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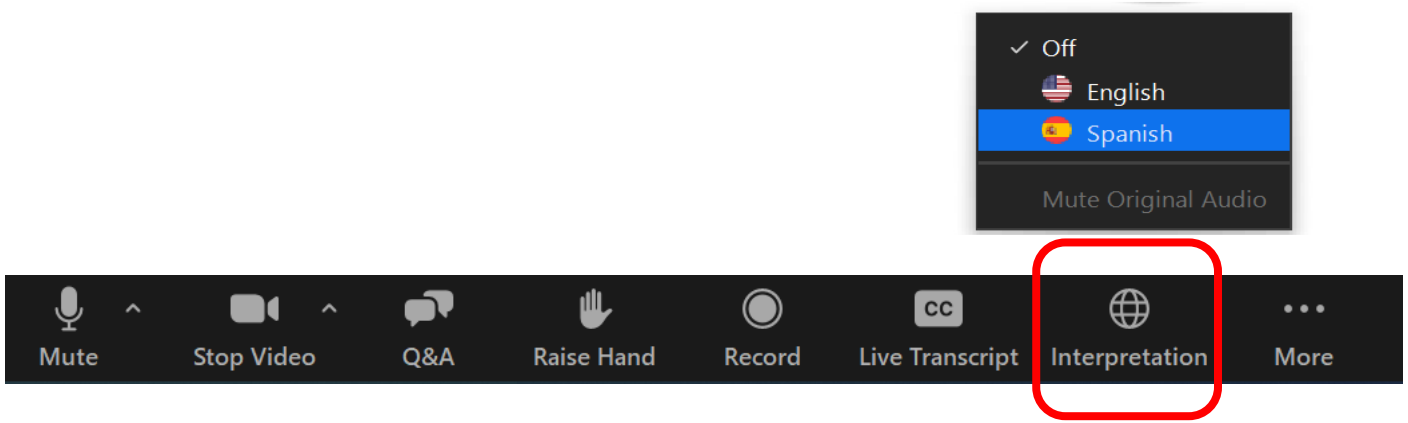

Logistics

- All attendees must select a language channel, even if viewing the presentation in English.
- Translated version of this presentation is available on www.mass.gov/2050CECP and www.mass.gov/gwsa-meetings
- All lines will be muted during the presentation. The line will be open for oral comments after the presentation.
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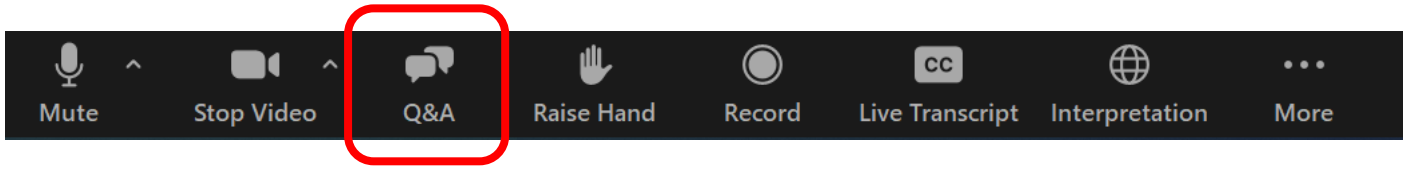


Clean Energy & Climate Plan for 2050

Limit, Sublimits, Goals, & Policies

Massachusetts Executive Office of Energy & Environmental Affairs

Public Hearings
October 6, 7, and 11, 2022

Agenda

- **Requirements of the 2021 Climate Law**
- **Limit & Sublimits for 2050**
  - Requirements for 2050
  - Sector Sublimits & CECP Policy Framework
- **Sector-by-Sector Goals & Strategies**
  - Transportation
  - Buildings
  - Electric Power
  - Non-Energy and Industrial
  - Natural and Working Lands
  - Cross-Cutting and Enabling Policies
- **Next Steps**
- **Additional Slides**
  - Net Zero Emissions: The Concept
  - Net Zero Emissions: Compliance Examples
  - Net Zero Emissions: Accounting Approach
  - Explanations of Terms and Acronyms

Requirements of An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy ("2021 Climate Law")

- As required by the 2021 Climate Law, the **Clean Energy and Climate Plan (CECP)** acts as a "roadmap" for how the Commonwealth will achieve its greenhouse gas emissions reduction goals
- Statutory requirements in 2021 Climate Law:
  - **Economy-wide GHG Reduction**
    - Requires ≥50% greenhouse gas (GHG) emissions reduction in 2030; ≥ 75% in 2040; ≥85% and net zero in 2050
    - Also requires emissions limit for 2025, 2035, and 2045
  - **Sector-Specific GHG Reduction**
    - Requires EEA Secretary to set sublimits for electric power, transportation, commercial and industrial heating and cooling, residential heating and cooling, industrial processes, natural gas distribution and service, and "any other sector or source the secretary may designate" as components of each emissions limit
  - **Natural and Working Lands (NWL)**
    - Codifies NWL definition
    - Requires EEA to track NWL carbon flux and set goals for reducing emissions and increasing carbon sequestration
    - Requires development of NWL plan within each CECP
  - **Progress Tracking**
    - Requires EEA to set numeric benchmarks and track emissions reduction products, solutions, and improvements used to achieve statewide emissions limits and sublimits

Requirements for 2050

By 2050 Massachusetts must:

1. Reduce statewide emissions by at least 85% from the 1990 baseline
2. Achieve net zero emissions on an annual basis

EEA has modeled an aggressive, yet achievable approach to meet 2050's 85% emission limit and ultimate net zero target

- Current approach reaches an estimated reduction beyond the required 85% at an 88.6% reduction
- Approach allows room for some uncertainties as each sector decarbonizes
  - Uncertainty in new technology developments and relative costs
  - Uncertainty in decarbonization solution adoption rates
  - Uncertainty in future greenhouse gas emission accounting and reporting
  - Uncertainty in the carbon sequestration and reduction ability

"Massachusetts is required to set a 2050 statewide emissions limit that achieves at least net zero statewide greenhouse gas emissions; provided, however, that in no event shall the level of emissions in 2050 be higher than a level 85 per cent below the 1990 level."
- Act Creating a Next Generation Roadmap for Massachusetts Climate Policy ("2021 Climate Law")

Sector Sublimits and CECP Policy Framework

Sublimit (per 2021 Climate Law)	2030 Emissions Sublimits (% below 1990 level)	2050 Emissions Sublimits - PROPOSED (% below 1990 level)	Subsectors Tracked in MassDEP GHG Inventory	Examples of Emitting Resources	Examples of Methods to Reduce Emissions	Policy Sector in the CECP
Power (including all building & transportation electricity)	70%	93%	Electricity	Power plants in MA and those we import from	Replace fossil plants with renewables	**Electricity**
Transportation	34%	86%	Transportation	Cars, trucks, planes	Replace gas vehicles with electric vehicles	**Transportation**
Residential Heating (& Cooling)	49%	95%	Residential	Residential space and water heating	Efficiency upgrades and clean heat technologies such as electric heat pumps	**Buildings**
Commercial & Industrial Heating (& Cooling)	49%	91%	Commercial	Commercial space and water heating		
			Industrial Energy	Manufacturing		**Non-Energy & Industrial**
Industrial Processes	-281%	-27%	Industrial Processes	Fluorinated gases	Technical assistance for industrial hygiene best practices; regulations and permitting requirements for key pollutants and sectors	
Natural Gas Distribution & Service	82%	71%*	Natural Gas Leaks	Natural Gas Leaks		
Others (with no sublimits)	NA	NA	Solid Waste	Landfills in MA		
			Wastewater	Deer Island		
			Agriculture	Dairy cows		

*Methodology for Natural Gas Distribution and Service emission accounting has recently changed by EPA.

What Does 85% GHG Emissions Reduction by 2050 Look Like?

- **Transportation: 86% ↓** **(Estimated Actual Reduction was 20% in 2020)**
  - Nearly all passenger vehicles and most medium and heavy-duty vehicles are electric.
  - Biofuels and hydrogen account for a share of the fuels used in sectors that are difficult to electrify, such as long-haul trucking, marine and air travel.
  - Total driving is stabilized as more Massachusetts residents have access to alternatives to personal vehicles for transportation.
- **Buildings (Residential & Commercial): 93% ↓** **(Estimated Actual Reduction was 18% in 2020)**
  - All new buildings are built with tighter envelopes and majority of all buildings are heated and cooled by electric heat pumps.
  - Clean Heat Clearinghouse centralizes technical assistance, connecting customers to decarbonization solutions.
- **Electricity: 93% ↓** **(Estimated Actual Reduction was 54% in 2020)**
  - More than 97% of electricity consumed in Massachusetts comes from renewable and clean energy sources.
  - Offshore wind is one of the primary sources of New England's electricity supply, along with a diverse portfolio of clean energy resources while keeping grid reliable and resilient.
- **Non-Energy & Industrial: 75%↓** **(Estimated Actual Reduction was 28% in 2020)**
  - HFCs and SF_6 are eliminated from cooling systems; some industrial emissions mitigated by carbon capture.
  - Most natural gas pipelines are likely phased out and replaced by fossil-free alternatives.
  - Solid waste disposal is reduced by at least 90%.

Transportation Sector

	2025/2030 CECP	2050 CECP Proposal
Policy Portfolio	• Implementation of vehicle emission standards • Promote alternatives to personal vehicles (MBTA Communities, MBTA Bus Modernization program, multimodal infrastructure, new ebike incentive). • Improve electric vehicle incentives by making incentives available at point of sale, adding targeted incentives for low income drivers. • Build charging infrastructure through investments and changes in rate structures. • Electrify markets with critical health and equity implications, including vehicles for hire, school buses, and delivery trucks. • Engage Consumers and Facilitate Markets	**Extension of Current Policy:** • Implementation of Advanced Clean Cars 2 and Advanced Clean Truck Standards which will require manufacturers to increase the number of zero-emission vehicles on the road. • Build charging infrastructure, including a network of public fast charging stations sufficient to serve the needs of a fully electrified fleet, as well as support for charging at homes and workplaces. • Continue to expand housing production near public transportation stops. • Prioritize multimodal transportation infrastructure. • MassDOT and the MBTA will continue to work to meet the goals for electrification of transit outlined in the Climate Bill and detailed in MBTA Rail Vision. • Expand EV incentives until the upfront cost of electric vehicles reaches upfront cost-parity with internal combustion equivalents. **New Policy:** • Begin to add additional policy incentives to retire old combustion vehicles. • Require commitment to smart charging as part of all EV incentives by 2031. • Adopt fuels policies to promote clean biofuels and hydrogen in difficult to electrify sectors such as aviation, marine and long-haul trucking.
GHG Emission Sublimit	19.8 $MMTCO_2e$ (34% below 1990) for 2030	4.1 $MMTCO_2e$ (86% below 1990)
Key Targets & Metrics	• 200,000 passenger EVs on the road by 2025; 900,000 by 2030 • 15,000 public charging stations by 2025, 75,000 by 2030	• Essentially all passenger vehicles on the road are electric. • Sufficient public EV charging infrastructure in place.

Buildings Sector

	2025/2030 CECP	2050 CECP Proposal
Policy Portfolio	• Cap on emissions from heating by having MassDEP implement regulations by the end of 2024 that consider emissions caps, standards and potentially a Clean Heat Standard. • Implement performance benchmarks and standards, including high efficiency specialized energy code, update to the stretch energy code, revisions to APS, and consideration of a uniform and consistent energy performance reporting approach. • Deliver results at scale through pursuit of a climate finance approach, set up a centralized clean heat clearinghouse, update the role/charge of Mass Save, minimize the environmental impacts of new construction through MEPA process, expand pilot programs for innovative clean energy approaches and expand workforce development, consumer outreach, and education initiatives.	**Extension of Current Policy** (based on preliminary recommendations from the MA Commission on Clean Heat): • Implement a Clean Heat Standard (CHS) as a regulatory approach to meet buildings emissions sublimits through electrification and energy efficiency. • Instruct utilities to conduct coordinated planning for targeted natural gas decommissioning and electric distribution and transmission systems. • Develop a Clean Heat Clearinghouse as a center point of contact for customers for all clean energy solutions (e.g., deep weatherization and EE measures, solar, heat pumps, EV charging, storage). • Establish climate finance mechanisms to de-risk and mobilize private sector investments for buildings pursuing deep decarbonization. • Conduct a comprehensive public education campaign and implement community-level engagement to build momentum for building electrification.
GHG Emission Sublimits	7.8 $MMTCO_2e$ (49% below 1990) for 2030 Residential Heating and Cooling 4.7 $MMTCO_2e$ (44% below 1990) for 2030 Commercial Heating and Cooling	0.8 $MMTCO_2e$ (95% below 1990) for 2050 Residential Heating and Cooling 0.9 $MMTCO_2e$ (89% below 1990) for 2050 Commercial Heating and Cooling
Key Targets & Metrics	• Deep weatherization in 10% of building stock by 2025 • Deep weatherization in 20% of building stock by 2030 • Electric heating in ~500,000 residences and 100 million commercial sq. ft. by 2025 • Electric heating in ~1 million residences and 300 million commercial sq. ft. by 2030	• Majority of buildings will be low-emitting.

Power Sector

	2025/2030 CECP	2050 CECP Proposal
Policy Portfolio	• Execute clean energy procurements, including the solicitation of 5,600 MW of offshore wind by end of 2027 • Support offshore wind and solar industry development by developing a regional offshore wind transmission plan, expanding offshore wind lease areas, and accelerating growth of solar and distributed energy • Incorporate decarbonization goals into distribution system modernization • Ensure that siting and permitting decisions consider the impact of energy projects on environmental justice (EJ) communities	**Extension of Current Policy:** • By 2030, develop successor to procurements for financing large-scale energy projects, such as forward clean energy market. • Support offshore wind development by collaborating with regional partners on long-term lease capacity, advancing floating offshore wind technologies, and catalyzing development of solar and storage technologies • Reform regional transmission planning and cost allocation • Modernize electric distribution system infrastructure to facilitate electrification and other decarbonization strategies, including deploying advanced meter infrastructure, and recommendations from the Grid Modernization Advisory Council. • Examine rate designs that promote efficient, clean energy use while ensuring that such designs are widely understood and include customer protections • Ensure that siting for solar, offshore wind, transmission, and distribution infrastructure consider the impact on EJ communities
GHG Emission Sublimit	8.4 MMTCO$_2$e (70% below 1990) for 2030	2.0 MMTCO$_2$e (93% below 1990)
Key Targets & Metrics	• 50 TWh of clean electricity used by MA customers in 2030 (out of approximately 73 TWh of total retail and municipal load) • 3.2 GW of offshore wind operating by 2030 • Robust pipeline of clean energy projects in the 2030	• Electricity sector modeling suggests that ~27 GW of solar and >20 GW of offshore wind are needed in 2050 to meet emission sublimit • By 2031, implement new regional transmission and wholesale market reforms • Start implementing floating technologies in 2031

Non-Energy & Industrial

	2025/2030 CECP	2050 CECP Proposal
Policy Portfolio	• Phase out HFCs according to AIM Act and explore regulation to minimize SF6 leakage rates • Review and propose changes to Gas System Enhancement Plans (GSEPs) by end of 2024 to upgrade leaky pipes that includes an economic evaluation of alternatives to full replacements in geographic areas with low anticipated natural gas utilization • Align with 2030 Solid Waste Master Plan, including a 90% reduction in solid waste disposal by 2050	**Extension of Current Policy:** <u>Industrial Energy & Processes:</u> • Continue to promote energy efficiency upgrades and electrification in industrial buildings • Continue to target HFCs and SF6 reductions <u>Waste:</u> • Continue to align with the 2030 Solid Waste Master Plan, and execute recommendations from future Solid Waste Master Plans produced every decade **New Policy:** <u>Natural Gas Delivery:</u> • Evaluate findings from 10-town pilot and future of gas infrastructure and, if appropriate, work with legislature to recommend broader natural gas delivery policies
Industrial Energy Sublimit	2.5 $MMTCO_2e$ (57% below 1990) for 2030	0.3 $MMTCO_2e$ (94% below 1990)
Natural Gas Delivery Sublimit	0.4 $MMTCO_2e$ (83% below 1990) for 2030	0.5 $MMTCO_2e$ (71% below 1990)* *Natural gas leak emission accounting methodology has been updated, and emission values have increased. 2030 values are now estimated at 0.7 $MMTCO_2e$
Industrial Process Sublimit	2.5 $MMTCO_2e$ (257% above 1990) for 2030	0.8 $MMTCO_2e$ (28% above 1990)
Key Targets & Metrics	• HFC emissions below 2.4 MMTCO2e by 2030 • 30% reduction in solid waste disposal by 2030	• 90% reduction in solid waste disposal by 2050

Natural and Working Lands

	2025/2030 CECP	2050 CECP Proposal
Policy Portfolio	• Expand state land acquisition, conservation and planning grants, tree planting, farmland protection, and healthy soils incentives. • Propose development projects clearing forest must undergo MEPA environmental impact review. • Launch Forest Resilient & Forest Viability Programs. • Pilot reporting of where cleared trees are milled. • Study end uses of MA timber, and opportunities and workforce to scale local durable wood market. • Require no-net-loss of stored carbon in replicated wetlands and a ≥2:1 replacement-to-loss ratio for wetland projects seeking variance. • Investigate approaches to increase statewide protection of wetlands and, at minimum, the first 50 ft. of the 100-ft. wetland buffer zone. • Streamline permitting for proactive wetland restoration. • Provide guidance for future solar siting. • Develop net zero emissions accounting and carbon sequestration market frameworks.	**Extension of Current Policy:** • Expand NWL conservation with federal and state funding, state support to municipalities and RPAs, and options to channel private investments to NWL conservation. • Encourage local tree supply and expand planting efforts to more state partners (e.g. NGOs, schools, youth groups). • Develop methodologies for quantifying GHG emissions implications of large-scale land clearing and potential options for mitigation, including reuse of wood for long-lived wood products and contributions to tree planting and land conservation efforts. **New Policies:** • Explore regulatory pathways to limit deforestation
Key Targets & Metrics	• Maintain current NWL net carbon sequestration through 2025 and increase to 25% below the baseline 1990 level by 2030 • ≥28% of land and water permanently conserved by 2025, and ≥30% by 2030 • 20% of privately owned forests and farms to adopt climate smart management practices by 2030 • ≥5,000 acres of new urban and riparian trees by 2025, and ≥16,100 acres by 2030 • Achieve no net loss of stored carbon in wetlands by 2030 • 5% improvement in durable wood product recovery of harvested timber by 2030	• Net NWL emissions of [ ]% below the 1990 level by 2050 • 40% of MA land and water permanently conserved by 2050 • At least 64,400 acres of new urban and riparian trees by 2050

Cross-Cutting & Enabling Policies

To achieve “2050 net zero,” the Commonwealth needs to take action now with cross-sector policies:

Workforce Development:

- Formally adopt and embed climate and energy transition curriculum into the state's "career clusters,” by working with state schools at all levels.
- In 2031, launch a “Climate Service Corps” for young adults that drives awareness and adoption of clean energy technologies.
- Work with labor unions to assist in training and retraining, particularly those who want or need to transition from other sectors.

Innovation:

- By end of 2023, establish partnerships with replicable approach to expand university “tech-transfer” programs to better build this capacity at MA-based public and private universities.

Climate Leadership:

- Expand DOER’s Lead by Example program to support '2050 Ready' existing-building retrofit projects at state facilities, take on more net-zero new construction projects, and substantially increase clean energy procurement to meet electrical load at state facilities.
- Increase EEA’s efforts in coordinating with municipal and regional entities on net zero planning, capacity-building, and implementation.

Cross-Cutting & Enabling Policies (Continued)

Future of Fuels:

- By 2024, MassDEP to consider whether changes are needed to the inventory conventions/guiding principles for greenhouse gas emission accounting methodologies for biobased and synthetic fuel combustion emissions. Considerations could include whether to include these emissions into the baseline and total emission accounting.

Environmental Justice (EJ) and Just Transition:

- Begin tracking and setting goals for certain percentage of clean energy and climate investments to benefit EJ communities or populations.

Next Steps

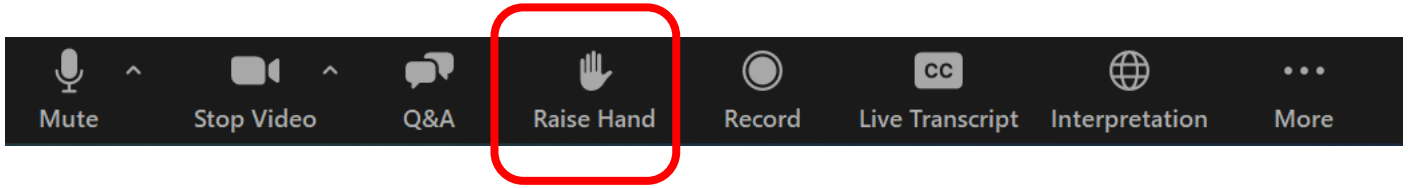
- **Receive oral comments on the proposed emissions limit, sublimits, goals, and policies for the 2050 CECP during upcoming public hearings.**
  - Public hearings on October 6th at 6PM-8PM, October 7th at 12PM-2PM, and October 11th at 12PM-2PM.
- **Receive written comments on the proposed emissions limit, sublimits, goals, and policies for the 2025 and 2030 CECP until October 21, 2022.**
  - Submit written comments at this portal or email gwsa@mass.gov
- **Review and synthesize submitted comments.**
- **Update the proposed emissions limit, sublimits, goals, and policies where feasible and appropriate.**
- **Submit 2050 CECP to Legislature and post on www.mass.gov/2050CECP by January 1, 2023.**

Oral Comments and Questions

- **To provide oral comments:**
  - Click on “Raise Hand” if you’re joining by Zoom—You can unmute yourself once we call on you.
  - Press *9 if you’re joining by phone—You can press *6 to unmute yourself when we call on you.

- **To ask a question, please submit your question in the Q&A box.**

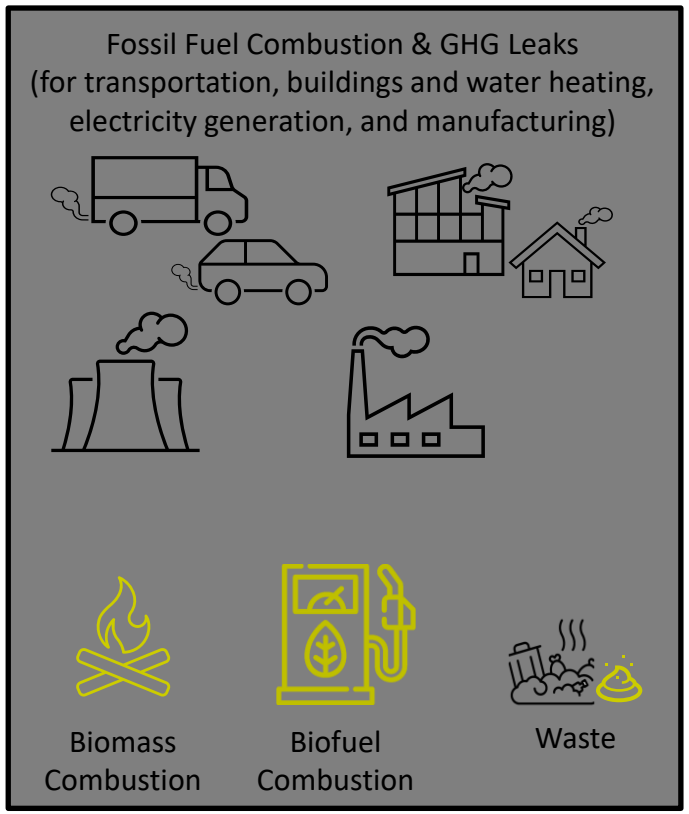
- **Written comments on the proposed emissions limits, sublimits, goals, and policies are accepted at this portal and gwsa@mass.gov until October 21, 2022.**
  - Comments in the Q&A box and Chat will not be considered written comments.

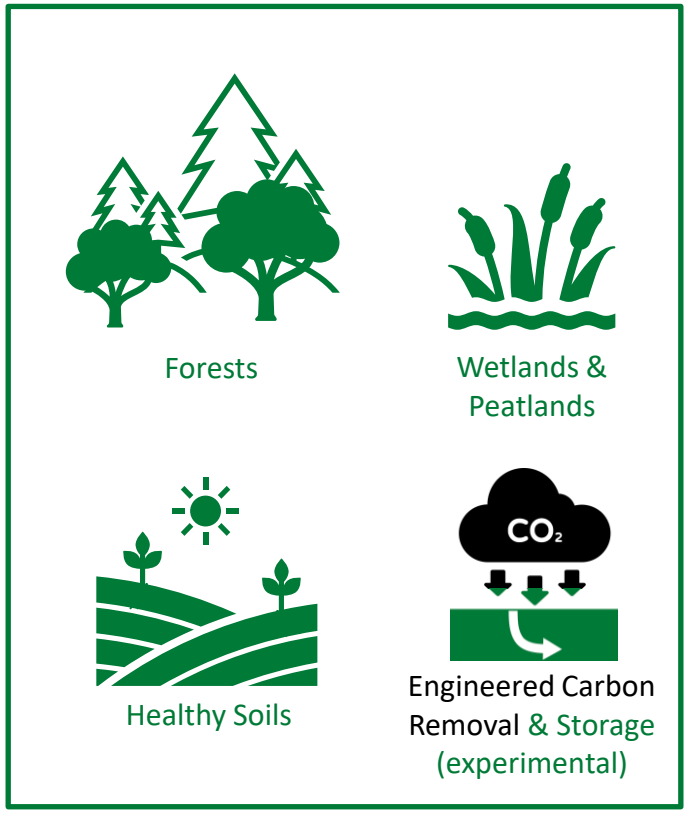


Additional Slides

Net Zero GHG Emissions: The Concept

Net Zero GHG Emissions = **GHG Emissions** − **Net Carbon Sequestration** = 0



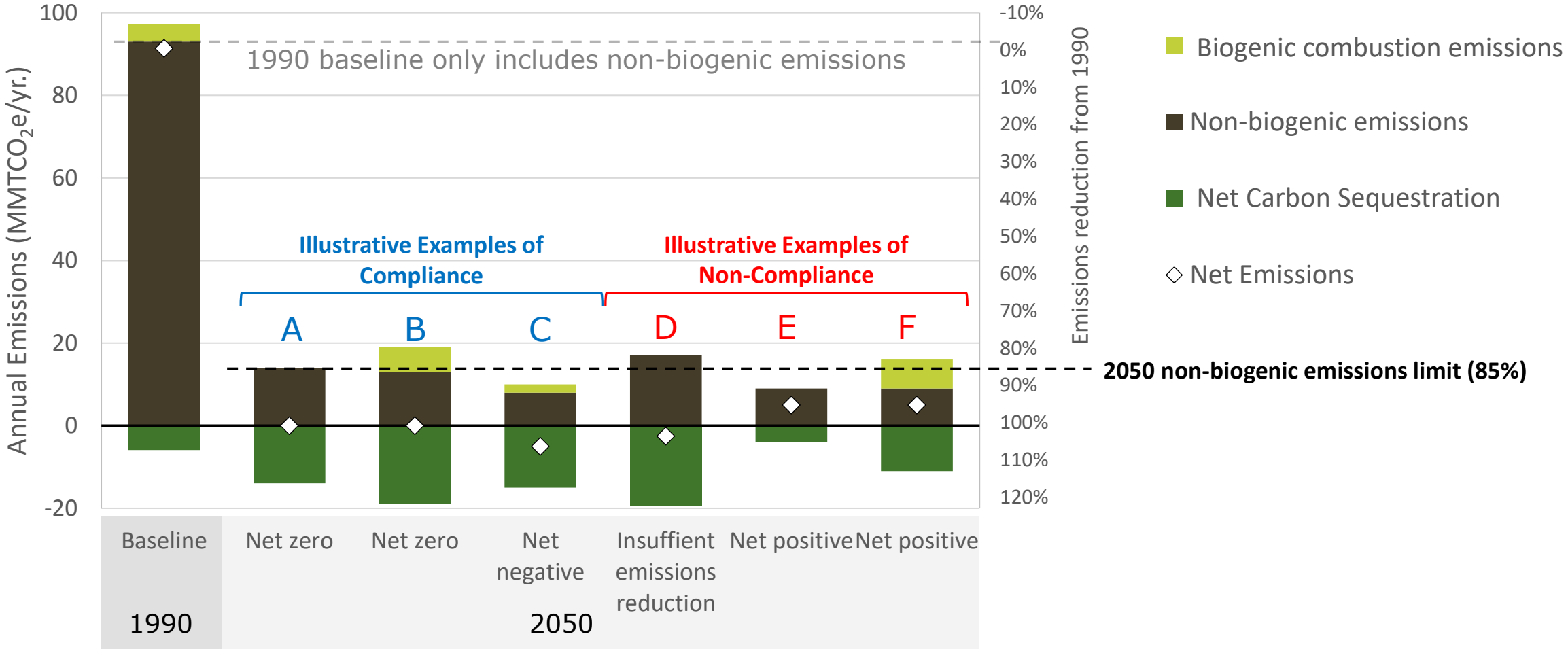


Black symbols: non-biogenic GHG emissions and sequestration sources
Yellow symbols: GHG emissions from biogenic sources
Green symbols: carbon sequestration from biogenic sources

Biogenic: *produced by living organisms or biological processes (excludes fossil fuels)*
Carbon Sequestration: *the removal and long-term storage of carbon dioxide from the atmosphere*

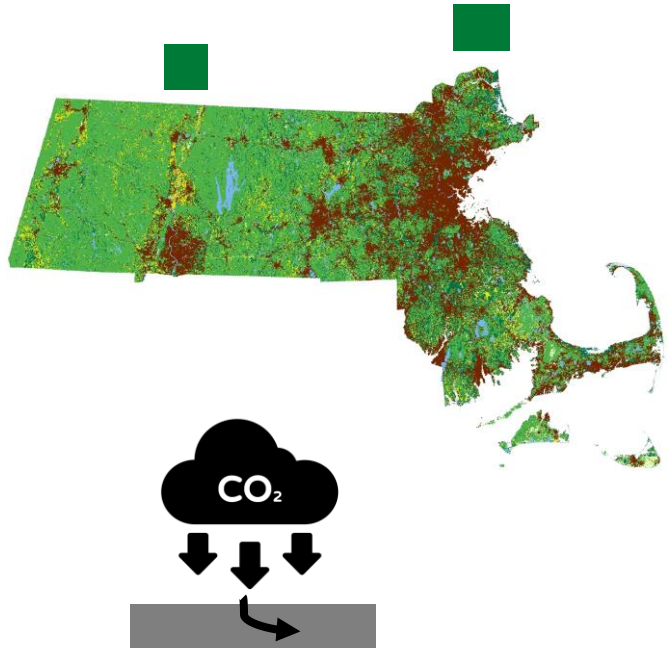
Net Zero Emissions: Compliance Examples

- **Net zero emissions requires an 85% emissions reduction in non-biogenic emissions and carbon sequestration equal to all remaining emissions, biogenic and non-biogenic, by 2050.**
- **In 2050: *Net Emissions* = *Non-Biogenic Emissions* + *Biogenic Combustion Emissions* – *Net Carbon Sequestration* = 0**



Net Zero Emissions: Accounting Approach

- Massachusetts uses primarily **"biophysical accounting approach" for accounting GHG emissions, including:**
  - **Emissions and sequestration within MA**
    - Emissions from biofuels and biomass combustion (with policies to measure life cycle emissions)
    - Nature-based *net* carbon sequestration *within* MA: All quantifiable annual net carbon sequestration on MA NWL including:
      - Carbon sequestration regardless of land ownership
      - Emissions from wetlands, croplands, settlement soils, and other NWL sources
  - **Emissions or sequestration attributable to MA**
    - Procurement of *additional* carbon sequestration *beyond* capability of MA NWL, such as:
      - Nature-based solutions outside of MA
      - Engineered carbon dioxide removal & storage



Explanations of Terms and Acronyms

- **GHG** – Greenhouse gas, such as carbon dioxide (CO_2), methane (CH_4), different types of hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF_6), that trap heat and cause the average global air temperature to rise, thus changing weather patterns globally.
- **GHG inventory** – A list of emission sources and their annual emissions quantified using standardized methods.
- **Fluorinated gas** – Greenhouse gas that have fluorine, such as different types of hydrofluorocarbons (HFCs) and sulfur hexafluoride (SF_6).
- **$MMTCO_2e$** – Million metric tons of carbon dioxide equivalence. This is a measure of how much greenhouse gas is emitted into our atmosphere. An emission of 1 $MMTCO_2e$ is equivalent to burning 112,523,911 gallons of gasoline.
- **Emission limit** – The level at which greenhouse gas emissions in Massachusetts can not exceed.
- **Emission sublimit** – The level at which greenhouse gas emissions from a specific sector can not exceed.
- **Carbon Sequestration** – The removal and storage of carbon dioxide from the atmosphere, commonly by plants and soil.
- **Biomass** – Organic matter, such as wood, that can be burned to produce electricity and heat.
- **Biogenic emissions or sources** – Emissions or sources of emissions that are produced by living organisms or biological processes (excludes fossil fuels)
- **Energy code or Stretch energy code** – These are different standards for energy usage in buildings and tightness of the building shell for which newly constructed buildings must meet.

Explanations of Terms and Acronyms

- **CECP** – Clean Energy and Climate Plan
- **DOER** – Department of Energy Resources
- **EEA** – Executive Office of Energy and Environmental Affairs
- **EV** – Electric vehicles powered by battery or hydrogen fuel cell
- **GW** – Gigawatt
- **GWh** – Gigawatt hours is unit of energy that is equivalent to one million kilowatt hours, and often used as a measure of the output of large electricity power stations
- **MassDEP** – Department of Environmental Protection
- **MEPA** – Massachusetts Environmental Protection Act
- **NWL** – Natural and working lands as defined in Chapter 8 of the Acts of 2021.
- **VMT** – Vehicle miles traveled