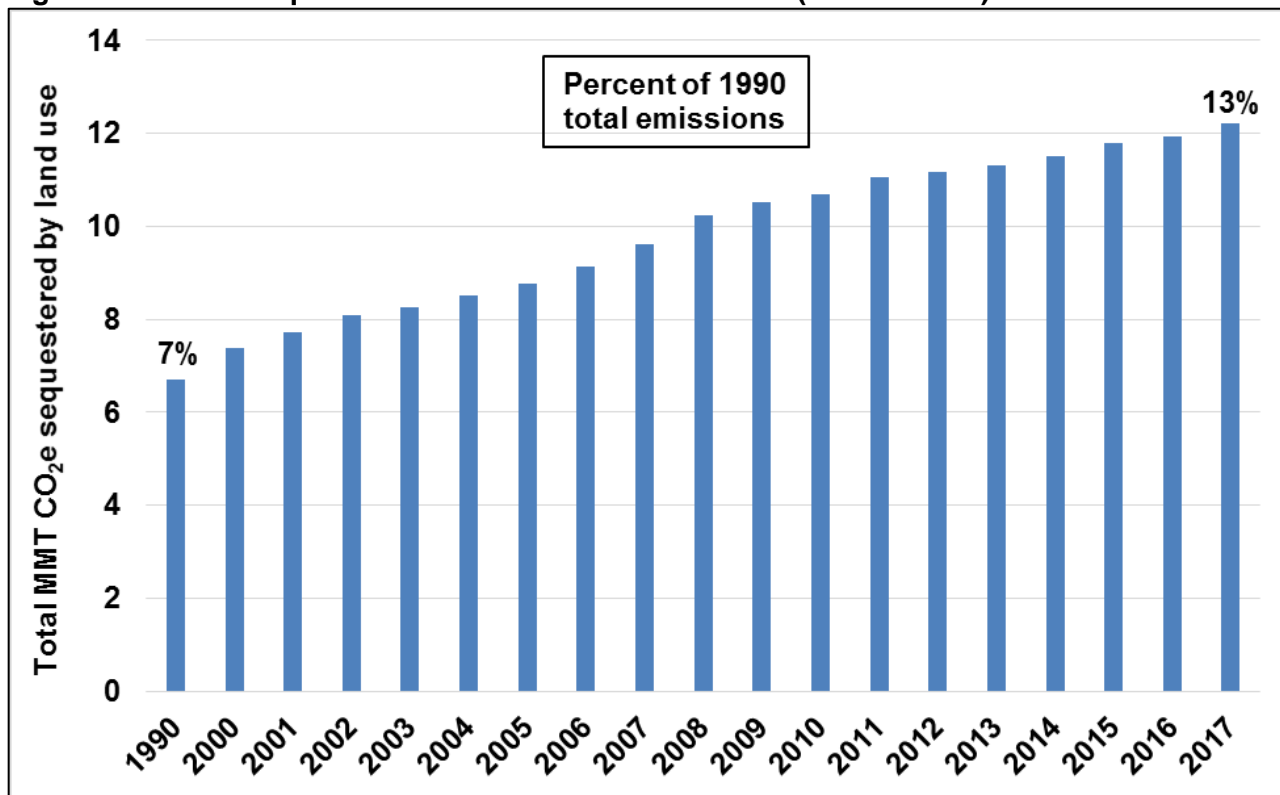
Data source: MA DEP. 2018. *Greenhouse Gas Emissions Reporting Program, Appendix C*. Available at: <https://www.mass.gov/doc/appendix-c-massachusetts-annual-greenhouse-gas-emissions-inventory-1990-2017-with-partial-2018/download>; U.S. EPA. 2018. *Greenhouse Gas Emissions from a Typical Passenger Vehicle*. Available at: <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle>

Carbon removal measures in the land use sector most commonly include afforestation, forest restoration, and changing farming practices to store more carbon in soils.³² Available land use carbon sequestration and emissions data from Massachusetts demonstrate that the land use sector accounts for 7 to 13 percent of the state’s total 1990 (baseline year) emissions (see Figure 3).

If the Commonwealth’s carbon sequestration from land use amounts to only 7 to 13 percent of 1990 emissions, this level either sets a limit on permitted netting or suggests that it will be necessary to go outside of the state’s borders to secure more sinks. Setting the emission reduction target at 90 percent or higher would allow the Commonwealth to rely exclusively on in-state sinks.

³² World Resources Institute. No date. “Carbon Removal”. Available at: <https://www.wri.org/our-work/project/carbon-removal>.

Figure 3. Carbon sequestration from the land use sector (1990 to 2018)



Data source: MA DEP. 2018. Greenhouse Gas Emissions Reporting Program, Appendix C. Available at: <https://www.mass.gov/doc/appendix-c-massachusetts-annual-greenhouse-gas-emissions-inventory-1990-2017-with-partial-2018/download>.

Between 2007 and 2013, 112,000 acres of land in Massachusetts have come under conservation protection.³³ According to a 2014 study by Harvard University, every year, thousands of acres of Massachusetts land are lost to development, erasing progress in land conservation efforts.³⁴ If recent land development trends continue or increase, the consequences for people and nature will include not only important missed benefits like water filtration and habitat health,³⁵ but severe limits to the state’s ability to utilize its land use sector for carbon sequestration.

5. No netting should be permitted in the 2030 and 2040 targets

Massachusetts’ Decarbonization Roadmap and greenhouse gas emission targets should make clear that the use of sinks to net emissions is neither necessary nor permissible in 2030 and 2040. “Net” emissions are meant to be a safety valve for any emissions that turn out to be very difficult to

³³ Harvard University. 2014. *Changes to the Land: Four Scenarios for the Future of the Massachusetts Landscape*.

³⁴ Ibid.

³⁵ Ibid.



eliminate. There will be sufficient room to accommodate recalcitrant emissions in the permitted emission set for 2030 and 2040.

If, for example, Massachusetts sets its targets based on a linear (straight line) path between a 25 percent reduction in 2020 and a (minimum) 80 percent reduction in 2050, allowable emissions in 2030 and 2040 would be 54 MMT and 36 MMT, respectively. Limited flexibility to use sinks to net out emissions should only become necessary as the Commonwealth approaches full decarbonization in 2050.

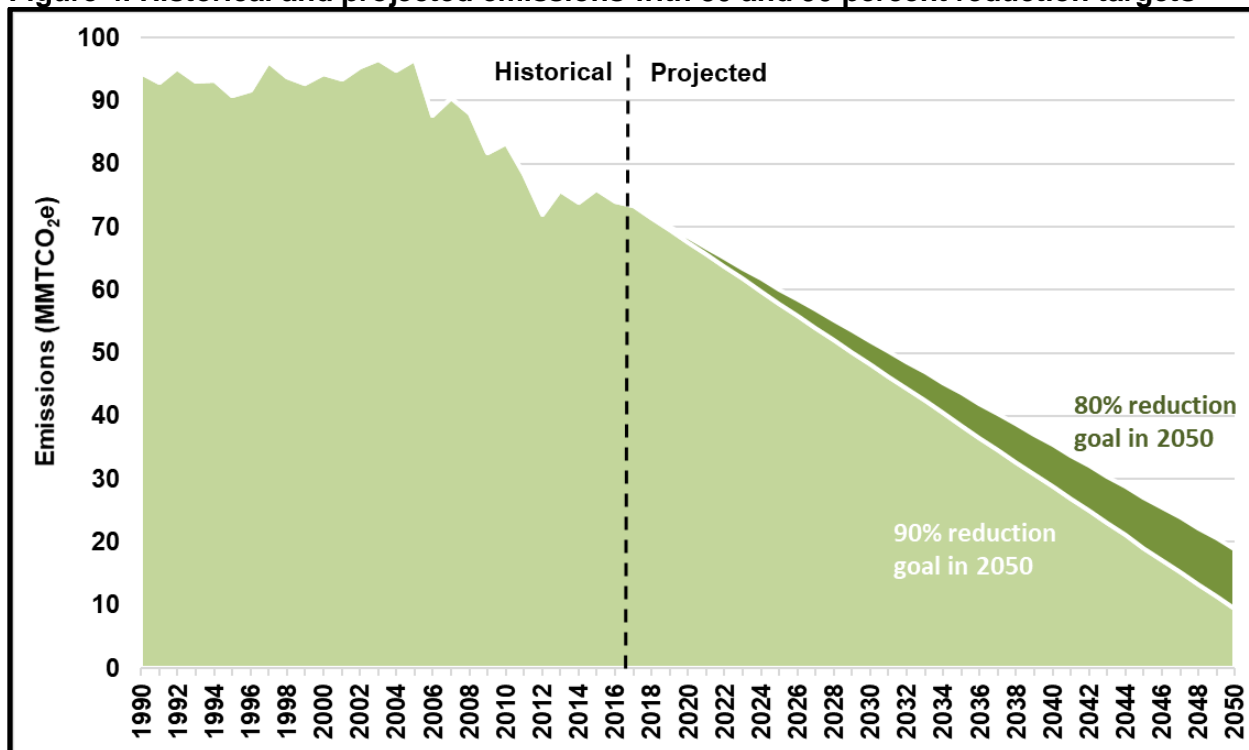
6. The level of netting permitted should be considered in terms of its impact on global climate change

If Massachusetts were to set an 80 percent emissions reduction target, total allowable emissions in 2050 would equal 18 MMT CO₂e. If Massachusetts were to set a 90 percent target, total allowable emissions in 2050 would equal 9 MMT. The difference between selecting a 80 or 90 percent target will results in the state netting out an additional 9 MMT, which is the equivalent of the annual emissions from over 2 million cars (see Table 1 above and Figure 4).³⁶

Nine million metric tons of CO₂e (the difference in the total greenhouse gas emitted in 2050 if the Commonwealth were to choose an 80 percent versus 90 percent emission reduction target) is not negligible. Massachusetts should consider its proposed emission reduction targets in the context of global climate change and the negative impacts that residual emissions will have on the ability to limit average global temperature increase and avoid the impacts of dangerous climate change in our home state and around the world.

³⁶ U.S. EPA. 2018. "Greenhouse Gas Emissions from a Typical Passenger Vehicle". Available at: <https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle>.

Figure 4. Historical and projected emissions with 80 and 90 percent reduction targets



Data source: MA DEP. 2018. *Greenhouse Gas Emissions Reporting Program, Appendix C*. Available at: <https://www.mass.gov/doc/appendix-c-massachusetts-annual-greenhouse-gas-emissions-inventory-1990-2017-with-partial-2018/download>.

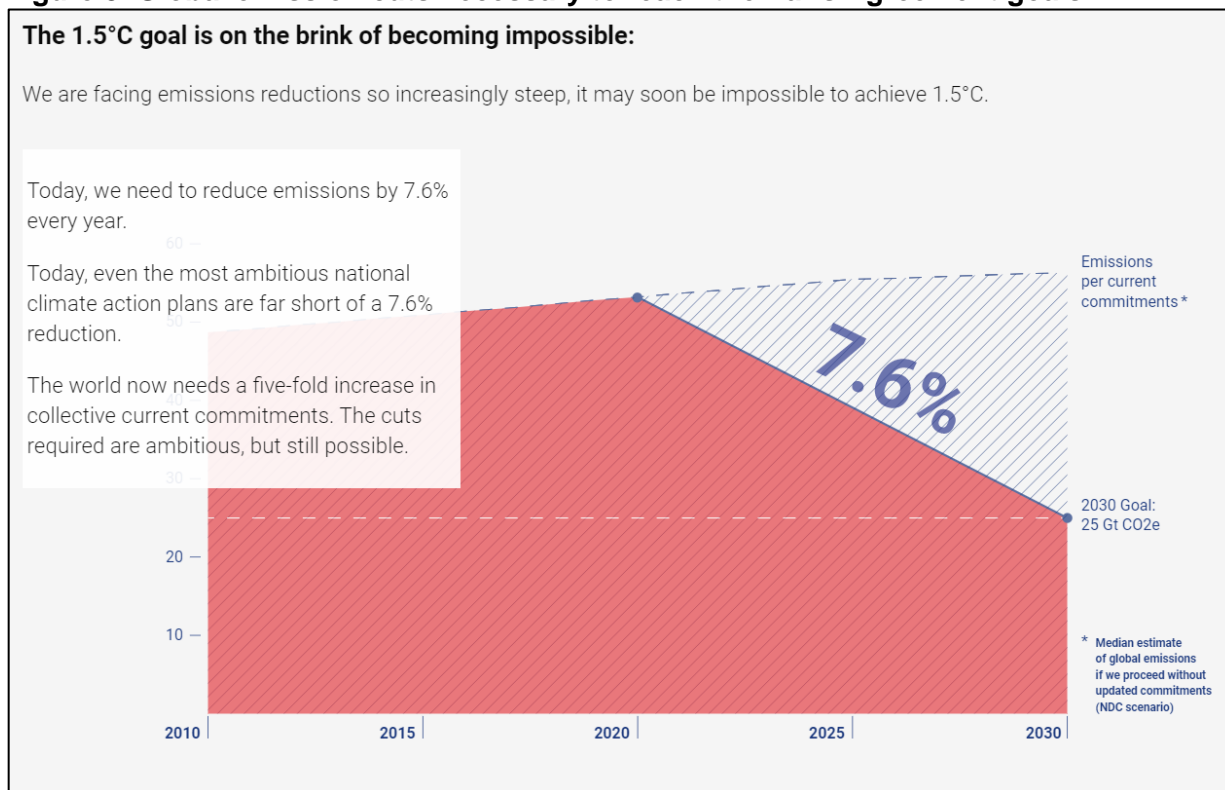
7. Massachusetts' carbon sinks should be fostered: they have an important role to play in slowing global climate change

In addition to balancing out truly recalcitrant emissions, the Commonwealth's carbon sinks can provide an important contribution to lowering global greenhouse gas emissions still further. According to the best available science from the Intergovernmental Panel on Climate Change (IPCC), even after accounting for existing emission reduction commitments by world governments (including pledges by the U.S. federal government, U.S. states and even U.S. cities)—global emissions must still fall by an additional 7.6 percent per year between 2020 and 2030 to have any chance of limiting global average warming to 1.5°C or less (see Figure 5).³⁷ At current emission levels (and accounting for existing emission reduction pledges), if we wait until 2025 to start making the necessary reductions—global emissions will need to fall by an additional 15.5 percent

³⁷ UN Environment Program. November 26, 2019. *Emissions Gap Report 2019*. United Nations. Available at: <https://www.unenvironment.org/interactive/emissions-gap-report/2019/?fbclid=IwAR2x7YSxJw4D-xNvGrIC4VnB2yVRq1gMHnzWLG7TJWf8910-fjrRThiScEA>.

each year, “making the 1.5°C target almost impossible.”³⁸

Figure 5. Global emission cuts necessary to reach the Paris Agreement goals



Source: Reproduced from UN Environment Programme. November 26, 2019. Emissions Gap Report 2019. Visual Interactive. Available at: <https://www.unenvironment.org/interactive/emissions-gap-report/2019/?fbclid=IwAR2x7YSxJw4D-xNvGriC4VnB2yVRq1gMHnzWLG7TJWf8910-fjrRThiScEA>.

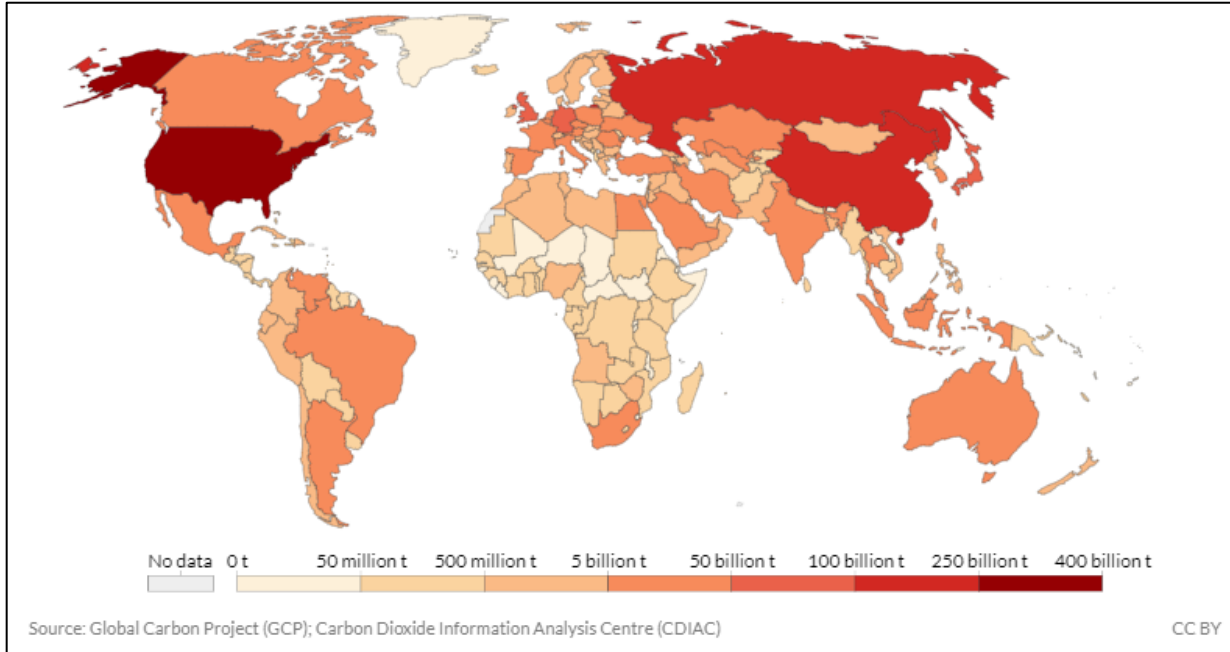
Given that the United States has emitted more than any other country historically (on a cumulative basis, see Figure 6), has the world’s highest per capita emissions (see Figure 7), and is failing to meet its existing emission reduction commitments³⁹—our “fair” share may be larger than our current share of global emissions. Massachusetts’ responsibility to reduce its emissions, includes the best possible use of its carbon sinks.

³⁸ Ibid.

³⁹ UN Environment Programme. November 26, 2019. Emissions Gap Report 2019. Available at: <https://www.unenvironment.org/resources/emissions-gap-report-2019>.

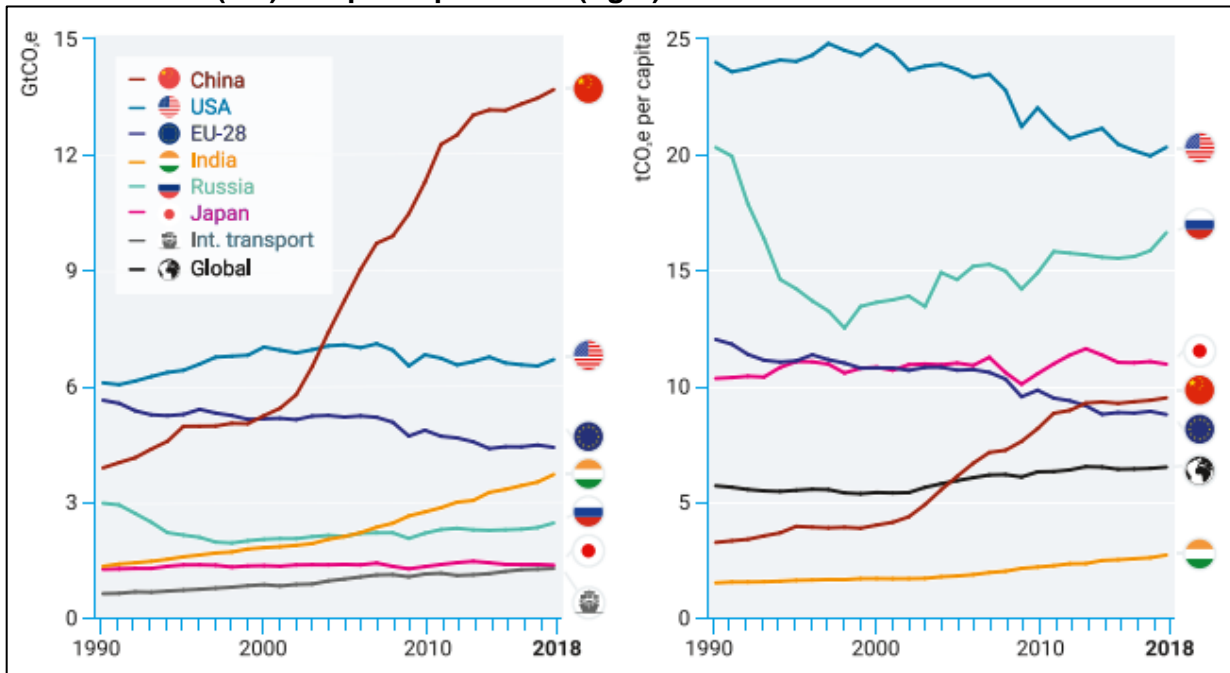


Figure 6. Cumulative CO₂ emissions from 1751 to 2017



Source: Reproduced from Ritchie, H. and Roser, M. December 2019. CO₂ and Greenhouse Gas Emissions. Our World in Data. Available at: <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions>.

Figure 7. Top greenhouse gas emitters (excluding land-use change emissions) on an absolute basis (left) and per capita basis (right)



Source: Reproduced from UN Environment Programme. November 26, 2019. Emissions Gap Report 2019. Figure ES-2. Available at: <https://www.unenvironment.org/resources/emissions-gap-report-2019>.

Every ton of emissions that we fail to reduce between now and 2050 pushes us, as a state, country and planet, further away from the 1.5°C limit necessary to avoid the most catastrophic impacts of climate change.

8. Massachusetts' Decarbonization Roadmap modeling tools should be capable of modeling sub-state level impacts and cutting-edge technologies

Massachusetts EEA is currently engaged in a research and modeling effort to identify “strategies, policies, and implementation pathways...to achieve at least 80 [percent greenhouse gas] reductions by 2050, including multiple pathways to net-zero emissions.”⁴⁰ EEA has engaged with several consulting groups to conduct this modeling and expects to publish its results in late 2020.

It is critical that the modeling tools select for this work have the capabilities necessary to represent a full range of emission reduction technologies and the techniques necessary to integrate these technologies in our energy system. Two areas of modeling capacity are of particular concern: geographic resolution and complex representation of electric dispatch.

Geographic resolution: It is not sufficient to model our energy system at the regional (New England) or even state level. Modeling sub-state electric distribution zones and other sub-state specific energy supply and demand distinctions is essential to achieve an accurate representation of the challenges and advantages expected in our decarbonization process. Without proper modeling of the distribution of energy services at a sub-state level, both the viability of emissions mitigation technologies and their costs may be represented inaccurately.

Complex representation of electric dispatch: A common failing of recent deep decarbonization studies is a built-in assumption that electric systems with very high shares of renewable energy supply must require either oversupply or “back up” supply to function: both of which add significant, and perhaps unnecessary, costs. Cutting-edge solutions to balancing high-renewable-supply electric systems include “flexible load balancers” such as demand response, behind-the-meter batteries, and virtual power plants. Not all electric dispatch modeling platforms have the capability to accurately model these solutions. To model inexpensive, flexible load balancers, models must be capable of hourly (or sub-hourly) dispatch resolution, demand-side (load reduction) dispatch, and representation of dispatchable demand response and batteries with varying characteristics.

⁴⁰ Executive Office of Energy and Environmental Affairs. No data. “MA Decarbonization Roadmap”. Commonwealth of Massachusetts. Available at: <https://www.mass.gov/info-details/ma-decarbonization-roadmap#current-research-effort->.



Conclusion

Massachusetts should set an ambitious emissions reductions target that aims for full decarbonization by 2050, while also prudently planning for flexibility by requiring net zero emissions and permitting the use of negative emissions measures to achieve this goal. Doing so will distinguish the Commonwealth as a national leader on climate, bring the state in line with the best available science, and mitigate against both global and local climate change impacts.

The Commonwealth, however, must be careful to ensure that its approach to net zero is clear, rigorous and transparent. Emissions netting should be embraced as a last recourse, not as an excuse to continue to emit easily mitigated greenhouse gases. In addition, it is vitally important that the Commonwealth protect against concentrating recalcitrant emissions in environmental justice communities that already face disproportionate environmental dangers and damages.