



July 1, 2026

A Message from Commissioner Dykes:

In July 2023, the Connecticut Department of Energy and Environmental Protection (DEEP) received a \$3 million grant to support climate action planning in Connecticut through the U.S. Environmental Protection Agency (EPA) Climate Pollution Reduction Grant (CPRG) Program. The first deliverable under the EPA grant agreement, a [Priority Climate Action Plan](#), was published in August 2024. The enclosed Comprehensive Climate Action Plan (CCAP) is the second deliverable required under the grant agreement with EPA and was prepared in accordance with EPA CPRG guidance. It was submitted to EPA on June 24, 2026.

Today, I am pleased to share the CCAP, prepared by the DEEP Office of Climate Planning, with support from ICF, Inc. and extensive input from the Bureau of Air Management, Bureau of Energy and Technology Policy, Bureau of Materials Management and Compliance Assurance, Bureau of Natural Resources, Office of Environmental Justice, and Office of Land Management as well as our sister state agencies of the Department of Transportation, the Department of Agriculture, and the Office of Workforce Strategy. The CCAP was also informed by four public meetings, a public survey, and extensive intergovernmental coordination with municipal government, Councils of Governments, and tribal government representatives, including through meetings with the Connecticut Equity and Environmental Justice Advisory Council. The CCAP provides Connecticut with a robust analytical foundation to inform future climate action planning—policy, programs, funding, and implementation decisions—in Connecticut. The CCAP provides one economy-wide mitigation pathway that the state could utilize, or use to compare and consider alternative pathways. It is important to note that the CCAP was developed in response to an EPA requirement and should not be considered a binding implementation plan or be interpreted as establishing any new mandates or goals beyond the state’s current statutory targets.

The CCAP mitigation pathway uses 17 measures that would result in greenhouse gas (GHG) emissions reductions or increased carbon sequestration across the transportation, buildings, electric power, industry, waste, agriculture, and natural and working lands sectors. These measures do not depend on any specific program or policy. They do not assume the federal government, the state, or any particular actor will implement the measures. Instead, they are intended to illustrate the scale of technology deployment, behavioral change, and land management that would be needed to meet Connecticut’s statutory GHG emissions reduction targets of:

- 45 percent below 2001 levels by 2030,
- 65 percent below 2001 levels by 2040,
- 0 percent from the electric power supply by 2040,
- at least 80 percent below 2001 levels by 2050, and
- Net zero by 2050.

As further described in the highlighted findings below, the mitigation pathway meets the state’s 2040 and 2050 targets, but no pathway to meet the 2030 target was identified due to technology turnover and deployment constraints. The largest modeled GHG emissions reductions in the pathway are driven by transportation electrification and low-carbon fuel adoption, building electrification and energy efficiency, and expansion of clean electricity resources, with natural and working lands measures contributing increasingly over time through enhanced carbon sequestration.



The CCAP shows improved health benefits from reducing ozone-forming air pollutants and particulate matter under the mitigation pathway. Reducing these pollutants equates to public health savings of \$8.13 billion to \$11.8 billion from 2030 to 2050, including from avoiding 466 to 692 premature deaths. Many CCAP measures provide economic and resilience benefits as well. For example, deploying heat pumps and improving building energy efficiency can lower energy use and costs for residents and businesses and keep them safer during power outages and heat waves. The average residential customer who participates in the Conservation & Load Management residential weatherization programs receives \$1,129 of value in services and achieves lifetime average savings of \$2,068 on their home energy bills. The CCAP also shows that Connecticut can leverage its existing workforce and transition workers from closely related fields to meet the needs of a clean energy economy. The measures in the mitigation pathway are expected to increase demand most notably for electricians, HVAC technicians, construction laborers, solar and telecommunications installers, utility and line workers, engineers, and selected transportation and waste related occupations.

To be clear, the scale of the technology deployment and behavioral changes contemplated in the CCAP are immense, aggressive, and not feasible without the partnership of the federal government and the private sector. While Connecticut cannot go it alone, the state can continue to make meaningful and informed programs that support these measures. Programs and policies like DEEP's CHEAPR rebates for electric vehicles, the Conservation & Load Management energy efficiency programs, advancing innovative clean energy and demand response energy efficiency procurements, looking ahead at options for new nuclear energy capacity, and others included in the 2026 [Connecticut's Connecticut Climate Progress](#) report, all align with the CCAP mitigation pathway and may provide lower cost energy options and enhanced community resilience and public safety. As DEEP continues to advance and evaluate these programs and develop new policies, the CCAP provides a pathway against which to benchmark the contribution of them. It can also elucidate where action beyond the state is critical to meet state targets.

When I first became the Commissioner of DEEP in 2019, the agency had just completed its last iteration of a potential mitigation pathway to 2030 in the 2018 Report, [Building a Low Carbon Future for Connecticut](#). Eight years after that last modeling effort, we have developed another potential path forward. Just as that 2018 effort informed the 61 recommendations of the Governor's Council on Climate Change (GC3) issued in the [January 2021 GC3 report](#), the analysis and findings of the CCAP will be a valuable resource for DEEP to weigh the relative costs and benefits of different mitigation pathways as the agency prepares the next Comprehensive Energy Strategy, Integrated Resources Plan, and ongoing planning and reporting under the Global Warming Solutions Act with the support of the GC3. This information will be important for Connecticut policymakers to consider as they weigh the best set of strategies to improve affordability and economic competitiveness, support energy security and reliability, and secure other environmental and conservation objectives. I have no doubt that Connecticut will continue to push ahead with balanced, innovative strategies as it has done steadily since the state first committed to lowering GHG emissions over 20 years ago.

A handwritten signature in blue ink that reads "Katie S. Dykes".

Commissioner Katie Dykes
Department of Energy and Environmental Protection



Highlighted CCAP Findings

- The business-as-usual scenario shows that under current state and federal policy and trends, Connecticut's economy-wide GHG emissions are projected to decrease by 34% by 2030, 42% by 2040, and 44% by 2050 relative to 2001 levels.
- Using 17 GHG emissions reduction measures, the CCAP models a "mitigation pathway" with the scale of technology deployment, behavioral change, and land management that meets the state's 2040 and 2050 targets, but there is no feasible pathway modeled for 2030 due to stock turnover and technology deployment constraints.
- Growth in on-road zero-emission vehicle adoption, increased electrification and efficiency of existing buildings, and expansion of grid-scale clean energy resources account for 65% of the overall GHG emissions reduction potential of the mitigation pathway by 2050.
- The transportation sector measures contribute 32% of GHG emissions reduction in the year 2050. Transitioning to electric vehicles (EVs) for light-duty vehicles (LDV) is the largest contributor within the transportation sector (14% in 2050), followed by switching to EVs for medium- and heavy-duty vehicles (MHDV) (9% in 2050). To meet this level of reduction:
 - Share of LDV population that is a battery electric vehicle or plug-in hybrid electric vehicle, would need to be 66% in 2040 and 99% in 2050.
 - Share of MHDV population that is a battery electric vehicle or plug-in hybrid electric vehicle, would need to be 30% in 2040 and 69% in 2050.
 - Cumulative total of LDV EV chargers (thousands) would need to be 980 in 2040 and 1,254 in 2050.
 - Cumulative total of MHDV EV chargers (thousands) would need to be 25.6 in 2040 and 57.9 in 2050.
- The buildings sector measures contribute 33% of GHG emissions reduction in the year 2050. Increasing electrification in existing residential and commercial buildings is the largest contributing measure in that sector (26% in 2050). To meet this level of reduction:
 - The number of air-source heat pumps installed annually in residential homes would need to be 40,828 in 2040 and 45,537 in 2050.
 - The number of heat pump water heaters installed annually in residential homes would need to be 64,161 in 2040 and 86,316 in 2050.
 - The portion of commercial building space with new air-source heat pumps installed since 2026 would need to be 25% in 2040 and 70% in 2050.
 - The portion of commercial building space with new hot water air-source heat pumps installed since 2026 would need to be 30% in 2040 and 84% in 2050.
- The electric power sector measures contribute 10% of GHG emissions reductions in the year 2050. The state would need to achieve the 2040 zero carbon electric supply target in statute to meet the economy-wide targets by moving the electric power sector to zero emissions and scope two GHG emissions from electrification of transportation and buildings to zero in 2040 and beyond.
- Industry measures contribute 7% GHG emissions reduction in the year 2050.
- Agriculture measures contribute 1% GHG emissions reduction in the year 2050.
- Natural and working lands measures provide a 13% carbon sink to meet the net zero by 2050 target.

Connecticut Comprehensive Climate Action Plan

EPA Climate Pollution Reduction Grant
Planning Grant Second Deliverable

June 2026



A large, stylized graphic of a tree trunk and branches in a dark blue color, positioned in the upper right corner of the page, extending from the top edge and curving downwards and to the left.

ACKNOWLEDGEMENTS

The Connecticut Comprehensive Climate Action Plan (CCAP) was developed by the Connecticut Department of Energy and Environmental Protection (CT DEEP), with contractor support from ICF, using funding provided by the U.S. Environmental Protection Agency (EPA) through the Climate Pollution Reduction Grant (CPRG) Program. The CCAP was prepared in accordance with EPA CPRG planning guidance and is intended to support Connecticut's climate planning. This report is the CCAP deliverable due to EPA by July 1, 2026, pursuant to the Grant Agreement Assistance Amendment, Number 5D-00A01405-2.

Development of the CCAP was informed by coordination across Connecticut state agencies, regional entities, municipalities, and external stakeholders. Participating state agencies included CT DEEP program areas spanning energy, air, water, materials management, and natural resources, as well as the Connecticut Department of Transportation, the Connecticut Department of Agriculture, and the Connecticut Office of Workforce Strategies, which provided subject matter expertise, data, and input to support sector-specific analyses. Additional state agency, business, nonprofit, community organization, tribal government, and regional and local government perspectives were incorporated through engagement with Connecticut's Councils of Governments (COGs), the Governor's Council on Climate Change (GC3), CT DEEP advisory committees (CEEJAC and SIPRAC), and the general public.

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ACRONYMS

Acronym	Definition
BAU	Business-as-Usual
BEB	Battery electric bus
BIL	Bipartisan Infrastructure Law
BLS	Bureau of Labor Statistics
C&LM	Conservation and Load Management
CAP	Criteria air pollutants
CCAP	Comprehensive Climate Action Plan
CCUS	Carbon capture, utilization, and storage
CHEAPR	Connecticut Hydrogen and Electric Automobile Purchase Rebate
COBRA	CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool
COG	Councils of Governments
CPRG	Climate Pollution Reduction Grant
CT DEEP	Connecticut Department of Energy and Environmental Protection
CT DOT	Connecticut Department of Transportation
DOE	Department of Energy
EIA	Energy Information Administration
EPA	Environmental Protection Agency (U.S.)
EV	Electric vehicle
EVSE	Electric vehicle supply equipment
FAA	Federal Aviation Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GHGRP	Greenhouse Gas Reporting Program

Acronym	Definition
HVAC	Heating, ventilation, and air conditioning
ICEV	Internal combustion engine vehicles
IPM	Integrated Planning Model
IRA	Inflation Reduction Act
LDV	Light duty vehicle
MECS	Manufacturing Energy Consumption Survey
MHDV	Medium- and heavy-duty vehicle
MOVES	Motor Vehicle Emission Simulator
NAAQS	National Ambient Air Quality Standards
PCAP	Priority Climate Action Plan
RD	Renewable diesel
RGGI	Regional Greenhouse Gas Initiative
RNG	Renewable natural gas
RPS	Renewable Portfolio Standard
SAF	Sustainable Aviation Fuel
SIT	State Inventory Tool
VMT	Vehicle miles traveled
ZEV	Zero emissions vehicle

DEFINITIONS

Term	Definition
Business-as-Usual (BAU) Scenario	A projection of future greenhouse gas emissions that assumes no new climate policies or actions beyond what is already in place. It shows what emissions are likely to be if current trends continue.
Carbon Dioxide Equivalent (CO₂e)	A unit used to compare different greenhouse gases based on how much heat they trap in the atmosphere, expressed as the equivalent amount of carbon dioxide.
Carbon Sink	A natural or managed system, such as forests, soils, or wetlands, that absorbs more carbon dioxide than it releases.
Co-Pollutants	Air pollutants that are released at the same time as greenhouse gases and that are known to harm human health and the environment.
Criteria Air Pollutants (CAPs)	A group of six common air pollutants regulated under the federal Clean Air Act and for which national health-based standards are established: ozone, particulate matter, nitrogen oxides, sulfur dioxide, carbon monoxide, and lead.
Decarbonization	The process of reducing or eliminating carbon dioxide emissions.
Greenhouse Gas (GHG)	Any chemical or physical substance that is emitted into the air and that the Commissioner of Energy and Environmental Protection may reasonably anticipate will cause or contribute to climate change, including, but not limited to, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride.
GHG Emissions Reduction Measure	A specific action, policy, technology, or program designed to lower greenhouse gases emissions or increase the removal of greenhouse gases from the atmosphere.
Mitigation	Actions taken to reduce greenhouse gas emissions or to increase the removal of greenhouse gases from the atmosphere to address the root causes of climate change.
Mitigation Pathway	A projected future that includes actions and policies intended to reduce greenhouse gas emissions compared to the business-as-usual scenario.
NetZero Emissions	A condition in which the amount of greenhouse gases released into the atmosphere is balanced by the amount removed, resulting in no overall increase in emissions.
Sequestration	The process of capturing and storing carbon dioxide or other greenhouse gases.



SECTION 1

INTRODUCTION



COMPREHENSIVE CLIMATE ACTION PLAN OVERVIEW

The purpose of the Comprehensive Climate Action Plan (CCAP) is to provide a robust analytical foundation for statewide climate action planning in Connecticut. The CCAP identifies near-and long-term measures that would result in greenhouse gas (GHG) emissions reductions or increased sequestration. These measures do not depend on any specific program or policy. Instead, they are intended to illustrate a mitigation pathway with the scale of technology deployment, behavioral change, and land management that would be needed to meet Connecticut's statutory GHG emissions reduction planning targets. The CCAP also assesses the benefits of implementing these measures in the areas of air quality and public health, economic benefits, and climate resilience. The plan concludes with a workforce planning analysis examining labor demand associated with these measures. The CCAP is not a binding implementation plan and does not establish new mandates. Rather, the economy-wide mitigation pathway is intended to inform future policy, programs, funding, and implementation decisions.



By 2050

Emissions 80% below
2001 levels and
economy-wide net-zero
emissions.

Climate Pollution Reduction Grant Program

As a Climate Pollution Reduction Grant (CPRG) Program grantee, the Connecticut Department of Energy and Environmental Protection (CT DEEP) developed this CCAP with funding from the U.S. Environmental Protection Agency (EPA) designated by the federal Inflation Reduction Act (IRA) of 2022. In 2024, CT DEEP developed a Priority Climate Action Plan (PCAP) under this program.¹ The PCAP included a focused list of near-term, high-priority measures to reduce GHG emissions and an analysis of GHG emissions reductions that would be achieved through implementation of the measures. The PCAP focused on identifying immediately implementable climate actions, many of which CT DEEP incorporated into applications for CPRG Implementation Grants in 2024. All required elements from the EPA CPRG Planning Grant guidance are included in this CCAP as identified in Table 1.

¹ [EPA Climate Pollution Reduction Grant Planning Grant First Deliverable: A Priority Climate Action Plan](#) (August 2024).

Table 1. Location of Required CCAP Elements

Required CCAP Element	Location in Document
GHG Inventory	Section 2: Greenhouse Gas Inventory
GHG Emissions Reduction Targets	Section 2: Progress Toward State Planning Targets
GHG Emissions Projections	Section 2: BAU Projections Appendix 2: BAU Results and Methodology Section 3: Target Achievement Under Mitigation Pathway Appendix 3: Measure Modeling Methodology
Quantified GHG Reduction Measures	Section 3: Cumulative GHG Emissions Reductions Appendix 3: Measure Modeling Methodology Appendix 4: Greenhouse Gas Emissions Reduction Measures Appendix 7: Measure Cost Methodology
Benefits Analysis (Reduction in Co-pollutants)	Section 4: Co-Pollutants Reduction Potential Appendix 5: Co-Benefits Analysis Methodology
Review of Authority to Implement	Section 5: Authority to Implement Appendix 4: Greenhouse Gas Emissions Reduction Measures
Intersection with Other Funding Availability	Section 5: Intersection with Other Funding Availability
Workforce Planning Analysis	Section 6: Connecticut's Workforce Delivery Capacity Appendix 6: Workforce Planning Analysis Methodology
Interagency and Intergovernmental Coordination	Appendix 1: Public and Stakeholder Input
Stakeholder and Public Engagement	Appendix 1: Public and Stakeholder Input

GHG EMISSIONS REDUCTION MEASURES

This CCAP identifies 17 GHG emissions reduction measures that could reduce GHG emissions from the transportation, residential and commercial buildings, electric power, industrial, waste, agriculture, and natural and working lands sectors. The measures were developed by CT DEEP with input from Connecticut state agencies and shared for public and stakeholder input. These measures do not represent every potential strategy Connecticut could use to reduce GHG emissions. Rather, these measures offer a potential pathway for comprehensively addressing GHG emissions in Connecticut and achieving the state's GHG emissions reduction planning targets. The measures reflect a broad range of strategies, some ready for immediate implementation and others requiring further exploration or collaboration. Measures do not apply equally to

every locality, organization, or partner, and the responsibility for achieving GHG emissions reductions does not rest solely with state government. Together, these measures represent shared opportunities for Connecticut residents, businesses, institutions, and agencies to contribute to a more sustainable, resilient, and low-carbon future.

Table 2. CCAP GHG Emissions Reduction Measures

CCAP GHG Emissions Reduction Measures	
Transportation Sector	
1.	Reduce vehicle miles traveled (VMT).
2.	Expand vehicle electrification, electric vehicle (EV) infrastructure, and zero- and low-carbon fuels in the on-road transportation sector.
3.	Decarbonize the nonroad transportation sector, including ports, airports, and rail.
Residential & Commercial Buildings Sector	
4.	Increase energy efficiency in existing residential and commercial buildings.
5.	Increase electrification in existing residential and commercial buildings.
6.	Maximize energy efficiency in new residential and commercial buildings.
7.	Maximize electrification in new residential and commercial buildings.
Electric Power Sector	
8.	Expand grid-scale clean energy resources.
9.	Deploy distributed clean energy resources.
Industrial Sector	
10.	Decarbonize industrial processes through energy efficiency, electrification, and low-carbon fuels.
11.	Expand carbon capture, utilization and storage (CCUS) at industrial facilities.
Waste Sector	
12.	Reduce emissions from the disposal of organic solid waste.
13.	Reduce emissions from the disposal of non-organic solid waste.
Agriculture Sector	
14.	Increase soil carbon sequestration and reduce emissions from agricultural soils.
15.	Reduce methane emissions from livestock and manure.
Natural and Working Lands Sector	
16.	Increase protection and conservation of high-carbon coastal habitats, wetlands, grasslands, and forests.
17.	Increase and manage urban tree canopy.

STAKEHOLDER AND PUBLIC ENGAGEMENT

CT DEEP conducted significant stakeholder and public engagement during the development of the CCAP, including four public meetings to inform the GHG emissions reduction measures and share information. In addition to holding and participating in public meetings, CT DEEP continuously accepted public comments via a public survey focused on the measures and potential implementation actions. CT DEEP also conducted targeted outreach to stakeholder groups and coordinated with other state agencies and governments to inform CCAP analyses. These activities are described below and further documented in Appendix 1: Public and Stakeholder Input.

Public Meetings for CCAP

CT DEEP hosted four public meetings throughout the CCAP development process. The first meeting in June 2025 served as a CCAP kickoff and described the CCAP development process and Connecticut's climate planning priorities. The second meeting in October 2025 focused on the business-as-usual (BAU) projection results and draft GHG emissions reduction measures. The December 2025 meeting focused on the transportation, buildings, and natural and working lands sectors to get specific feedback on near- and long-term tactics the state could pursue to achieve Connecticut's GHG emissions reduction planning targets for these key sectors. This meeting also included a focus on implementation and how the state can work with other stakeholders to implement related actions. The fourth meeting in January 2026 again presented GHG emissions inventory and BAU projection results as part of a report to the Governor's Council on Climate Change on progress towards the state's GHG emissions reduction planning targets. Meeting details are summarized in Appendix 1: Public and Stakeholder input.

Public Input Survey

CT DEEP encouraged comment and input through a public Climate Action Plan survey. The survey was open to the public for six months and received 136 responses. The central goal of the survey was to solicit

Governor's Council on Climate Change (GC3) Engagement

Engagement activities conducted during the development of the CCAP built on extensive coordination and outreach efforts undertaken to develop the state's climate action plan. These efforts included the creation of seven working groups, from which the 61 climate action recommendations of the GC3 2021 report were drawn. Each working group and any associated subgroups met many times over the course of 2020. Every working group meeting was open to the public and most meetings provided an opportunity for public comment. Altogether, the working groups included 231 individuals representing over 100 different organizations and 186 meetings were conducted.

Each working group submitted a draft report; those reports were subject to a 30-day public review period. During the public review period, a series of six public forums were held to present the findings and recommendations of each of the working groups and to provide an interactive opportunity to solicit feedback from the public. In addition to feedback received during the public forums, hundreds of written comments on the GC3 draft reports were submitted by the public and reviewed by the working groups. After the close of the public comment period, each working group revised its report and submitted a final report. The final reports are available to view on the GC3 Working Group Report webpage, where the compiled public comments can also be found.

input on potential implementation actions that the state could take to reduce GHG emissions and address community priorities. Results from the survey are summarized in Appendix 1: Public and Stakeholder Input.

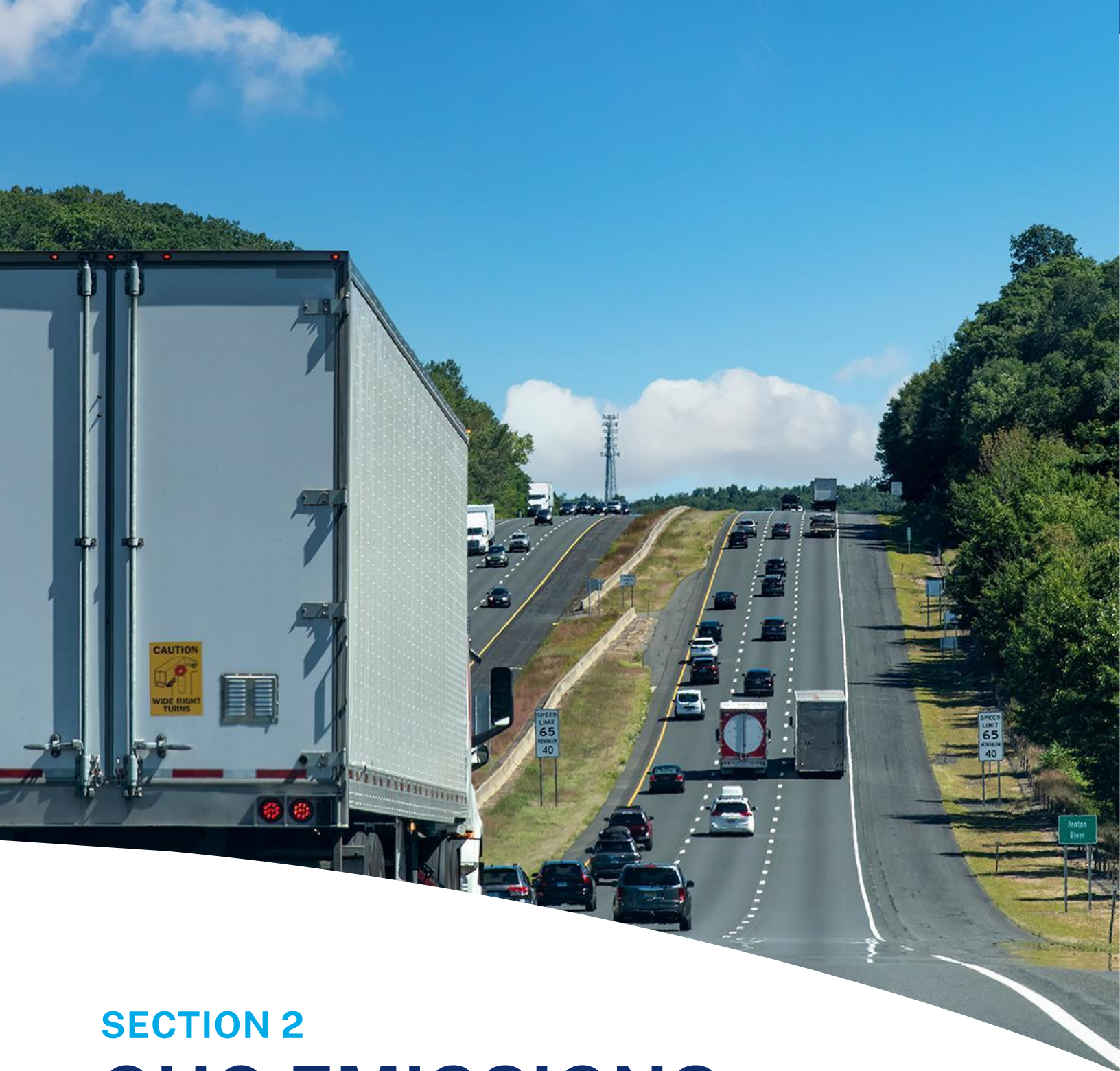
Industrial Stakeholder Outreach

CT DEEP convened three virtual industrial stakeholder meetings, attended by 14 representatives from a total of nine stakeholder organizations, including trade organizations and manufacturers from the following industries: aerospace & defense, chemicals & pharmaceuticals, paper & pulp, technology solutions & end-use products. The goal of these meetings was to better understand decarbonization motivators, barriers, and needs to inform the implementation of industrial sector GHG emissions reduction measures. Appendix 1: Public and Stakeholder Input summarizes the stakeholder feedback received during these discussions.

Interagency and Intergovernmental Coordination

In addition to community and private sector stakeholders, CT DEEP continuously collaborated with state agencies and Connecticut Councils of Governments (COGs) throughout the development of the CCAP. CT DEEP held a series of meetings with technical experts across CT DEEP including the Bureau of Energy and Technology Policy, Bureau of Materials Management & Compliance Assurance, Bureau of Air Management, Bureau of Water Protection & Land Reuse, Office of Equity & Environmental Justice, Office of Environmental Review & Strategic Initiatives, and Bureau of Natural Resources. CT DEEP worked with experts in the Connecticut Department of Transportation; the Connecticut Office of Workforce Strategies; and the Connecticut Department of Agriculture to share the proposed approach for the CCAP modeling analyses and solicit input. CT DEEP engaged its advisory committees, the SIPRAC and the CEEJAC, to advise on the CCAP. The Governor's Council on Climate Change (GC3), chaired by the CT DEEP, also served as a touchpoint for interagency coordination. Its members include the following state agencies, quasi-state agencies and state university: Office of Policy and Management, Department of Public Health, Department of Transportation, Department of Administrative Services, Department of Economic and Community Development, Department of Insurance, Department of Housing, Department of Agriculture, Department of Emergency Services and Public Protection, the Public Utilities Regulatory Authority, the Connecticut Green Bank, and the UConn Connecticut Institute for Resilience and Climate Adaptation.

The coordination with the COGs focused on alignment with the Connecticut Metropolitan Statistical Area (MSA) CCAPs and understanding the focus of each MSA's CCAP measures. The meetings with the COGs also included the COGs representing the regions of the state not covered by an MSA. CT DEEP also met with the COGs to discuss their benefits analyses and workforce assessments to understand potential gaps and opportunities. CT DEEP invited tribal representatives to this outreach meeting and one tribal representative attended the meeting. The CEEJAC also includes a member of the Mashantucket Pequot Tribal Nation. The GC3 includes two local government representatives from a municipality and a COG. Appendix 1: Public and Stakeholder Input includes the full list of meetings conducted during the development of CCAP that supported CCAP development and/or to inform future implementation strategies for the CCAP measures.



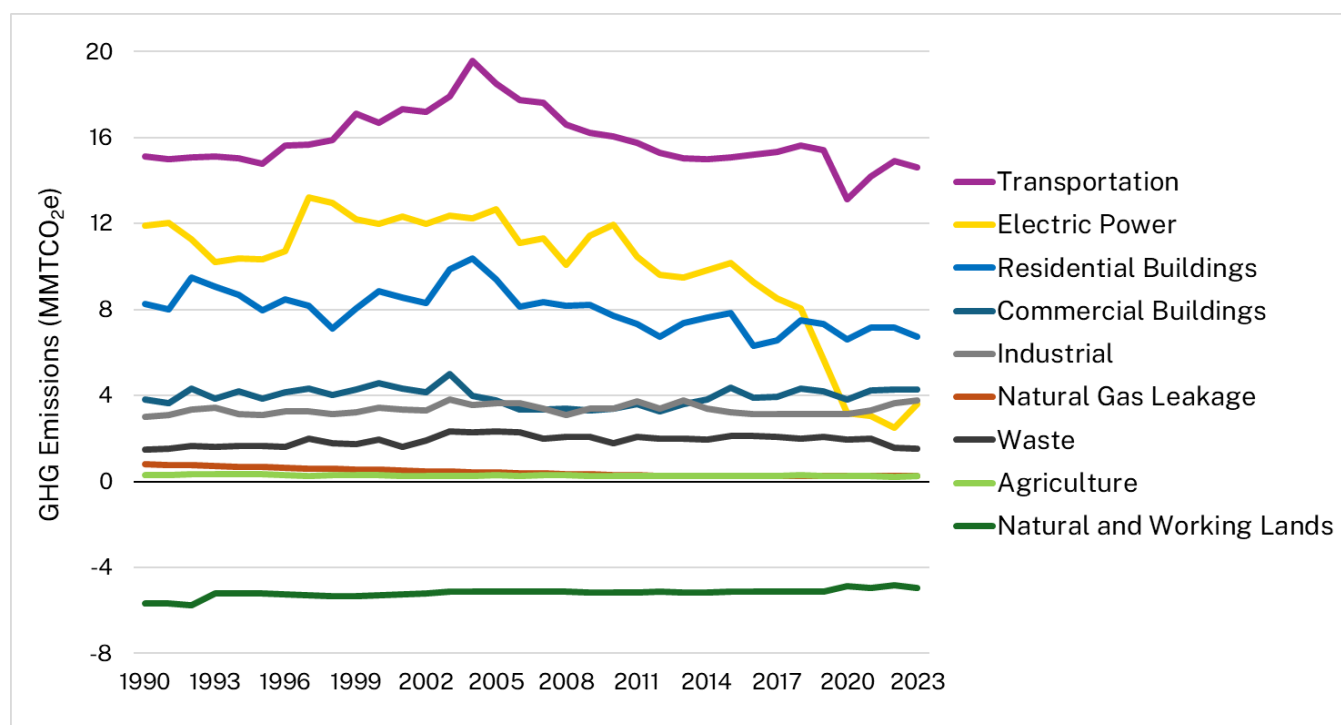
SECTION 2

GHG EMISSIONS INVENTORY AND BAU PROJECTIONS

GREENHOUSE GAS INVENTORY

Emission inventories provide insight into GHG sources and sinks and enable data tracking over time to assess the impacts of GHG mitigation efforts. Since 2003, CT DEEP has developed an annual economy-wide GHG inventory for the state using the EPA State Inventory Tool, supplemented by state-specific data and methods. The CCAP inventory relied on the state's 2023 GHG Inventory and methodology to assess baseline emissions.² The economy-wide inventory accounts for emissions and carbon sinks from the following sectors: transportation, electric power, residential and commercial buildings, industrial, natural gas leakage, waste, agriculture, and natural and working lands. Included gases are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), and nitrogen trifluoride (NF₃). Figure 1 shows emissions and sinks for each sector from 1990 to 2023. The electric power sector has been the primary driver of the total emissions reductions. The substantial emissions reduction from this sector reflect the shift from coal power plants to natural gas since 2005, and the acquisition of all environmental attributes from the Millstone Nuclear Power Plant in 2019.

Figure 1. Connecticut Greenhouse Gas Emissions Inventory, 1990-2023

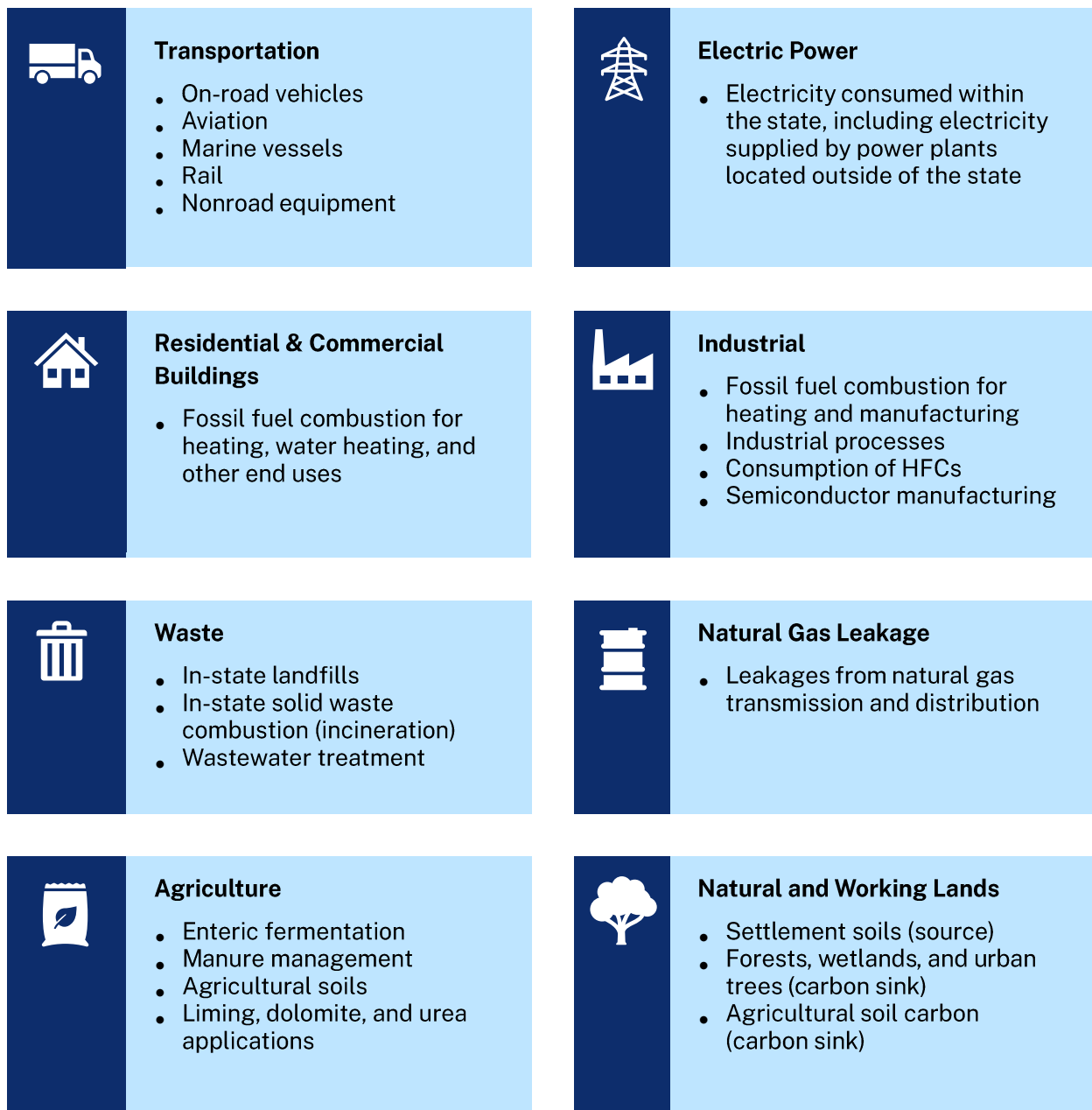


In 2023, Connecticut GHG emissions totaled approximately 35 million metric tons of carbon dioxide equivalent (MMTCO₂e). The transportation sector represented the largest source of GHG emissions, contributing 42% of total emissions, followed by residential buildings (19%), commercial buildings (12%), industrial (11%), electric power (10%), waste (4%), agriculture (1%), and natural gas leakage (1%).³ At the same time, natural and working lands across the state were responsible for sequestering approximately 2.04 MMTCO₂e of carbon from urban trees and 2.91 MMTCO₂e from forests in 2023.

² Connecticut Greenhouse Gas Emissions Inventory 1990–2023 (August 2025).

³ Emissions from transportation electricity consumption, residential and commercial building electricity consumption, and industrial building electricity consumption are included under the Electric Power sector.

Figure 2. Key Emission Sources and Sinks by Sector

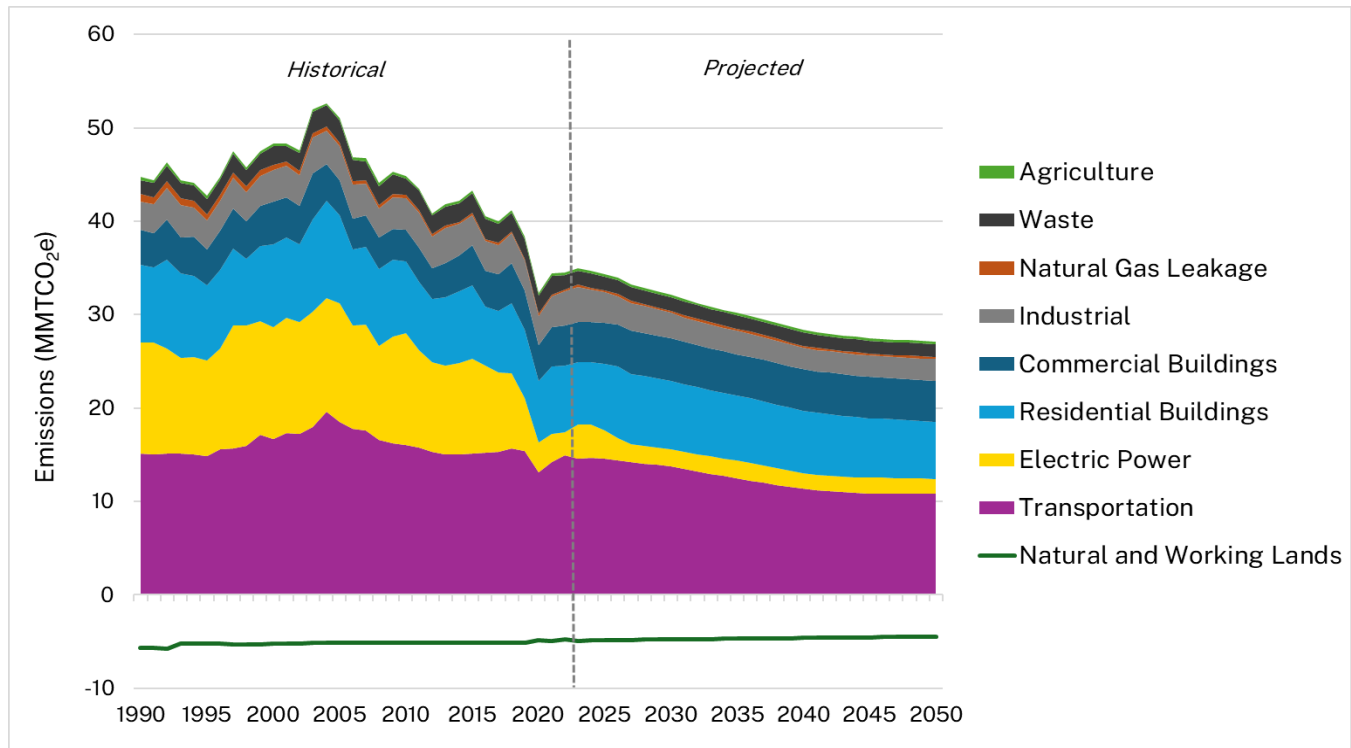


BAU PROJECTIONS

Using the 2023 inventory as a starting point, a BAU emissions projection scenario was developed to establish a baseline from which to model potential reductions achieved through measure implementation. BAU projections, while subject to a changing policy and economic landscape, provide a useful benchmark for assessing how future GHG emissions compare to statutory planning targets and for informing potential pathways to achieve them. Along with evolving macroeconomic trends and market drivers, the BAU reflects the current state and federal policy landscape, including the phase-out of federal EV and clean energy tax incentives under the One Big Beautiful Bill Act of 2025, proposed increases to federal fuel efficiency standards applicable to cars and

trucks,⁴ and the proposed repeal of the Clean Air Act 111(b) and (d) regulations.⁵ The assumptions and methodology used to project BAU emissions are documented in Appendix 2: BAU Results and Methodology. Figure 3 presents the historical and projected emissions by sector.

Figure 3. Historical and Projected BAU Emissions in Connecticut by Sector (1990-2050)



The BAU scenario projects that economy-wide GHG emissions will continue to decrease through 2050. This trend is primarily driven by increases in energy efficiency, electrification, and clean energy adoption in the transportation and building sectors, even as VMT and commercial energy demand are projected to grow. GHG emissions from the electric power sector are expected to further decrease in the near-term as more clean energy is deployed within the state and across the region. While the in-state electricity supply is projected to reach net-zero GHG emissions by 2040, GHG emissions from the power sector will persist due to the state's increasing reliance on imported electricity to meet growing demand.

GHG emissions from other sectors are also projected to decline. GHG emissions from the industrial sector are projected to decrease as a result of the phase down of hydrofluorocarbons under the American Innovation and Manufacturing (AIM) Act of 2020. Waste sector GHG emissions are additionally expected to decline following the recent closure of two resource recovery facilities⁶ and the continued export of waste out of state, emissions from which are not included within the scope of Connecticut's inventory.

GHG emissions from the remaining sectors are expected to stabilize or slightly rise. Fugitive natural gas leakage emissions have already declined and stabilized due to efforts to replace older gas infrastructure with

⁴ United States Department of Transportation. [President Trump & Transportation Secretary Sean P. Duffy Unveil New "Freedom Means Affordable Cars" Initiative to Reset Fuel Economy Standards](#). December 3, 2025.

⁵ "Repeal of Greenhouse Gas Emissions Standards for Fossil Fuel-Fired Electric Generating Units." Proposed Rule. June 11, 2025. United States Environmental Protection Agency, https://www.epa.gov/system/files/documents/2025-06/12674-01-oar_carbon-pollution-standards-repeal-nrpm_proposal_20250611_clean_v3_0.pdf.

⁶ The Wallingford facility closed in 2015, and the Hartford facility closed in 2022.

newer distribution lines. GHG emissions from agriculture are expected to rise as livestock populations grow while carbon sequestration from natural and working lands are projected to decline due to conversion of forested land to developed land, cropland to developed land, and the overall loss of forested land.

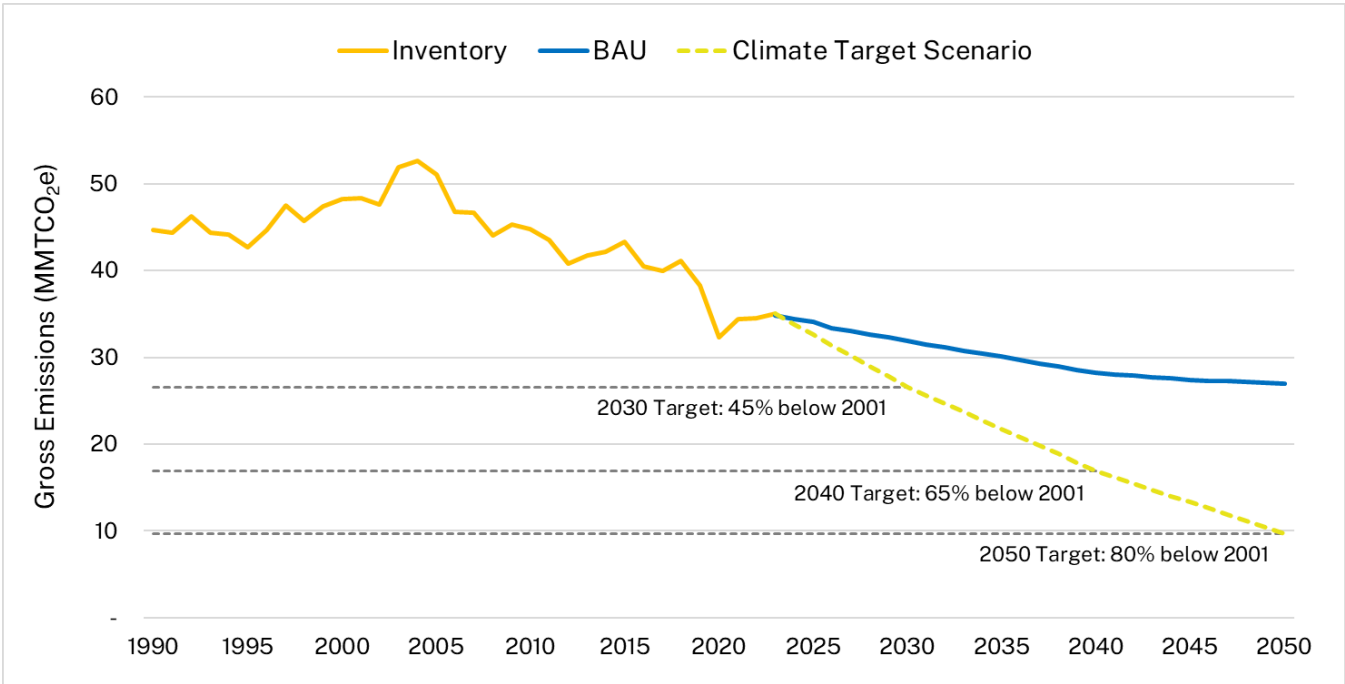
Progress Toward State Planning Targets

Connecticut first established statutory GHG emissions reductions planning targets through the passage of An Act Concerning Climate Change in 2004 that set a 2020 target of 10% below 1990 levels and in 2008 the Global Warming Solutions Act (GWSA) set the economy-wide planning target for 2050. In 2018, Connecticut added the 2030 target and in 2025, the state added the 2040 and net zero by 2050 targets. Connecticut met its statutory GWSA target of 10% emissions reductions below 1990 levels by January 1, 2020.

2030	2040	2050
•26.58 MMTCO ₂ e (45% reduction in gross emissions from 2001)	•16.91 MMTCO ₂ e (65% reduction in gross emissions from 2001)	•9.60 MMTCO ₂ e (80% reduction in gross emissions from 2001) •0 MMTCO ₂ e (net emissions)

Under the BAU scenario, Connecticut’s economy-wide GHG emissions are projected to decrease by 34 percent by 2030, 42 percent by 2040, and 44 percent by 2050 relative to 2001. While the BAU scenario projects an overall decline in GHG emissions, the rate of reductions is not enough to meet the state’s planning targets as illustrated in Figure 4.

Figure 4. Projected BAU Gross Emissions Relative to Connecticut’s Statutory Climate Target





SECTION 3

GREENHOUSE GAS MITIGATION PATHWAY

The mitigation pathway developed for the CCAP assesses a potential mitigation pathway for Connecticut to further reduce emissions relative to the BAU scenario and meet its economy-wide GHG planning targets through 2050. The state’s 2030, 2040, and 2050 planning targets serve as the economy-wide reduction planning targets for the CCAP mitigation pathway. The mitigation pathway reflects the implementation of 17 GHG Emissions Reduction Measures that decrease GHG emissions and increase carbon sequestration. The mitigation pathway is illustrative and designed to assess the scale and types of action that would be needed to meet Connecticut’s statutory GHG emissions reduction planning targets. It does not represent a binding implementation plan, regulatory requirement, or commitment to specific policies, timelines, or technology adoption levels.

The quantified results presented in this section demonstrate that the state can achieve deep decarbonization through a diverse portfolio of measures combining technology deployment, behavioral change, and natural systems management. While the modeled pathway represents a technically feasible pathway, achieving it will require new policies and regulations and depend on sustained collaboration across state government agencies, utilities, and community partners. This pathway is a foundation for continued policy and program development to enable Connecticut to achieve its GHG emissions reduction planning targets.

CUMULATIVE GHG EMISSIONS REDUCTIONS

The cumulative GHG emission reductions that would result from measure implementation are summarized in Table 3. The detailed assumptions and methodology used to estimate GHG emissions reductions for each measure are documented in Appendix 3: Measure Modeling Methodology.

Table 3. Cumulative GHG Emissions Reductions under Mitigation Pathway (MMTCO₂e)

CCAP Measure	2025-2030	2025-2040	2025-2050
Transportation			
Reduce VMT.	1.2	4.3	6.3
Expand vehicle electrification, EV infrastructure, and zero- and low-carbon fuels in the on-road transportation sector.	4.1	32.0	82.6
Decarbonize the nonroad transportation sector, including ports, airports, and rail.	<0.05	6.1	17.2
Buildings			
Increase energy efficiency in existing residential and commercial buildings.	0.5	5.7	17.5
Increase electrification in existing residential and commercial buildings.	1.2	16.2	60.2
Maximize energy efficiency in new residential and commercial buildings.	<0.05	<0.05	0.2
Maximize electrification in new residential and commercial buildings.	<0.05	<0.05	<0.05

CCAP Measure	2025-2030	2025-2040	2025-2050
Electric Power			
Expand grid-scale clean energy resources. ⁷	(0.5)	4.1	26.6
Deploy distributed clean energy resources. ⁸	-	-	-
Industry			
Decarbonize industrial processes through energy efficiency, electrification, and low-carbon fuels.	1.8	10.6	22.6
Expand CCUS at industrial facilities.	0.0	0.4	1.7
Waste⁹			
Reduce emissions from the disposal of organic solid waste.	-	-	-
Reduce emissions from the disposal of non-organic solid waste.	-	-	-
Agriculture			
Increase soil carbon sequestration and reduce emissions from agricultural soils.	<0.05	0.1	0.2
Reduce methane emissions from livestock and manure.	0.2	0.7	1.6
Natural and Working Lands¹⁰			
Increase protection, conservation, and management of high-carbon coastal habitats, wetlands, grasslands, and forests.	1.8	12.5	36.2
Increase and manage urban tree canopy.	<0.05	0.2	0.5
Total			
Excluding Natural and Working Lands	8.5	80.2	236.7
Including Natural and Working Lands	10.3	92.8	273.4
Including Natural and Working Lands + Emerging Technologies¹¹	10.3	92.8	278.5

⁷ In the near term, electrification increases electricity demand and slightly increases power sector emissions; over time, as the grid becomes cleaner, lower-carbon electricity enables net emissions reductions even as electrification expands.

⁸ Distributed solar generation is not modeled as an incremental mitigation measure because the BAU scenario already assumes substantial continued deployment consistent with full implementation of existing policies and ongoing market development. BAU projections are based on the 2025 CELT Load Forecast, which estimates approximately 950 MW of DG PV capacity in 2024, increasing to about 2,550 MW by 2034. Extending this adoption trajectory results in approximately 5 GW of DG PV by 2050, which was determined to be consistent with an aggressive net-zero-aligned future. As a result, no additional DG PV capacity beyond BAU levels is assumed in the mitigation pathway, and no incremental GHG reductions are quantified. Continued action will still be required to maintain the BAU deployment trajectory.

⁹ The waste sector GHG reduction measures modeled for this CCAP are assumed to only result in the reduction of emissions from waste that is exported and treated outside of Connecticut. Emissions from waste that is treated outside the state are considered Scope 3 emissions and are not included within the state's inventory boundary, which only captures Scope 1 waste sector emissions. Since the reductions quantified in this CAP are relative to the state's baseline inventory (i.e., Scope 1 emissions), no reductions are shown in the table for the waste sector measures. Instead, these measures result in a reduction in Scope 3 emissions. See Measures 12 and 13 in Appendix 4 for Scope 3 emissions reductions.

¹⁰ Measures that target the natural and working lands sector result in an increase in carbon sequestration rather than a reduction in GHG emissions.

¹¹ Emerging carbon capture technologies such as point-source capture, direct air capture, and carbon removal, have the potential to reduce future GHG emissions by capturing and permanently storing or utilizing CO₂ that would otherwise be released to the atmosphere,

DECARBONIZATION DRIVERS

To assess the potential GHG emissions reductions from measure implementation, CT DEEP modeling included key decarbonization drivers that would result in GHG emissions reductions or increased sequestration. These drivers do not depend on any specific program or policy. Instead, they are intended to illustrate a mitigation pathway with the scale of technology deployment, behavioral change, and land management that would be needed to meet Connecticut's statutory GHG emissions reduction planning targets. The most significant sectoral decarbonization drivers include growth in on-road zero-emission vehicle adoption, increased electrification and efficiency of existing buildings, and expansion of grid-scale clean energy resources. Together, these three drivers account for 55 percent of the overall GHG emissions reduction potential. The key decarbonization drivers by sector, listed by order of GHG emissions reduction potential, are summarized below. Additional details on what was included in the modeling can be found in Appendix 3: Measure Modeling Methodology.

Key Decarbonization Drivers by Sector



Transportation

- Increased sales of zero emission vehicles (ZEVs) and expansion of charging infrastructure, targeting 100% light-duty ZEV sales by 2035 and 100% of medium- and heavy-duty ZEV sales by 2050.
- Increased consumption of renewable diesel (RD) over time.
- Increased consumption of sustainable aviation fuel (SAF) over time.
- Net-zero electric grid that supports vehicle electrification.
- Reduced overall VMT by shifting trips toward safer, more accessible walking and biking options and improved public transit.
- Electrification of ferry routes and passenger rail lines.



Residential & Commercial Buildings

- Increased building electrification (heat pump adoption reaching 90% of residential space heating sales by 2040).
- Increased number of weatherized homes (~70% of homes are weatherized¹² by 2050).
- Partial adoption of all electric building codes and higher efficiency standards for new equipment.
- Growing consumption of renewable natural gas (RNG) over time.



Electric Power

- Achievement of 100% zero-carbon electricity supply by 2040.

particularly in hard-to-abate sectors. These technologies are included as a strategy to demonstrate a technological pathway to achieve the state's net-zero target.

¹² Home weatherization is defined as either improvements to the existing building shell through retrofits or as a high-quality code compliant building shell for new construction. Retrofits to existing building shells were estimated to reduce energy use 13%.



Industry

- Efficiency improvements, electrification, and fuel switching aligned with the Department of Energy's (DOE) Industrial Decarbonization Roadmap Near-Zero pathway.
- Expansion of carbon capture, utilization, and storage at industrial facilities.



Waste

- Diversion of 80% of compostable and recyclable waste by 2050.



Agriculture

- Increased methane capture efficiency from anaerobic digesters.
- Increased adoption of feed additives to reduce methane generated during animal digestion.
- Increased adoption of cover crops.
- Decreased N₂O from nitrification inhibitor application.
- Increased renewable diesel adoption.



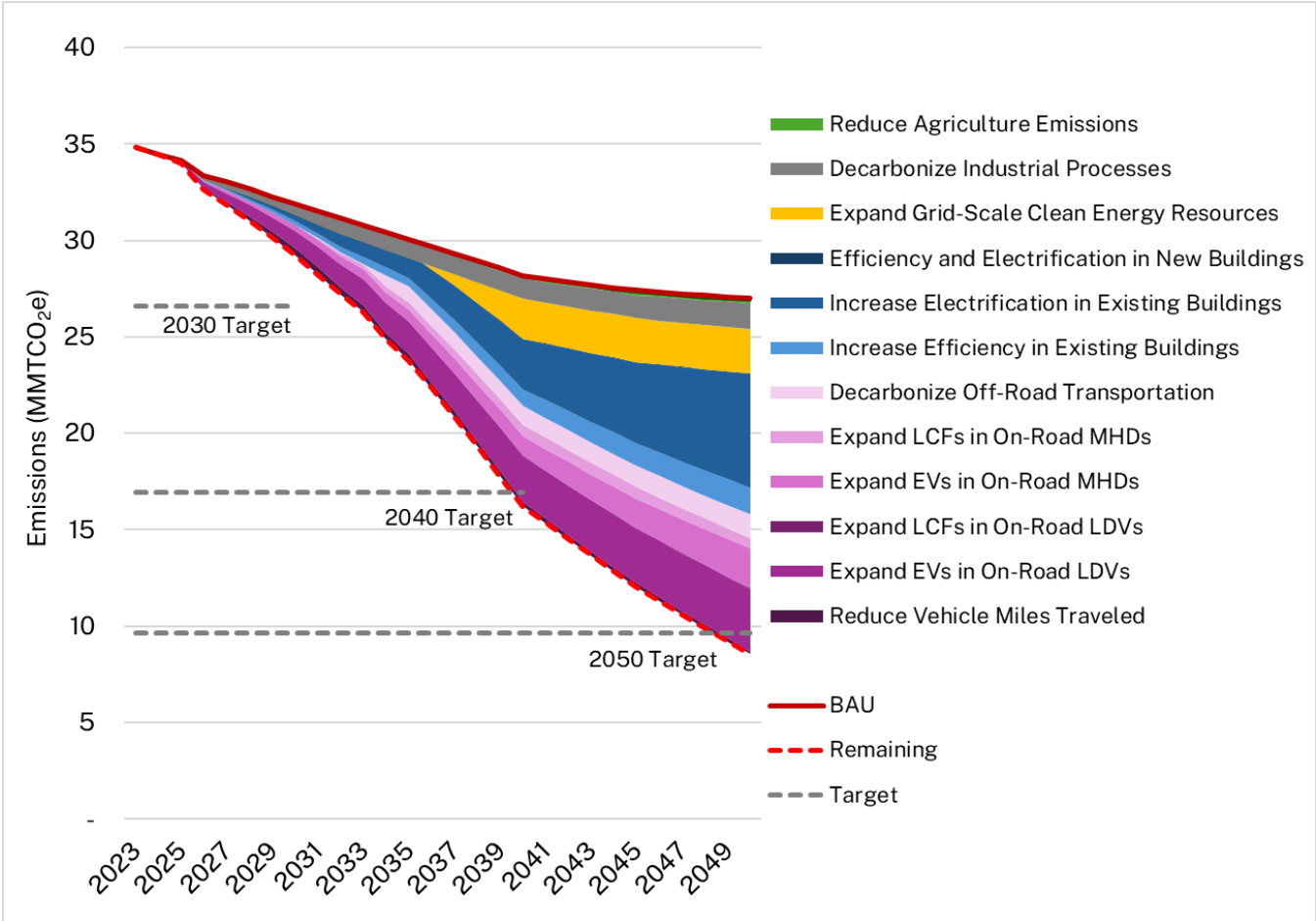
Natural and Working Lands

- Improved forest and wetland management practices (25% more forest land and wetlands actively managed by 2050).
- Increased conservation of forest and wetland areas each year (1,236 acres and 40 acres preserved yearly of forests and wetlands, respectively, through 2050).
- Preservation of existing urban tree canopy in environmental justice (EJ) communities.
- Expanded urban tree canopy by 5% in communities as defined in CGS § 32.9p(b) with a baseline tree canopy cover under 40%.

TARGET ACHIEVEMENT UNDER MITIGATION PATHWAY

Implementation of the GHG emissions reduction measures enables Connecticut to meet its economy-wide 2040 and 2050 statutory GHG emissions target of 65 percent and 80 percent below 2001 levels, respectively. The mitigation pathway does not achieve the state's 2030 reduction target of 45 percent below 2001 levels. The analysis found that the remaining GHG emission reductions needed between 2023 and the 2030 target are too large to achieve given delays in clean technology deployment in the preceding decade and current turnover constraints. However, continued investments in clean energy, building efficiency and electrification, and transportation electrification along with targeted efforts across all sectors can result in GHG emissions reductions that meet the 2040 and 2050 planning targets. Figure 5 illustrates the gross GHG emissions reduction potential by key decarbonization driver (excluding natural and working land sector emissions).

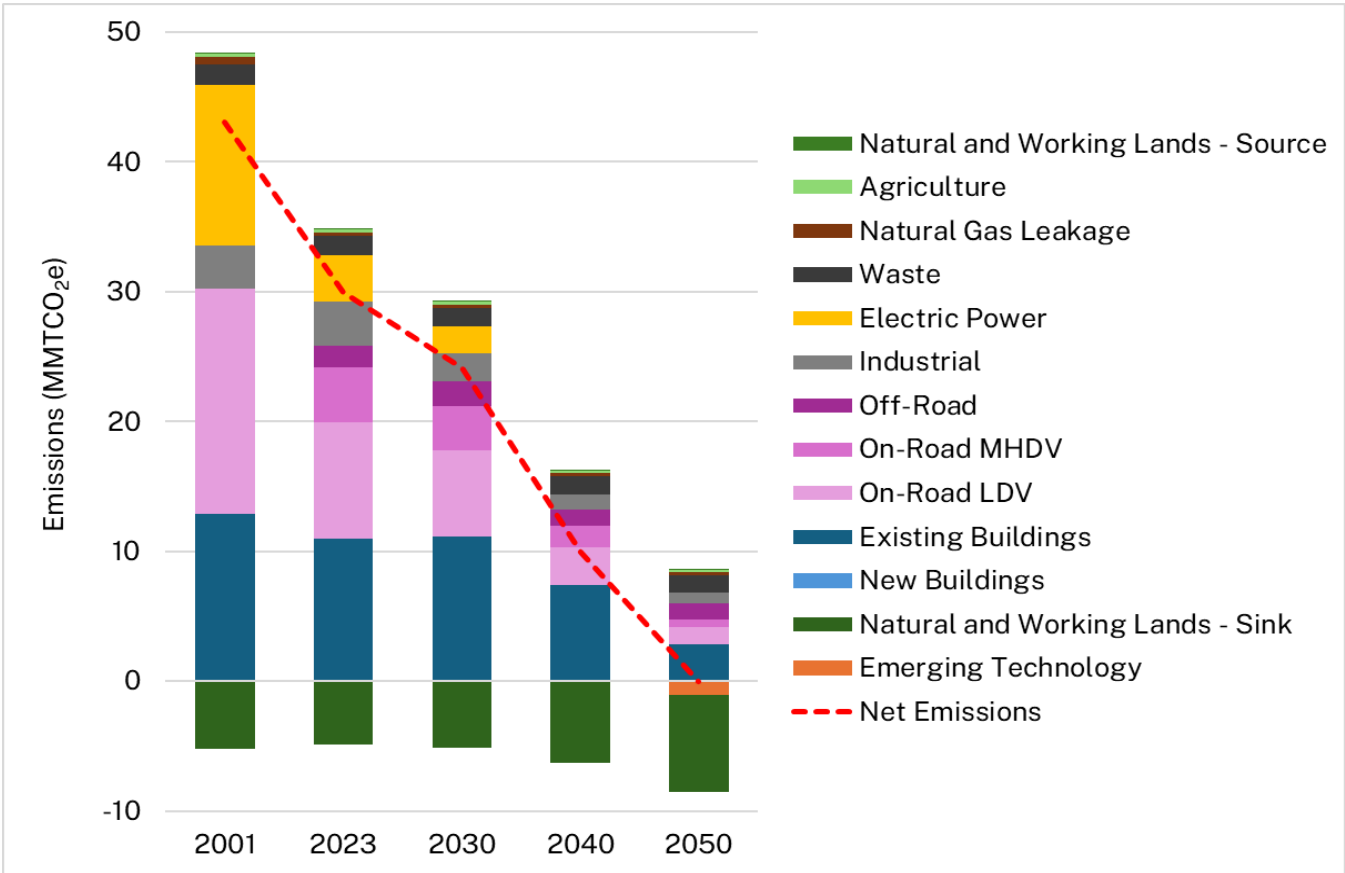
Figure 5. Gross GHG Emissions Reduction Potential by Key Decarbonization Driver¹³



The implementation of the GHG emissions reduction measures, with the inclusion of a strategy to deploy emerging technologies for carbon management, enables Connecticut to meet its 2050 net-zero target. While the scale, cost, and deployment potential of carbon removal technologies is currently uncertain, these developing technologies can potentially be utilized to reduce GHG emissions in the long-term. Figure 6 visualizes the integration of emerging technologies to close the gap between reduced and sequestered GHG emissions from measure implementation and reach net-zero GHG emissions by 2050. While the state's net-zero target is not effective until 2050, net GHG emissions in prior years are included to visualize progress toward 2050 levels.

¹³ The drivers identified in the prior section were aggregated for the purpose of presenting data in Figure 5.

Figure 6. GHG Emissions and Sinks by Sector/Subsector under the Mitigation Pathway, 2023–2050



Measure Contribution to Achieving Net-Zero Target

For each of the 17 GHG emissions reduction measures identified in this plan, Table 4 showcases the contribution of each measure to total reductions in 2030, 2040, and 2050 (inclusive of natural and working lands and emerging technologies). The reduction contributions are largest for sectors that account for a greater portion of baseline GHG emissions (i.e., transportation, buildings, and electric power), with increased sequestration from natural and working lands also playing a key role in net-zero achievement by 2050.

Table 4. Percent Contribution Relative to Total GHG Emissions Reductions by Measure

CCAP Measure	2030	2040	2050
Transportation	52%	38%	32%
Reduce VMT	12%	2%	1%
Expand vehicle electrification, EV infrastructure, and zero- and low-carbon fuels in the on-road transportation sector	40%	29%	26%
<i>Expand EVs in LDVs</i>	<i>30%</i>	<i>17%</i>	<i>14%</i>
<i>Expand low-carbon fuels in LDVs</i>	-	<1%	<1%
<i>Expand EVs in MDVs</i>	<i>10%</i>	<i>8%</i>	<i>9%</i>

CCAP Measure	2030	2040	2050
<i>Expand low-carbon fuels in MDVs</i>	-	4%	2%
Decarbonize the nonroad transportation sector, including ports, airports, and rail	<1%	7%	5%
Buildings	21%	26%	33%
Increase energy efficiency in existing residential and commercial buildings	6%	6%	6%
Increase electrification in existing residential and commercial buildings	15%	19%	26%
Maximize energy efficiency in new residential and commercial buildings	<1%	<1%	<1%
Maximize electrification in new residential and commercial buildings	<1%	<1%	<1%
Electric Power	-5%	15%	10%
Expand grid-scale clean energy resources ¹⁴	-5%	15%	10%
Deploy distributed clean energy resources ¹⁵	-	-	-
Industry	17%	8%	7%
Decarbonize industrial processes through energy efficiency, electrification, and low-carbon fuels	17%	7%	6%
Expand CCUS at industrial facilities	-	1%	1%
Waste¹⁶	-	-	-
Reduce emissions from the disposal of organic solid waste	-	-	-
Reduce emissions from the disposal of non-organic solid waste	-	-	-
Agriculture	2%	1%	1%
Increase soil carbon sequestration and reduce emissions from agricultural soils	<1%	<1%	<1%
Reduce methane emissions from livestock and manure	1%	1%	<1%
Natural and Working Lands	13%	12%	13%
Increase protection, conservation, and management of high-carbon coastal habitats, wetlands, grasslands, and forests	12%	12%	13%
Increase and manage urban tree canopy	<1%	<1%	<1%
Deploy Emerging Solutions for Carbon Management	-	-	5%
Total	100%	100%	100%

¹⁴ In the near term, electrification increases electricity demand and slightly increases power sector emissions; over time, as the grid becomes cleaner, lower-carbon electricity enables net emissions reductions even as electrification expands.

¹⁵ As the BAU projections for distributed solar were based on the CELT 2025 Load Forecast, which showed significant growth in distributed solar for the state, no additional distributed solar was assumed beyond the BAU levels and therefore there are no GHG reductions associated with this measure in the mitigation pathway. See footnote 8 above and Table 66 in Appendix 4 for the CELT 2025 Load Forecast for distributed solar.

¹⁶ The waste sector GHG reduction measures modeled for this CCAP are assumed to only result in the reduction of emissions from waste that is exported and treated outside of Connecticut. Emissions from waste that is treated outside the state are considered Scope 3 emissions and are not included within the state's inventory boundary, which only captures Scope 1 waste sector emissions. Since the reductions quantified in this CAP are relative to the state's baseline inventory (i.e., Scope 1 emissions), no reductions are shown in the table for the waste sector measures. Instead, these measures result in a reduction in Scope 3 emissions. See Measures 12 and 13 in Appendix 4 for Scope 3 emissions data.



SECTION 4

BENEFITS ANALYSIS

Implementing the GHG emissions reduction measures identified in this plan is expected to deliver additional health, economic, and resilience benefits for Connecticut communities, residents, and businesses. The transition to clean energy and transportation technologies would improve air quality and reduce exposure to co-pollutants that contribute to respiratory and cardiovascular disease. Reducing GHG and co-pollutant emissions can also strengthen climate resilience, helping communities better withstand extreme weather, heat, and other climate related stresses. Economic benefits can also include cost savings through increased energy efficiency, reduced fuel use, and avoided health and infrastructure expenses.

To understand these potential benefits, CT DEEP estimated the potential co-pollutant reductions from measure implementation and identified potential resulting benefits across the state. Co-pollutants are air pollutants — such as fine particulate matter, nitrogen oxides, and sulfur dioxide — that are released alongside GHGs during fuel combustion (including fossil fuels and biofuels) and certain industrial processes. Measures that reduce or avoid fuel combustion therefore not only reduce GHG emissions, but also harmful air pollutants, including particulate matter (both PM₁₀ and PM_{2.5}, particulates smaller than 10 and 2.5 micrometers, respectively), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO_x), ammonia (NH₃, which can contribute to secondary particulate matter concentrations), and volatile organic compounds (VOCs, which react with nitrogen oxides and sunlight to form tropospheric ozone (smog)¹⁷). These pollutants contribute to environmental impacts such as smog and acid deposition and are known to harm human health by worsening respiratory and cardiovascular diseases. As such, reductions in these co-pollutants can have widespread public health benefits, including decreased incidents of respiratory and cardiovascular diseases, asthma exacerbation, cancer incidence, and premature death.

While air quality has improved greatly in Connecticut over the last 30 years as evidenced by attainment of the National Ambient Air Quality Standards (NAAQS) for both CO and PM_{2.5}, the state is currently designated as nonattainment for both the 2008 and 2015 ozone NAAQS. Connecticut continues to experience poor air quality resulting from local air pollution from transportation, power generation, industry, and other sources and remains significantly impacted by interstate transport of ozone and its precursor pollutants. It is therefore important to understand what pollutants are impacting Connecticut and how climate action can reduce GHG emissions and co-pollutants to provide broad environmental and health benefits.

CO-POLLUTANT BASELINE INVENTORY

As a baseline, CT DEEP used emissions data from EPA's 2022 Emissions Modeling Platform to create a 2022 base county-level co-pollutant inventory for the sectors targeted by the GHG emissions reduction measures.¹⁸ The co-pollutants inventory, shown in Table 5, provides a baseline year from which to measure potential reductions in emissions from the implementation of measures.

¹⁷ Volatile Organic Compound Exemptions | US EPA

¹⁸ <https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform>

Table 5. 2022 Emissions Inventory by County and Pollutant (million pounds)

CT County	CO	NO _x	VOC	PM ₁₀	PM _{2.5}	SO ₂	NH ₃
Fairfield	151.4	18.1	42.1	13.9	6.9	0.4	2.1
Hartford	130.3	16.2	44.2	13.9	6.5	0.5	2.9
Litchfield	42.3	3.3	31.9	7.8	3.1	0.1	1.5
Middlesex	34.8	4.5	19.5	3.9	2.2	0.6	0.8
New Haven	119.6	15.3	38.5	10.9	5.6	0.4	2.3
New London	47.1	7.6	30.6	7.6	3.2	0.5	1.5
Tolland	25.0	2.6	19.0	4.5	1.9	0.1	1.0
Windham	21.2	2.4	21.1	4.5	1.8	0.1	1.0
State Total	571.8	69.9	246.8	66.9	31.2	2.7	13.0

CO-POLLUTANTS REDUCTION POTENTIAL

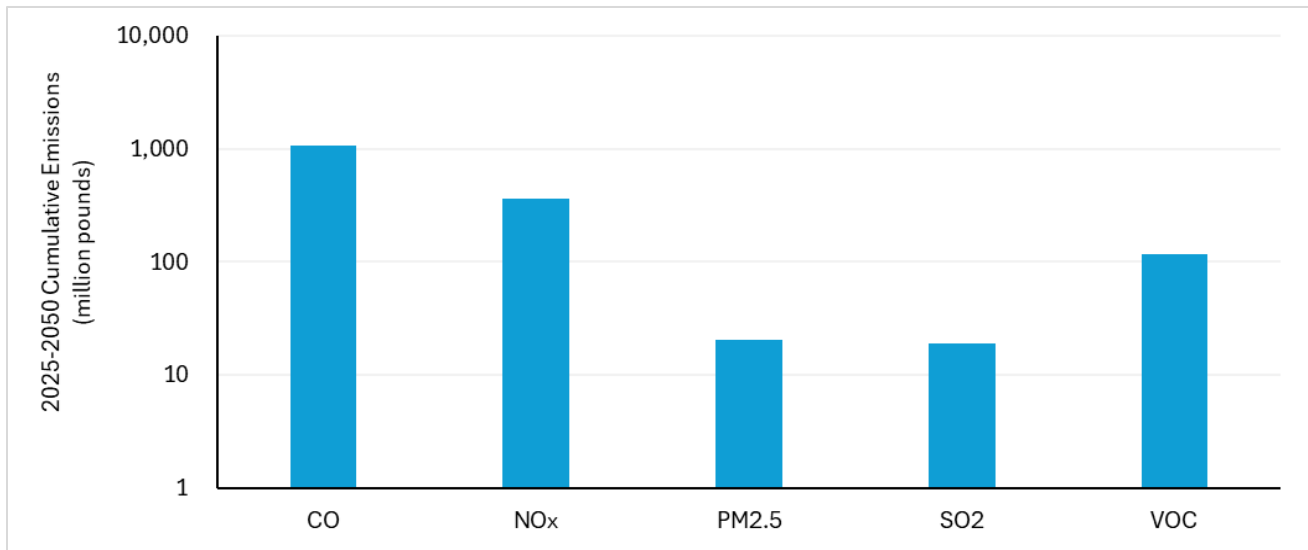
The quantification of co-pollutants focused on five criteria air pollutants (CAPs). CAPs are prioritized in this report due to their regulatory significance and the availability of emissions factors suitable to estimate the reductions. CAP emissions reductions are primarily driven by measures that impact energy-consuming sectors, including transportation, buildings, industry, and electric power. Implementing the measures would lead to reductions of all CAPs statewide. These reductions are due to both reductions in the amount of fuel combusted and by changing the types of fuel consumed. Figure 7 shows the cumulative amount of reductions achievable by 2050 for selected CAPs. Table 6 shows the cumulative, statewide reductions by pollutant by sector for the same period (note that not all CAPs are calculated for all sectors).

Table 6. Cumulative Co-Pollutant Emission Reductions by Sector, 2025-2050 (million pounds)

	Industry	Aviation	Buildings	Power	Passenger Rail	Ferry	On-road	Total
CO	52.3	0.6	68.9	0.0	0.2	2.2	934.7	1,058.9
NO _x	90.6	7.7	142.7	13.0	1.7	26.2	80.1	361.8
PM _{2.5}	5.4	1.0	10.9	1.1	+	0.3	1.6	20.4
SO ₂	2.5	13.5	1.1	0.0	0.0	0.8	1.3	19.1
VOC	45.9	(0.0)	5.4	0.6	0.1	1.0	65.3	118.3

Note: Values marked with a "+" indicate $p < 0.05$.

Figure 7. Cumulative Statewide CAP Emissions Reductions, 2025-2050



The most significant reduction potential in CAP emissions is from the transportation sector. On-road and nonroad electrification and reducing VMT (thereby reducing the amount of time vehicles may idle on roads) mitigate vehicular emissions.¹⁹ In a 2022 report, *Assessment of Connecticut's Need to Adopt California's Medium- and Heavy-Duty Emission Standards*,²⁰ DEEP identified multiple benefits associated with implementing California's emissions standards for new MHDVs including a significant reduction in harmful smog-forming air pollution which contributes to unhealthy air quality and fine particulates. Significant reductions in NO_x and PM emissions were found to result in avoided healthcare costs, especially in communities located in transportation corridors, which are disproportionately impacted by transportation-related air pollution. Rising temperatures, furthermore, will lead to conditions more conducive to the formation of ground level ozone (smog) and will have the potential to exacerbate the effects of transportation-related emissions on air quality. This relationship between extreme heat and poor air quality makes it all the more important to pursue actions that mitigate emissions as a critical step toward protecting community health during extreme heat events.

The following maps demonstrate how co-pollutant emissions reductions are distributed among Connecticut's counties to provide context for understanding where Connecticut's climate mitigation measures will deliver the greatest air quality and health benefits. Figure 8 and Figure 9 illustrate county-level contributions to fine particulate matter (PM_{2.5}) and nitrogen oxides (NO_x), two pollutants that are produced alongside fossil fuel combustion and that play a central role in Connecticut's long-standing air quality challenges. NO_x is a key precursor to ground-level ozone, which can have an acute impact on the lungs and cause immediate breathing difficulties. Chronic exposure to ozone can reduce lung function and damage the respiratory system, leading to premature mortality in at-risk populations.²¹ The leading contributors to NO_x emission reductions are the buildings, industrial, and on-road mobile sectors. PM_{2.5} contributes to cardiovascular and respiratory illnesses. The buildings and industrial sectors are the leading contributors to PM_{2.5} emission reductions. Both pollutants disproportionately affect communities located near highways, industrial corridors, and fossil-fuel power infrastructure.

¹⁹ "Greenhouse Gas Emissions from a Typical Passenger Vehicle," US EPA.

²⁰ "An Assessment of Connecticut's Need to Adopt California's Medium and Heavy-Duty Vehicle Emission Standards," CT DEEP.

²¹ "Ozone," American Lung Association.

Figure 8. Total PM_{2.5} Reductions (2025-2050)

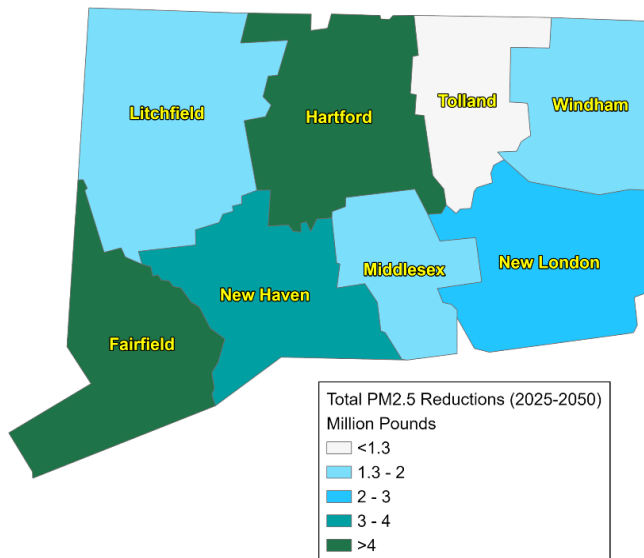
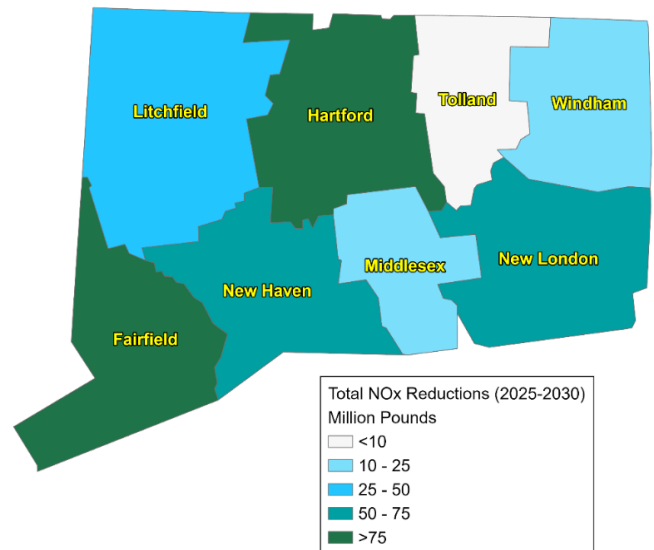


Figure 9. Total NOx Reductions (2025-2050)



As noted above, some sectors are expected to contribute more to the potential reductions as shown in Figures 10 and 11. Figure 10 shows cumulative 2025-2050 reductions in CO from on-road transportation. Figure 11 shows cumulative 2025-2050 reductions in PM_{2.5} emission reductions from the power and industry sectors.

Figure 10. Reductions in CO from Roads

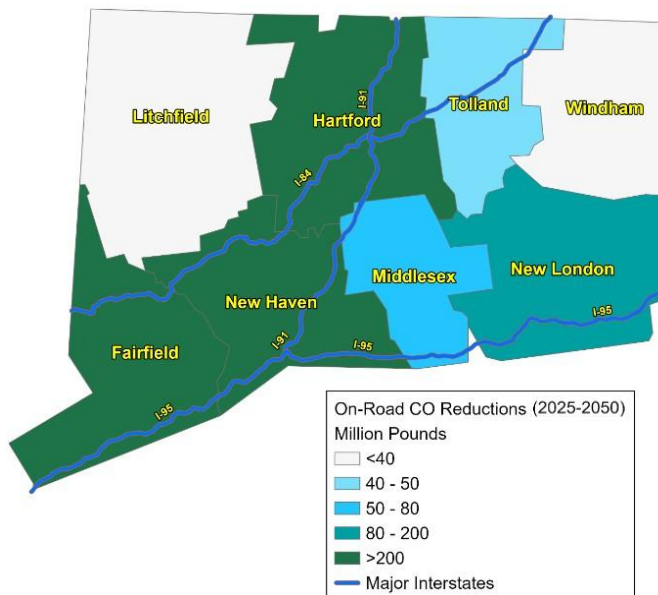
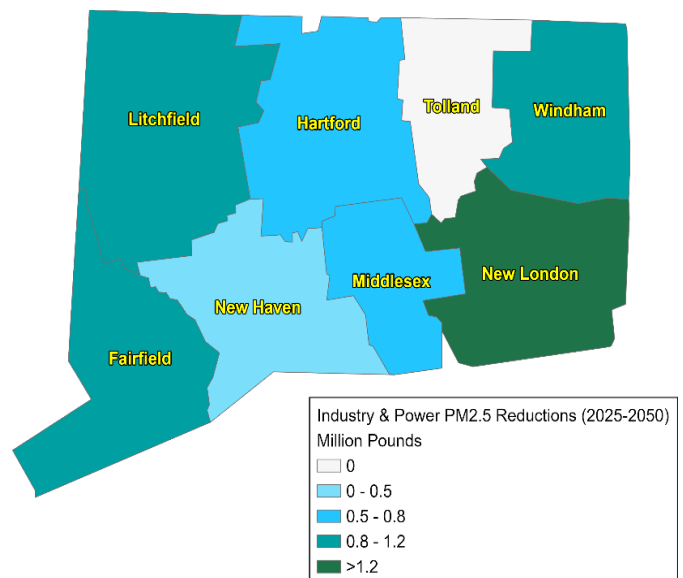


Figure 11. Reductions in PM_{2.5} Emissions from Industry and Power



POTENTIAL BENEFITS

Measure implementation is expected to provide direct community benefits across multiple sectors. Actions such as grid decarbonization, industrial electrification, and reduced reliance on combustion-based energy sources lead to improvements in air quality. While the adoption of low-carbon fuels such as hydrogen and renewable natural gas can provide climate benefits by reducing or eliminating GHG emissions, their combustion may still result in emissions of criteria pollutants, underscoring the importance of strategies that reduce total combustion where feasible. Beyond GHG and criteria pollutant emissions reductions, measure implementation can support economic development, reduce long-term operating costs, strengthen critical infrastructure, and improve quality of life in communities across Connecticut. The health, air quality, economic, and resilience benefits of reducing GHG emissions in each economic sector are further described in this section with illustrative examples of how these benefits have been realized in Connecticut.

Transportation Sector

Health Benefits and Air Quality Improvements

Transportation measures are expected to deliver significant public health and air quality benefits by reducing emissions of co-pollutants from on-road and nonroad sources. Electrification of vehicles and reductions in vehicle miles traveled mitigate emissions of CO, VOC, NO_x, and PM, while also providing co-benefits such as reduced road noise and improved neighborhood livability near busy roads. Cumulative CO emission reductions are shown by county, along with the location of major interstate freeways in Figure 10. Because CO is primarily emitted from vehicle tailpipes, electrification of on-road transportation — particularly the transition to EVs — drives the majority of statewide CO reductions.

Taken together, these reductions are expected to improve ambient air quality, particularly through reductions in PM_{2.5} and ozone concentrations associated with adverse health outcomes such as asthma, heart attacks, emergency room visits, and premature mortality. These benefits are especially important in Connecticut, where three counties are designated as “severe nonattainment” for the 2008 Ozone NAAQS and all eight counties are designated as “serious nonattainment” for the 2015 Ozone NAAQS.

Economic Benefits

Transportation measures can also support broader economic benefits by reducing fuel and maintenance costs over time, particularly as vehicles shift from internal combustion engines to electric drivetrains. As the cost of gasoline has risen, programs such as Connecticut Hydrogen and Electric Automobile Purchase Rebate (CHEAPR) offers incentives to Connecticut residents who purchase or lease an eligible new or used battery electric (BEV) or plug-in hybrid electric (PHEV) vehicle from a licensed Connecticut automobile dealership or original equipment manufacturer. CHEAPR Rebate+ provides qualified Connecticut residents greater access to electrified transportation options with up to \$4000/\$5000 rebates on new/used electric vehicles. United Illuminating and Eversource ratepayers can also receive incentives to enroll in managed charging, which lowers the operational costs for the EV owner and all ratepayers by charging at off-peak times. Investments in transit, charging infrastructure, fleet modernization, and related services may also support in-state jobs in construction, installation, operations, and maintenance. In addition, improving mobility and expanding access to reliable public transportation can strengthen access to employment, education, health care, and other essential services, with particular benefits for households that face transportation cost burdens. Reducing congestion and improving the efficiency of goods and passenger movement may also provide productivity benefits for businesses and communities.

Resilience Benefits

Transportation measures can improve resilience by reducing stress on transportation infrastructure, increasing system redundancy, and helping communities maintain access during extreme weather events. A more diverse transportation system can also reduce reliance on any single mode during emergencies, supporting continuity of travel and goods movement during disruptions. Batteries in electric vehicles can be utilized to stabilize the grid and provide backup power to homes or community centers through two-way chargers. Reducing VMT through expanded public transit, micromobility, and alternative transportation modes may also enhance community resilience through improved health and well-being, particularly for vulnerable and disadvantaged populations, by improving mobility, connectivity, and access to essential services.

Residential and Commercial Buildings Sector

Health Benefits and Air Quality Improvements

Building measures are expected to improve health outcomes by reducing onsite combustion and lowering both indoor and outdoor exposure to combustion-related pollutants. As buildings shift away from combustion-based energy sources, associated reductions in co-pollutant emissions are expected to contribute to improved ambient air quality and related public health benefits. As noted above, buildings measures have a high potential to reduce PM_{2.5} emissions. Energy-efficient buildings also provide more stable indoor temperatures, improving comfort and safety during heat waves and cold snaps.²² Air source heat pumps can also improve indoor air quality through air filtration and dehumidification.

Economic Benefits

Building measures can generate economic benefits by reducing energy consumption, lowering operating costs, and limiting exposure to fuel price volatility over time. Energy-efficient buildings also reduce overall electricity demand, which can lessen system strain during peak periods and reduce the need to purchase more expensive energy supply, which is nearly double the cost of energy efficiency. Further investments in energy efficiency, electrification, weatherization, and distributed energy resources may continue to support jobs in construction, electrical work, HVAC services, energy auditing, and ongoing building operations. These measures can also improve building quality and comfort, helping households and businesses manage energy costs while supporting longer-term affordability. For commercial buildings, lower energy use and improved system performance can enhance competitiveness by reducing overhead costs and improving the reliability and comfort of workspaces.

For example, in 2025, the state's Conservation and Load Management (C&LM) programs served 11,023 low-income households and 794 small businesses as well as delivering cost savings to both participants and nonparticipants. Through these programs, 30,525 residences were weatherized, 4,923 energy-efficient new construction homes and units were built, and 35,250 energy efficiency workers were supported by clean energy investment. Altogether, C&LM programs resulted in \$159.7 million in participant health, safety, and comfort benefits for the year 2025.²³ The average residential customer who participates in the C&LM residential weatherization programs receives \$1,129 of value in services and achieves lifetime average savings of \$2,068 on their home energy bills. There are significant energy savings benefits for participating businesses as well. For example, small businesses in Connecticut receive an average of over \$9,500 in services and achieve an average of over \$35,000 in lifetime savings on their energy bills.²⁴

²² "Valuation of Efficiency for Energy Resilience," Pacific Northwest National Laboratory.

²³ "Connecticut Energy Efficiency Board 2025 Programs and Operations Report," Energize CT.

²⁴ "DEEP Approves Three-Year Energy Savings Plan for Connecticut," CT DEEP.

Additionally, Connecticut's Weatherization Assistance Program (WAP) expended \$3.4 million, representing 85 percent of its \$4 million DOE allocation, to weatherize 191 homes and help families lower energy costs while improving comfort and safety in Program Year 2024. An additional \$324,000 in Weatherization Readiness Funds supported critical health, safety, and structural repairs for 148 of those homes, preventing them from being deferred and ensuring more households could fully benefit from weatherization services.²⁵ For commercial buildings, lower energy use and improved system performance can enhance competitiveness by reducing overhead costs and improving the reliability and comfort of workspaces.

Resilience Benefits

Building measures can improve resilience by enhancing comfort and safety during extreme weather and reducing pressure on the electric system. Energy-efficient buildings provide more stable indoor temperatures, improving comfort and safety during heat waves and cold snaps. Smart electrification can improve local resilience and provide more reliable power for users. In addition, reducing building energy demand can lessen strain on the grid during periods of high demand. For example, the use of heat pumps for consistent air conditioning is much more efficient, with a lower cost to operate, than existing window units, that on average are eight years old in Connecticut. A ductless heat pump mini split, for instance, is approximately 1.2x more efficient than many existing window air conditioning units.²⁶ Overall, heat pumps have a greater capacity to maintain more comfortable and healthier living spaces because of their ability to cool, heat, and dehumidify building spaces across seasons and temperatures.²⁷

Homes and businesses equipped with distributed energy resources such as rooftop solar paired with batteries are more likely to retain power when centralized infrastructure is disrupted by storms.²⁸ Diversifying and decentralizing energy generation and storage adds redundancy, reducing the risk of widespread outages during extreme weather events. These resilience benefits can also reduce disruption-related costs for households, businesses, schools, and community facilities during extreme weather events.

Electric Power Sector

Health Benefits and Air Quality Improvements

The electric power sector presents some of the largest point-source opportunities for air quality and climate co-benefits. As clean electricity expands and fossil generation declines, reductions from these facilities are expected to provide substantial net air quality and climate co-benefits. Moving toward an electric power system that relies less on fuel combustion can reduce harmful air pollution. Clean energy sources such as nuclear and renewables reduce pollution from power generation, although low-carbon fuels such as hydrogen and renewable natural gas may still result in emissions of criteria pollutants when combusted, reinforcing the importance of reducing total combustion where feasible.

Economic Benefits

Electric power measures can generate economic benefits by supporting investment in energy infrastructure, grid modernization, clean energy deployment, and distributed energy resources. These activities may also support jobs in planning, engineering, construction, installation, operations, and maintenance. Over time, a more flexible and efficient electric system can help reduce exposure to fuel price volatility, lower customer costs, and reduce the economic losses associated with outages and service disruptions. Strategic

²⁵ "2025 Annual Report," DEEP Office of Affordable Housing Energy Retrofits (AHER).

²⁶ Efficiency ratings differ and cannot be directly compared between heat pumps and window AC units; with heat pumps using a seasonal efficiency rating (SEER) across many operating temperatures and window AC units using an efficiency rating at 95F only (EER).

²⁷ "Mini Splits vs. Window Acs: Pros, Cons, and Prices," Energy Sage.

²⁸ "Power outages and community health: a narrative review," PMC.

deployment of demand-side resources, storage, and distributed generation may also help defer or reduce certain infrastructure needs, depending on program design and system conditions.

DEEP recently launched a procurement process for demand response that exemplifies these benefits. In March 2026, DEEP selected proposals to help lower energy bills under a novel efficiency request for proposals. One selection includes residential behavioral and incentive-based demand response that could result in up to \$40 per year in incentive payments for participating customers. A second selection has no upfront costs for small business energy efficiency upgrades and could allow the average small commercial participant to save approximately \$18 per month on energy bills, with the potential for demand cost reductions as well. Together, these offerings will also reduce costs for all ratepayers, even for non-participants, by lowering distribution, transmission, and supply costs experienced across the grid. After costs, selected proposals are expected to reduce all ratepayer bills by \$3.36 per year for the average residential customer. Ratepayers who choose to actively participate in the efficiency and demand response programs will receive even more savings.²⁹

Resilience Benefits

Electric power measures can strengthen the resilience of critical infrastructure as climate change places increasing strain on energy systems. Extreme weather can damage transmission infrastructure, while rising temperatures increase electricity demand for cooling and place additional pressure on the grid. Clean energy sources such as nuclear and renewables can reduce pollution from power generation, but they must be supported by grid upgrades, energy storage, and other flexible resources to ensure electricity is available when demand is highest or weather conditions are severe. Distributed clean energy resources – such as battery storage, rooftop and community solar paired with batteries, demand-side programs, and smart electrification – can help maintain electricity service during outages, improve local resilience, and provide more reliable power for users. Reliable and resilient energy systems are also critical to protecting public health, since power outages can disrupt life-sustaining medical equipment, increase the risk of carbon monoxide exposure from improper generator use, and exacerbate heat-and cold-related illnesses.³⁰ By reducing outage frequency and duration, these measures can help protect critical services, limit economic disruption, and improve continuity for households, businesses, and public facilities.

Industrial Sector

Health Benefits and Air Quality Improvements

Industrial measures are expected to reduce pollution burdens on nearby communities through cleaner fuels, improved controls, efficiency measures, and industrial electrification. More broadly, reductions in reliance on combustion-based energy sources are expected to improve air quality. At the same time, while the adoption of low-carbon fuels such as hydrogen and renewable natural gas can reduce or eliminate GHG emissions, their combustion may still result in emissions of criteria pollutants.

Economic Benefits

Industrial measures can generate economic benefits by improving energy productivity, lowering operating costs, and providing greater control over long-term energy expenditures. Investments in efficiency upgrades, electrification, process improvements, and emissions controls may also support jobs in engineering, equipment installation, maintenance, and specialized technical services. For industrial facilities, reduced

²⁹ “DEEP Selects Proposals to Help Lower Electric Bills Under Novel Efficiency RFP,” CT DEEP.

³⁰ “Power outages and community health: a narrative review,” PMC.

exposure to fuel price volatility and improved energy performance can enhance long-term competitiveness and support business continuity.

One success story that exemplifies these benefits was featured by EnergizeCT³¹ where Brook + Whittle in Guilford, CT, a leading North American manufacturer of premium prime label solutions with highly differentiated capabilities, upgraded exhaust fans, converted mercury vapor lamps to LED, and updated their printing line of three printing presses. The results were a reduction in their CO₂ emissions by 4,755 tons, SO₂ emissions by 5,531 pounds, and their NO_x emissions by 6,519 pounds. Their net annual energy savings was 1,873,201 kWh and total lifetime savings of 22,526,977 kWh. With savings from this project, Brook + Whittle was able to reinvest funds into other facility improvements such as adding four new printing presses in their Connecticut plants, creating over 30 new jobs. LED UV printing technology increased production pace, cutting project turnaround times in half while maintaining consistent quality.

Resilience Benefits

Industrial sector resilience benefits are linked primarily to a more reliable and resilient electric system. As power outages and climate-related disruptions place increasing strain on facilities, improved grid resilience and reduced outage frequency and duration can help industrial operations maintain continuity and recover more effectively from extreme weather events. Measures that reduce energy demand and modernize equipment may also improve operational flexibility, helping facilities better manage climate-related disruptions, fuel supply risks, and periods of system stress.

Waste Sector

Health Benefits and Air Quality Improvements

Reducing solid waste can provide environmental and public health benefits by limiting pollution burdens associated with waste management systems including from landfills and municipal waste combustors. These benefits complement broader improvements in air quality associated with measure implementation across sectors and can help reduce stressors on communities located near waste infrastructure. For Connecticut, these benefits will largely be realized outside of the state since there are no active municipal waste landfills within the state. Supporting municipalities that want to pursue these strategies will help Connecticut become more self-sufficient in the management of our waste by reducing the amount of municipal solid waste tonnage that may be disposed of at out of state landfills. These strategies also help to advance progress towards the statewide 60% diversion rate set forth in the State's Comprehensive Materials Management Strategy (CMMS).

Economic Benefits

Waste measures can generate economic benefits by reducing disposal needs, extending the useful life of existing disposal infrastructure, and creating opportunities in collection, processing, reuse, repair, recycling, and organics diversion. Depending on program design and market conditions, these activities may also support local jobs and workforce development. Over time, reducing waste and increasing materials recovery can also help lower costs for municipalities, businesses, and households where disposal, hauling, and material use are avoided.

Connecticut's Sustainable Materials Management (SMM) Grant Program helps municipalities and regional entities by providing funds to develop and implement a wide variety of waste diversion and reduction programs and initiatives. These programs and initiatives include unit-based pricing systems operated at

³¹ ["Industrial Energy Solutions: Energy Efficiency Case Study,"](#) Energize CT.

municipal transfer stations; decentralized food scrap collection units; technical assistance for the startup of an aerated static pile composting facility; curbside food scraps collection; regional composting enhancements paired with an in-vessel composter installation; technical support for the expansion of a regional waste authority's operations; and a major urban initiative to launch curbside co-collection of municipal solid waste and food scraps within a unit-based pricing system. The first round of the SMM grant program resulted in more than 1,000 tons of waste diverted across participating municipalities. Given the increasing cost of municipal solid waste disposal, this represents significant potential savings for towns.³² The state's Materials Management Infrastructure (MMI) Grant Program is another waste-management pilot program that provides grant funds to develop small- to medium-scale waste management infrastructure.³³ Restoring Connecticut's self-sufficiency in waste management is critical for a reliable waste system and long-term stability in tipping fees.

Resilience Benefits

Waste measures can support resilience by reducing stress on both natural and built systems. Reducing solid waste disposal helps limit plastic pollution that can clog waterways and stormwater infrastructure, which can otherwise worsen flooding and related damage. By reducing these stressors, such measures can help communities better withstand and recover from severe storms and flooding.

Agriculture and Natural and Working Lands Sectors

Health Benefits and Air Quality Improvements

Natural and working lands measures can provide important health and environmental benefits. Urban trees and green infrastructure play an important role in reducing extreme heat, improving air quality, and protecting public health.³⁴ Strategically planting trees in high-heat, high-traffic, and underserved areas helps lower surface temperatures, reduce cooling costs, and decrease health risks during heat waves.³⁵ These investments also improve comfort and safety for pedestrians and transit users while advancing environmental equity.

Economic Benefits

Natural and working lands measures can generate economic benefits by supporting agricultural productivity, reducing damages associated with flooding and erosion, and sustaining the ecosystem services on which communities and businesses rely. Investments in restoration, urban forestry, and green infrastructure may also support jobs in planting, ecological management, and long-term maintenance. In New Haven, CT, the Yale Urban Resources Initiative - a community forestry program - offers paid Greenspace and GreenSkills internships for New Haven high school students enrolled Common Ground and Sound School and adults with a history that includes incarceration.³⁶ In agricultural settings, practices that improve soil health can also strengthen farm resilience and help protect the long-term economic viability of working lands.

Resilience Benefits

Natural and working lands measures can strengthen resilience by supporting healthier ecosystems that serve as important climate resilience assets. Agricultural practices such as the use of cover crops help soils

³² ["Governor Lamont Announces \\$7.5 Million in Grants Awarded to 18 Municipalities and Regional Organizations To Support Sustainable Waste Reduction," CT DEEP.](#)

³³ ["DEEP Announces \\$15 Million in Grant Awards for Materials Management Infrastructure Grant Program," CT DEEP.](#)

³⁴ ["Urban tree canopies drive human heat stress mitigation," ScienceDirect.](#)

³⁵ ["Multiple health benefits of urban tree canopy: The mounting evidence for a green prescription," ScienceDirect.](#)

³⁶ ["Internships," Urban Resources Initiative.](#)

retain structure and nutrients, improving their ability to absorb and hold water during heavy rainfall and reducing runoff and erosion.³⁷ These same soil health benefits help agricultural lands better withstand drought and extreme heat by improving moisture retention.³⁸ Connecticut offers support for improving soil health through the Connecticut Agriculture Experiment Station, the UConn Soil Nutrient Analysis Lab, the Connecticut Resource Conservation and Development Area, and the Connecticut Northeast Organic Farming Association Soil Health Program.³⁹

Conservation and enhanced management of natural and working lands—particularly wetlands—can also reduce vulnerability to flooding and drought. Wetlands act as natural resilience infrastructure by absorbing storm surge, slowing floodwaters, and protecting shorelines from erosion. As sea levels rise, healthy wetlands can adapt and migrate inland, preserving these protective benefits. Wetlands also help moderate temperatures, support water availability, and improve water quality by filtering pollutants from runoff.^{40,41} Forests, grasslands, and other vegetation similarly reduce erosion and protect communities from inland and riverine flooding.

POTENTIAL DISBENEFITS

While the GHG emissions reductions measures identified in this plan are expected to deliver significant climate, health, economic, and resilience benefits, some measures may also have unintended impacts that CT DEEP will seek to minimize through thoughtful design and implementation. For example, certain strategies may result in localized increases in air pollution. Under the mitigation pathway, the use of substitute biofuels in aviation is projected to cause a small increase in volatile organic compound emissions, which could affect air quality near Connecticut's airports. In addition, some low-carbon fuels can reduce GHG emissions while still resulting in emissions of criteria pollutants when combusted.

There may also be financial, infrastructure, and equity considerations associated with the transition. Upfront costs for clean technologies such as EVs, heat pumps, and building upgrades may be prohibitive for low- and moderate-income households without additional support. In the electric power sector, investments needed to modernize infrastructure and integrate clean energy resources may affect electricity rates if not carefully managed. However, DEEP and its sister agencies currently implement several statewide programs to help mitigate these barriers.

As mentioned in the Benefits section of this report, CHEAPR and CHEAPR's Rebate+ programs offer incentives to Connecticut residents who purchase or lease an eligible new or used BEV or PHEV vehicle from a licensed Connecticut automobile dealership or original equipment manufacturer. Additionally, through the state's EV Charging Program, the state's electric distribution companies provide charger and wiring upgrade rebates up to \$1,500 to customers meeting income eligibility requirements of up to 300% of the federal poverty level or who live in high poverty, low opportunity areas to help set up EV home charging. These rebates can be made towards the costs of a home wiring upgrade, the purchase of a Level 2 Smart Charger, or used to offset some of the cost of both. Residential EV charger rebates are available for 1-to 4-unit homes. Rebates are also available for larger apartment buildings.⁴²

³⁷ [“The Role of Cover Crops in Flood Damage Prevention,”](#) Live to Plant.

³⁸ [“Cover Crops for Climate Change Adaptation and Mitigation,”](#) EESI.

³⁹ [“Soil Health,”](#) CT Department of Agriculture.

⁴⁰ [Why Wetlands Are Critical for Animal Life and Survival](#)

⁴¹ [“Wetlands as nature-based solutions for water management in different environments,”](#) ScienceDirect.

⁴² [“Connecticut's Climate Progress,”](#) CT DEEP.

In the electric power sector, the Residential Renewable Energy Solutions program compensates residents for the power produced from their residential distributed generation (Renewable Energy) systems and Renewable Energy Certificates. The homeowner can select one of two incentive rate structures— Buy-All or Netting — along with the interconnection application. Additional incentives are available for income-eligible residential customers or customers who reside in distressed municipalities.⁴³ The Shared Clean Energy Facilities Program provides access to the benefits of solar for lower income-eligible households or those residential customers who cannot install solar.⁴⁴

Energize CT, managed through the Conservation and Load Management Plan and the Energy Efficiency Board, provides affordable financing options for residents and businesses to support home energy assessments and rebates and incentives for weatherization/insulation, efficient appliances, heat pumps and heat pump hot water heaters, windows and geothermal heating. For example, for single family (1-4 units), rebates for residential air source heat pumps for building heating and cooling that replace natural gas, oil, propane or electric resistance heat are \$1000 per ton, up to \$15,000.⁴⁵ In Program Year 2025, over 11,000 low-income households were served.⁴⁶

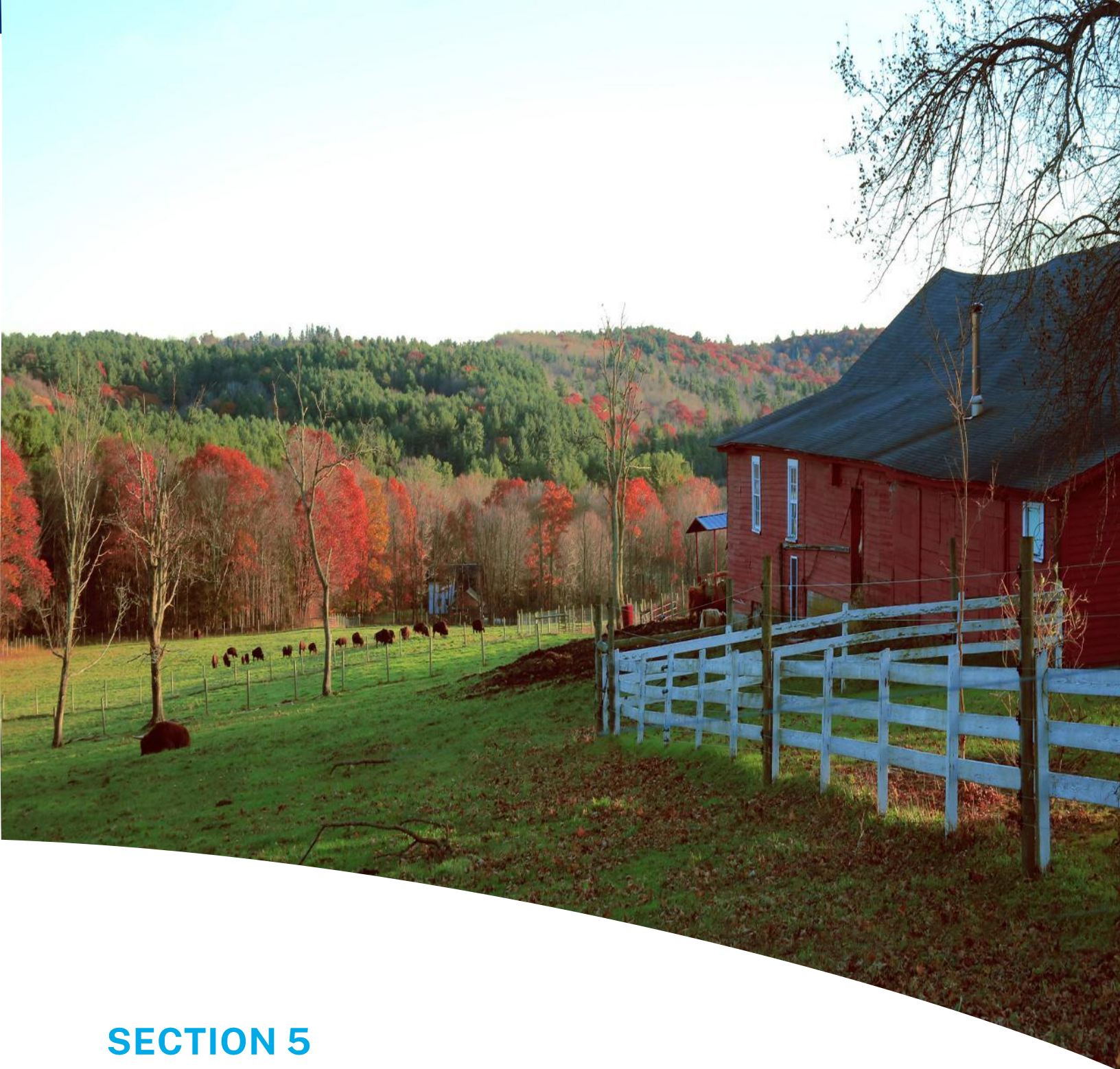
Ensuring grid reliability, maintaining affordability, and supporting equitable implementation will require continued planning and investment as the energy system evolves. The magnitude of these potential disbenefits will depend on future program design. The actions noted above illustrate CT DEEP's commitment to addressing potential disbenefits. CT DEEP will continue to work with stakeholders and the public to refine climate actions, prioritize equity, and reduce or avoid negative impacts where possible.

⁴³ "Connecticut's Climate Progress," CT DEEP.

⁴⁴ "Statewide Shared Clean Energy Facility Program," CT DEEP.

⁴⁵ "Residential Air Source Heat Pump Energy Optimization Incentive," Energize CT.

⁴⁶ "Connecticut Energy Efficiency Board 2025 Programs and Operations Report," Energize CT.



SECTION 5

CONSIDERATIONS FOR MEASURE IMPLEMENTATION

AUTHORITY TO IMPLEMENT

CT DEEP reviewed existing statutory and regulatory authority related to each GHG emissions reduction measure included in the CCAP. Most notably, CT DEEP has existing statutory authority under Section 22a-200a of the Connecticut General Statutes that align with the EPA CPRG requirements for the CCAP. Section 22a-200a, commonly known as the Global Warming Solution Action, requires CT DEEP to produce a greenhouse gas inventory annually and to monitor progress towards the state’s greenhouse gas emissions reduction planning targets and provide a schedule of proposed regulations, policies, and strategies designed to achieve those planning targets in a report every three years. Specifically for each measure in the CCAP, the proposed implementing state agency has existing authority that can support the implementation of these measures, and, in many cases, an existing state program could be built upon or expanded to implement the measures. The measure profiles in Appendix 4: Greenhouse Gas Emissions Reduction Measures include a review of existing statutory and regulatory authority to support implementation each GHG emissions reduction measure through planning, programs, and/or regulations. CT DEEP and all proposed implementing state agencies also have authority to implement federal programs authorized by congress that can support the implementation of these measures.

INTERSECTION WITH OTHER FUNDING AVAILABILITY

CT DEEP assessed funding availability broadly with the aim of aligning public investment with the measures in this plan where appropriate and applicable. The identification of targeted measures and implementing actions enables CT DEEP and other agencies to apply for or allocate funding to support implementation. Connecticut can continue to leverage available federal, state, utility, and other funding sources to implement climate solutions and deliver benefits statewide. Connecticut agencies and implementers can strategically apply for formula and competitive federal and other funds and identify or dedicate matching funds to maximize these opportunities to implement initiatives in the state. Table 7 provides a list of currently available federal, state, utility, and partner funding opportunities that could support the measures in this CCAP. This list is not exhaustive. It does not include local government, private sector, or philanthropic funds that may be utilized. This list is a snapshot in time and as such it is subject to change, including changes in state and federal policy.

Table 7. Potential Funding Opportunities for GHG Emissions Reduction Measures

Funding Source	Funding Focus Area(s)	Relevant Measure(s)
Federal Funding		
Carbon Reduction Program	Complete streets roadway improvements for pedestrians and bicyclists, train and rail transit improvements; battery electric bus (BEB) and charging infrastructure funding, transit emission reduction	1, 2, 3

Funding Source	Funding Focus Area(s)	Relevant Measure(s)
Federal Railroad Administration (FRA) Northeast Corridor (NEC) Funding	Railroad improvements, including catenary structures used by electric trains	1, 3
National EV Infrastructure (NEVI) Program	Alternative Fuel Corridor build out and community charging infrastructure	2
Federal Transit Administration (FTA) Low or No Emission Grant Program	BEBs and charging infrastructure	2
Clean Heavy-Duty Vehicle Program	School buses and vocational vehicle Class 6 and Class 7 ZEV replacements	2
Clean School Bus (CSB) Rebates Program	School bus ZEV or low-emission vehicle replacements	2
Federal Aviation Administration's (FAA) ZEV Program	Electric maintenance equipment and charging station for Tweed-New Haven Airport (HVN)	3
EPA Clean Ports Program	Electric equipment, charging infrastructure, and renewable energy storage systems for port operations	3
Home Energy Rebates–Efficiency & Electrification & Home Electrification and Appliances Rebate	Energy efficiency and electrification rebates for homes	4, 5, 6, 7
DOE Weatherization Assistance Program (WAP)	Increase energy efficiency of homes owned or occupied by low-income persons, reduce total residential energy expenditures, and improve health and safety	4
New England Heat Pump Accelerator CPRG Implementation Grant	Residential heat pumps	5
Grid Resilience State/Tribe Formula Grant Program	Grid modernization, power grid resilience	8, 9
Grid Resilience and Innovation Partnership (GRIP)–Grid Innovation Program (GIP)	Grid flexibility and resilience	8
DOE Loan–Industrial Decarbonization Projects	Large-scale industrial decarbonization project loans	11

Funding Source	Funding Focus Area(s)	Relevant Measure(s)
Composting and Food Waste Reduction (CFWR) Cooperative Agreements	Composting and food waste reduction planning	12
Consumer Recycling Education and Outreach Grant Program	Local waste management infrastructure, recycling programs, and public education	13
NRCS Climate-Smart Agriculture Programs	Climate-smart mitigation activities	14, 15
NRCS Environmental Quality Incentives Program	Technical assistance for conservation plan development and covers some costs of conservation plan development	14, 16
NRCS Agricultural Conservation Easement Program	Protect and restore working farms and ranches with conservation easements	14
Urban Forested Natural Areas and Riparian Corridor Restoration Grant	Improves forest health and resilience through reforestation and invasive species removal	16, 17
U.S Fish and Wildlife Service Highlands Conservation Act	Highland acreage protection	16
Bipartisan Infrastructure Law (BIL) Coastal Zone Management Funding	Build capacity, increase resilience, and restore and protect coastal habitats	16
BIL Long Island Sound Study	Habitat restoration; green infrastructure and access along the Long Island Sound coast	16
Resilient Forestry Practices Grant	Resilient forestry practices	16
Urban Forest Resilience Grant	Efforts to restore and improve urban forests lost due to catastrophic losses from Emerald Ash Borer and other pests and diseases	17
Urban and Community Forest Planning	Urban forestry planning and data collection	17
Urban Forest Equity/Trees for Communities	Stewardship projects such as tree planting, workforce development, or tree stewardship	17
Urban Forest Equity through Capacity Building	Support capacity building through urban forestry projects that will increase tree cover	17
US Forest Service Urban and Community Forestry Program	Grow and maintain urban and community trees, forests, and green spaces	17

Funding Source	Funding Focus Area(s)	Relevant Measure(s)
Federal Tax Credits		
Alternative Fuel Infrastructure Tax Credit	Reduce upfront cost of EV charging and other alternative fuel refueling equipment	2
Federal 45Q tax credit under the IRA	Carbon capture, utilization, and storage, (CCUS) credits	11
48C Advance Manufacturing Tax Credit	Industrial facility retrofits credits and decreased carbon intensity credits	11
Land and Water Conservation Fund	Supports increased public access to and protection for federal public lands and waters including national parks, forests, wildlife refuges and recreation areas, and provides matching grants to state governments for the acquisition and development of public parks and other outdoor recreation sites.	16
USFS Forest Legacy Program	Protects of privately owned forest lands through conservation easements or land purchases.	16
USFWS Wildlife Restoration Program	Funds projects to restore, conserve, manage and enhance wild birds and mammals and their habitats. The program was first authorized by the Wildlife Restoration Act (Pittman-Robertson).	16
State Funding		
Battery Electric Bus Program	Abatement of diesel emissions by replacing diesel buses with ZEV buses	2
Comprehensive Energy Strategy	Examines future energy needs in the state and identifies opportunities to reduce costs for ratepayers, ensure reliable energy availability, and mitigate public health and environmental impacts of Connecticut's energy use, such as greenhouse gas (GHG) emissions and emissions of criteria air pollutants	4, 5, 6, 7, 8, 9
Connecticut Hydrogen and Electric Automobile Purchase Rebate (CHEAPR)	Rebates to purchase or lease eligible new or used battery electric (BEV) or plug-in hybrid electric (PHEV)	2
Community Connectivity Grant Program (CCGP)	Improvements for pedestrians and bicyclists	1

Funding Source	Funding Focus Area(s)	Relevant Measure(s)
DEEP's Microgrid and Resilience Grant and Loan Program	Local distributed energy generation for critical facilities	9
Housing Environmental Improvement Revolving Loan and Grant Fund	Energy efficiency upgrades/retrofits at existing single-family and multi-family homes	4, 5
Heat Pump State Bond Funds	Authorized \$25 million in state bond funds for supporting the cost-effective deployment of heat pumps for thermal needs throughout the state	5, 7
Open Space and Watershed Land Acquisition Program	Land acquisition for open space and for access to water supply properties	16
DEEP Urban Green and Community Gardens Grant Program (CGS § 7-131d to 7-131k)	Develop or enhance urban green spaces for public enjoyment and/or environmental education in distressed municipalities or environmental justice communities.	16
Recreation and Natural Heritage Trust Program (CGS § 23-73 through 23-99)	Acquires lands and waters to be added to the State's system of public Parks, Forests, Wildlife Management, recreational water access, and other natural open spaces.	16
Sustainable Materials Management Grant Program	Development of food scrap collection and unit-based pricing programs, and other reduction, recycling, and diversion programs	12
Utility Programs		
Residential Renewable Energy Solutions Program	Compensates residents for power produced from their residential distributed generation (Renewable Energy) systems and Renewable Energy Certificates	9
Statewide Shared Clean Energy Facility (SCEF) Program	Provides locally generated, renewable, carbon-free clean energy benefits to select customers who are income-eligible or who cannot install solar on their home	9
Non-Residential Renewable Energy Solutions Program	Provides renewable energy tariffs to compensate non-residential owners of distributed energy resources for the power their systems produce and provide to the electric grid	9
PURA EV Charging Program	Residential and commercial EV charging ports	2

Funding Source	Funding Focus Area(s)	Relevant Measure(s)
Other Funding Sources		
Conservation & Load Management Plan/Ratepayer Funds collected on electric and/or natural gas bills	Provides incentives for home energy assessments, weatherization, efficient appliances, heat pumps and heat pump water heaters, windows, and geothermal heating	4, 5, 6, 7, 10
Ratepayer Funds collected on electric bills/ Solicitation of Class I renewable energy resources and zero carbon electricity generating resources	DEEP procurement of grid-scale clean energy projects to meet the state's electric supply needs	8
Connecticut Green Bank Clean Energy Financing and Incentives	Electric school buses, home energy and resiliency upgrades, energy storage, and C-PACE	2, 4, 5, 9, 10, 11
Mutual Security Credit Union	EV loan for residents in Fairfield, Litchfield, and New Haven counties	2
Regional Greenhouse Gas Initiative (RGGI)	Energy efficiency initiatives, renewable energy projects, energy bill rebates	4, 5, 6, 7, 8, 9, 10
Sustainable Connecticut	Technical and financial assistance for sustainable community projects	12
Volkswagen Settlement Environmental Mitigation Trust	Abatement of diesel emissions through on-road and nonroad vehicle and equipment replacement	2, 3



SECTION 6

WORKFORCE PLANNING

The feasibility of implementing the GHG emissions reduction measures in the CCAP will depend on the availability of a skilled, adaptable, and well-supported workforce across multiple sectors, including transportation, buildings, electric power, industry, waste, agriculture, and natural and working lands. To inform implementation readiness, Connecticut conducted a statewide workforce planning analysis examining labor demand associated with the plan's 17 GHG emissions reduction measures and the supply of workers in occupations that would be critical to implementing those measures.

The analysis detailed in Appendix 6: Workforce Planning Analysis Methodology, indicates that Connecticut's workforce is generally well positioned to support implementation of the measures. The state has substantial existing employment in occupations directly connected to the measures, as well as a mature ecosystem of education, training, and workforce development institutions. Approximately 18 percent of current employment statewide is in occupations linked to the measures, spanning construction trades, engineering, utilities, transportation, manufacturing, and environmental services. While targeted shortages are projected in certain roles, these challenges are concentrated in specific occupations and do not indicate a system-wide labor constraint.

Taken together, the findings suggest the primary workforce challenge for the measures is not the absence of workers in Connecticut, but the alignment of existing workers, training pathways, credentials, and support systems with the occupations and skills most critical to implementation.

PRIORITY OCCUPATIONS AND WORKFORCE TRENDS

The GHG emissions reduction measures, if implemented, are expected to increase demand most notably for electricians, HVAC technicians, construction laborers, solar and telecommunications installers, utility and line workers, engineers, and selected transportation and -waste related occupations (See Table 137 in Appendix 6: Workforce Planning Analysis Methodology). Many of these roles support multiple measures and sectors — particularly building electrification and efficiency, transportation electrification, and grid modernization — making them implementation-critical and likely to be needed consistently for the measures to be deployed.

At the same time, the analysis identifies balanced or surplus labor conditions in several adjacent occupations, including HVAC mechanics, plumbers and pipefitters, general maintenance workers, automotive and diesel mechanics, and helper level construction trades (See Table 136 in Appendix 6: Workforce Planning Analysis Methodology). This pattern indicates that workforce constraints are best characterized as an alignment and transition challenge rather than an overall shortage. Many of the most relevant occupations for the measures can be accessed through targeted upskilling, reskilling, and work-based learning pathways, rather than requiring new labor force entry alone.

This finding has important implications for developing an implementation strategy. Leveraging workers in adjacent occupations, particularly through short term credentialing, bridge training, and employer-connected pathways, can help meet near-term labor needs while reducing schedule risk for infrastructure deployment.

WORKFORCE ACCESS AND PARTICIPATION

The workforce needs for the GHG emissions reduction measures could increasingly intersect with broader access and participation challenges. Even where training opportunities exist, participation and retention can be constrained by transportation access, childcare availability, licensing and tool costs, housing affordability, and limited awareness of climate-aligned career pathways. These barriers disproportionately affect low-income residents, as well as women, youth, career changers, and individuals with prior involvement in the justice system.

Connecticut has an established set of workforce access points, including American Job Centers, Adult Education programs, community colleges, technical high schools, and targeted re-entry and support programs, that provide a strong foundation for expanding participation in climate-aligned occupations. Strengthening linkages between these systems and CCAP implementation, particularly through paid work-based learning, wraparound supports, and clearly articulated advancement pathways, will be important to ensure that climate workforce opportunities are broadly accessible.

Workforce development can not only be a labor-market consideration, but also a mechanism for directing climate investments into communities facing persistent economic barriers. Aligning workforce strategies with measure deployment can support both timely implementation and the plan's broader equity objectives.

CONNECTICUT'S WORKFORCE DELIVERY CAPACITY

Connecticut could implement the GHG emissions reduction measures with a well-developed and coordinated workforce system that can be leveraged and scaled rather than built from scratch. The state's workforce infrastructure—led by the Connecticut Office of Workforce Strategy and the Connecticut Department of Labor and delivered through regional Workforce Development Boards, education and training providers, employers, labor organizations, and community-based partners—provides an established platform for recruitment, training, and job placement across a wide range of climate relevant occupations. This existing delivery capacity gives Connecticut a strong foundation to support workforce needs associated with the measures while adapting to evolving labor demand over time.

Multiple Entry Points into the Workforce System

A central strength of Connecticut's workforce delivery system is the availability of multiple entry points that allow residents with diverse backgrounds, experience levels, and support needs to access training and employment opportunities. American Job Centers, WIOA-funded services, and Adult Education programs provide access to career counseling, job search assistance, training vouchers, GED preparation, English-language learning, and supportive services. These programs play a critical role in connecting individuals to climate-aligned career pathways, particularly for workers who may need foundational skills, career navigation, or transitional support before entering occupational training.

Connecticut also offers targeted workforce services designed to support populations that face additional barriers to employment. Jobs First Employment Services provides workforce programming for Temporary Assistance for Needy Families participants, while reentry focused workforce initiatives coordinated with the Department of Correction and partner organizations support individuals transitioning back into the labor

market. Together, these access-oriented programs create a practical base for expanding participation in climate related-occupations while advancing equity and inclusion as CCAP implementation progresses.

Earn-and-Learn and Apprenticeship Pathways

Earn-and-learn pathways are another core strength of Connecticut’s workforce system and are especially relevant to CCAP implementation. Registered apprenticeships administered through the Connecticut Department of Labor remain one of the state’s most important tools for preparing workers in electrical, HVAC, plumbing, and other skilled trades that are central to building electrification, energy efficiency, and utility and infrastructure measures. These programs combine paid on-the-job training with classroom instruction, enabling workers to earn wages while developing industry recognized skills.

Pre-apprenticeship programs and other access-oriented training models further strengthen these pathways by helping youth, career changers, and underrepresented populations prepare for entry into registered apprenticeships. At the same time, the workforce analysis indicates that apprenticeship and licensing structures should be viewed as both a strength and a scaling challenge. While they provide high-quality training and strong labor market outcomes, expanding these pathways and increasing training capacity will be important to avoid bottlenecks that could impact the feasibility of the measures.

Sector-Based and Employer-Connected Training Models

Connecticut has also demonstrated strong capacity to deliver sector-based and employer-connected training that can support measure workforce needs. Programs such as the Eastern CT Manufacturing Pipeline Initiative⁴⁷ provide short-term, employer-aligned training with demonstrated placement outcomes, offering a replicable model for preparing workers for climate-aligned manufacturing and industrial occupations. The Manufacturing Innovation Fund⁴⁸ supports incumbent worker upskilling across advanced manufacturing, providing a framework for workforce modernization that is directly relevant to industrial decarbonization and clean energy supply chain development. CareerConneCT further illustrates the state’s ability to pair training with wraparound supports and direct connections to employment, particularly for workers transitioning into high-demand fields. These models are well suited to supporting upskilling and reskilling in occupations that are adjacent to, or directly involved in, the measures. For example, Connecticut has a particularly strong nuclear workforce training system, which include employer supported programs at like the Nuclear Engineering Technology program⁴⁹ at Three River’s campus of the CT State Community College.

Youth Pipelines and Early Career Exposure

Connecticut’s youth workforce pipeline initiatives represent an additional delivery strength that could support measures over the longer-term. Programs such as Energize Connecticut’s Green STEP introduce high school students to energy efficiency, HVAC, heat pumps, weatherization, solar, and green building concepts, helping build early awareness of climate-aligned careers. More broadly, the state’s youth career pathway initiatives, summer youth employment programs, and emphasis on industry-recognized credentials create opportunities for earlier exposure to priority occupations and smoother transitions into postsecondary education, apprenticeships, and employment. These youth-focused efforts are particularly important

⁴⁷ [Eastern CT Manufacturing Pipeline Initiative](#)

⁴⁸ [Manufacturing Innovation Fund](#)

⁴⁹ [Nuclear Engineering Technology Program at Three River’s campus of the CT State Community College](#)

because many measure-relevant occupations — especially skilled trades and technical roles — require sustained talent pipelines over time rather than short-term recruitment alone.

Coordinated Delivery and Cross-Sector Partnerships

Finally, Connecticut benefits from a broad and collaborative delivery ecosystem that brings together public agencies, education providers, organized labor, employers, and community organizations. Regional Workforce Development Boards play a central role in aligning training with regional labor market demand and coordinating across partners. The involvement of labor organizations, community colleges, technical high schools, human service agencies, municipalities, and industry partners further supports integrated workforce delivery.

This coordinated structure is especially important to support the measures because many priority occupations sit at the intersection of public investment, private hiring demand, and regulated infrastructure deployment. Connecticut’s existing collaboration across institutions positions the state to align workforce development investments with funding, procurement, and project timelines.

Taken together, Connecticut’s existing workforce delivery capacity — including access-oriented entry points, earn-and-learn pathways, sector-based training models, youth pipelines, and coordinated partnerships — provides a strong foundation to support the measures. The key challenge is not the creation of new systems, but the strategic alignment and scaling of these existing strengths toward implementation-critical occupations and skills, while ensuring that supportive services enable broad participation in the clean energy transition.

WORKFORCE SOLUTIONS FRAMEWORK

The workforce analysis indicates that meeting measure workforce needs will depend primarily on targeted upskilling, reskilling, and structured entry pathways, rather than reliance on new labor-force entrants alone. Connecticut’s existing workforce infrastructure provides a strong foundation, but effective alignment with the identified priority occupations, credentials, employers, and project timelines is also needed. Several adjacent or surplus occupations — including construction helpers, maintenance workers, automotive technicians, and material movers — represent practical feeder pathways into implementation-critical roles through bridge training and work-based learning. Coordinating workforce investments with funding, procurement, and deployment schedules can help smooth peaks in labor demand, reduce schedule risk, and support employer investment in training and staffing.

Table 8 presents a workforce solutions framework with potential solutions that align workforce strategies with the GHG emissions reduction measures while supporting equitable access, employer coordination, and accountability. Successful implementation of these potential solutions will require ongoing coordination among state agencies, workforce boards, employers, utilities, education providers, and community partners to ensure that workforce capacity supports timely implementation and longer-term economic opportunity.

Table 8. Workforce Solutions Framework

Priority Area	What the State Can Do	Implementation Relevance
Targeted upskilling and retraining	Use existing surplus and feeder occupations to transition workers into shortage roles such as electricians, solar installers, energy-efficiency trades, EV maintenance, and utility-support occupations.	Supports near-term project delivery without relying only on new entrants.
Climate-aligned curriculum modernization	Embed heat pumps, building performance, electrification, solar, EV, and digital skills into current trade, technical, and community-college programs.	Helps existing programs prepare workers for CCAP-related implementation tasks.
Entry and re-entry pathways	Expand pre-apprenticeship, re-entry, adult education, and paid work-based learning models linked to employer demand.	Broadens participation and creates accessible pathways into implementation-critical occupations.
Wraparound supports and access	Pair training with childcare, transportation, tools, stipends, and career navigation supports, especially for populations facing barriers.	Improves completion, retention, and equitable access to climate workforce opportunities.
Employer and agency coordination	Coordinate among state agencies, workforce boards, employers, utilities, unions, educators, and community-based organizations around priorities, credentials, and timelines.	Improves alignment between workforce investments and CCAP deployment needs.
Performance management	Track workers trained, credentials earned, job placement, retention, and participation from underserved communities; refine programs over time.	Supports implementation accountability and continuous improvement.



SECTION 7

NEXT STEPS

STATUS REPORT

Building on the strategies and measures identified in this plan, CT DEEP will continue to coordinate with other state agencies and stakeholders to evaluate programs and policies that could support measure implementation. CT DEEP will develop the final required CPRG Planning Grant deliverable of a Status Report for submission to EPA that will:

- **Track Progress:** Track the implementation status of the measures.
- **Update Analyses:** Identify any needed updates to analyses or projections that could support measure implementation.
- **Identify Next Steps and Continue Coordination:** Identify next steps, including associated budget and staffing needs, to execute next steps for measures; and continue coordinating across state agencies and with partners such as municipalities, utilities, regional entities, and private sector stakeholders.
- **Continue Stakeholder and Community Engagement:** Continue meaningful engagement with stakeholders and incorporate feedback into program development and implementation.



APPENDIX 1: PUBLIC AND STAKEHOLDER INPUT

This appendix provides additional information on public and stakeholder activities conducted during the development of the CCAP and outcomes from these activities.

Public Meetings

The four public meetings that were held during development of the CCAP are detailed in Table 9.

Table 9. CCAP Public Meetings Hosted by CT DEEP

Meeting Date	Meeting Title
June 13, 2025	Connecticut Climate Action Planning Public Meeting: CCAP Kickoff
October 8, 2025	Connecticut Climate Action Planning Public Meeting and Opportunity for Public Comment: BAU Results and Overview of Proposed GHG Reduction Measures
December 11, 2025	CT DEEP Climate Action Plan Stakeholder Convening: Pathways to Implementation (Transportation, Buildings, Natural and Working Lands)
January 13, 2026	Governor’s Council on Climate Change Meeting: Presentation of Climate Progress Draft Report with GHG Inventory and BAU Results

Public Survey Results

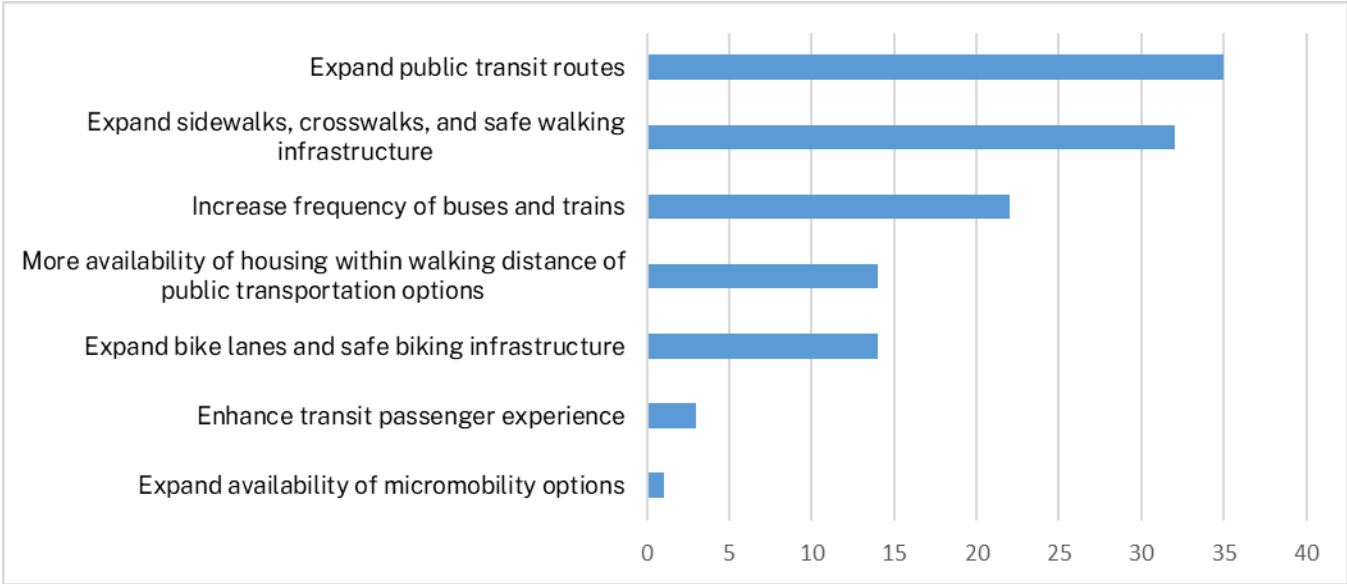
The DEEP Climate Action Plan survey was open to the public from September 21, 2025, to April 1, 2026, and received 136 total responses. The survey included 29 questions, organized by sector to gauge public opinions and priorities regarding potential actions. The survey was promoted on the CT DEEP CCAP webpage⁵⁰ and the link was shared during public meetings on October 8 and December 11.

Transportation Sector

The transportation sector survey questions focused on transit improvements, EV adoption incentives, and nonroad emissions reduction actions. Respondents noted that the key barriers for EV adoption are the upfront cost and insufficient charging infrastructure in rural areas and multi-family housing. For transit improvements, many respondents urged faster rail connections between cities, better integration of bus and train schedules, and using school buses for public transit during off-hours.

⁵⁰ <https://portal.ct.gov/deep/climate-change/comprehensive-climate-action-plan>.

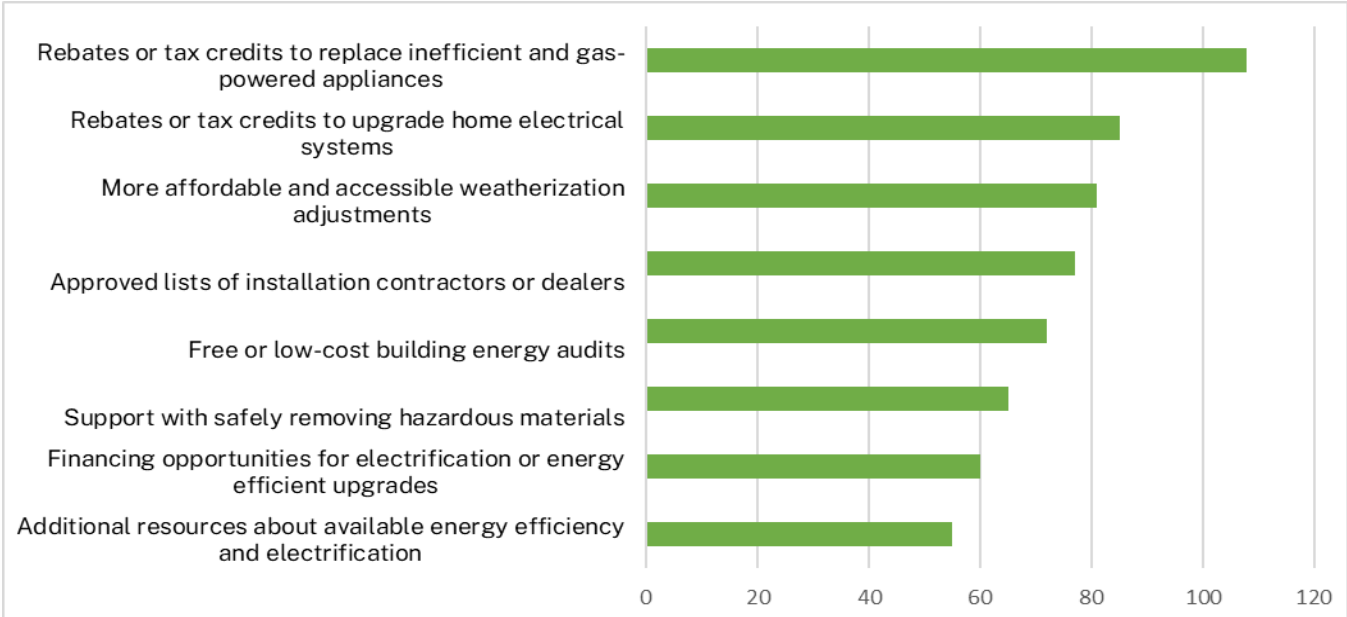
Figure 12. Which improvements would make you more likely to use public transportation or alternative modes of transit, like biking or walking (first ranked choices)?



Residential & Commercial Buildings Sector

The residential & commercial buildings sector survey questions focused on understanding motivations to electrify and improve energy efficiency at homes and businesses. Multiple respondents emphasized that low-income renters and homeowners face the steepest barriers to electrification, and supported actions to provide rebates or tax credits.

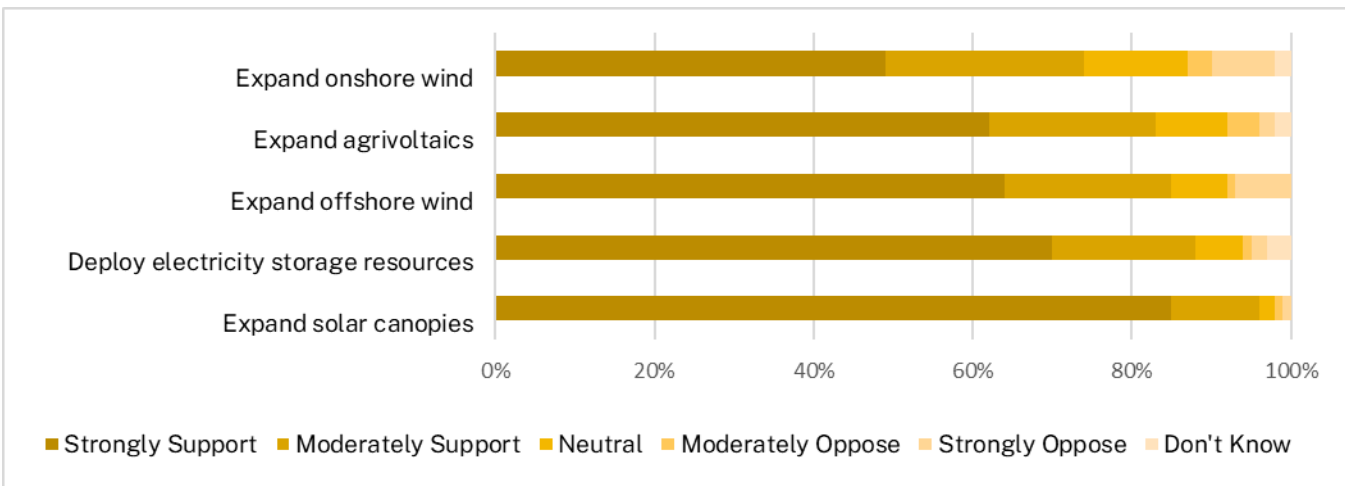
Figure 13. Which of the following actions would make you more likely to implement energy efficiency or electrification measures in your home or business?



Electric Power Sector

The electric power sector survey questions focused on understanding respondents' support for various generation technologies and identifying incentives that could encourage solar adoption. Respondents demonstrated strong support for solar canopies, energy storage, offshore wind, and agrivoltaics. Respondents also shared support for public agencies such as the state, municipalities, schools, and libraries to lead by example and install solar on their buildings and lands.

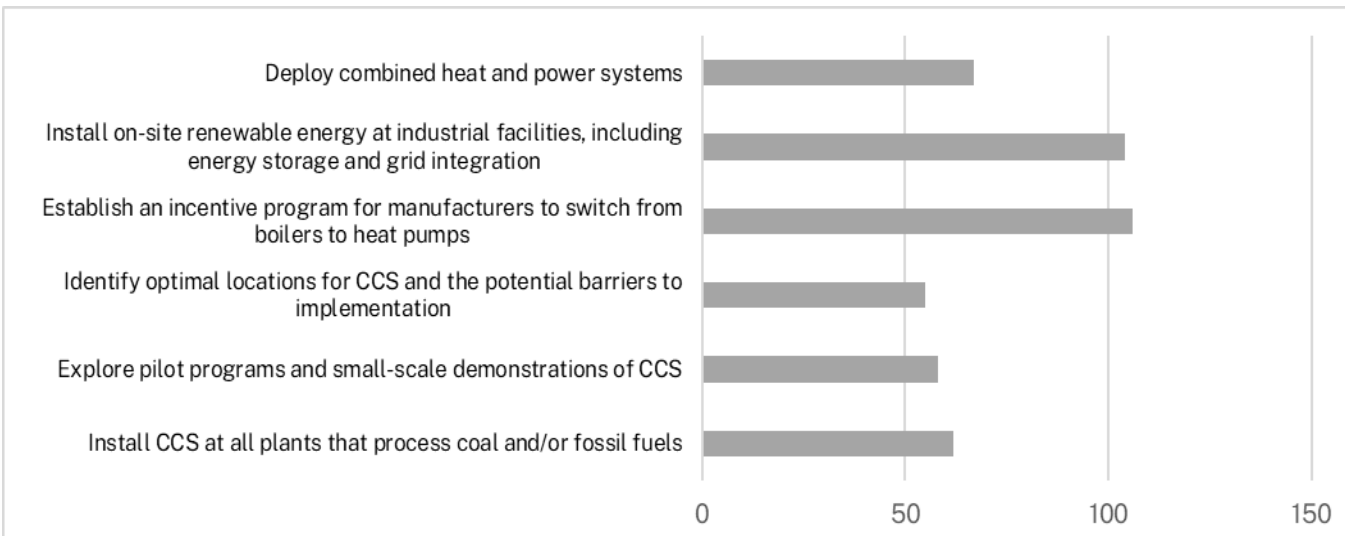
Figure 14. To what extent do you support the following actions to expand clean energy power generation in Connecticut?



Industrial Sector

The industrial sector survey questions focused on potential actions to decarbonize industrial facilities including carbon capture, on-site renewables, and incentives for cleaner manufacturing processes. Respondents emphasized the importance of emissions reduction strategies coupled with emerging carbon capture technologies.

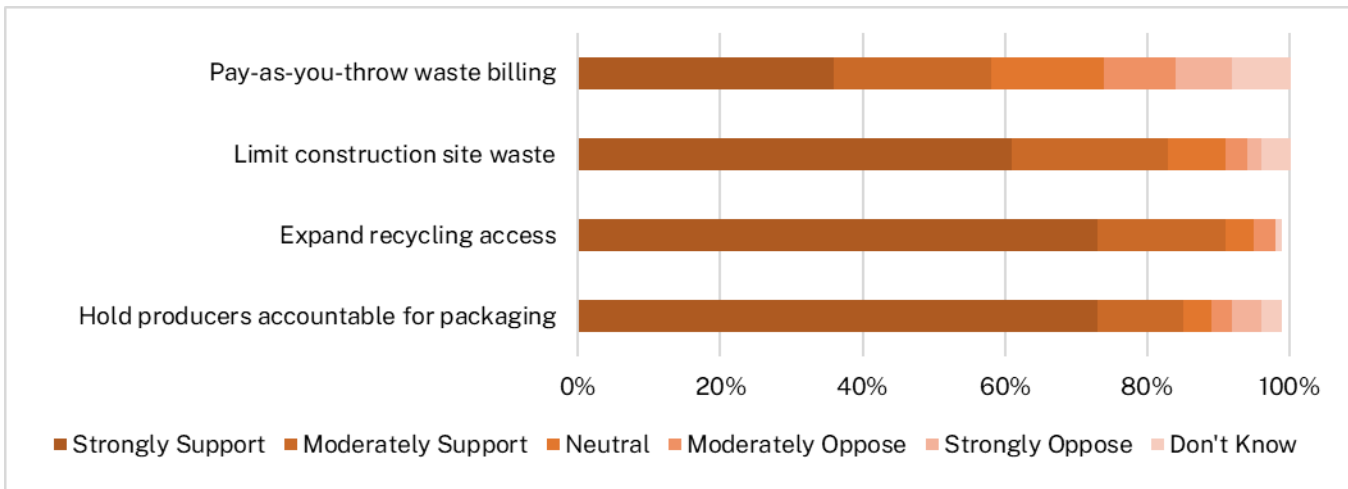
Figure 15. Which of the following actions do you support for decarbonizing the industrial sector?



Waste Sector

The waste sector survey questions focused on potential actions to reduce organic waste, including food waste, and non-organic waste, including packaging. Respondents expressed interest in having easy access to composting similar to curbside recycling and increasing producer responsibility for non-recyclable waste.

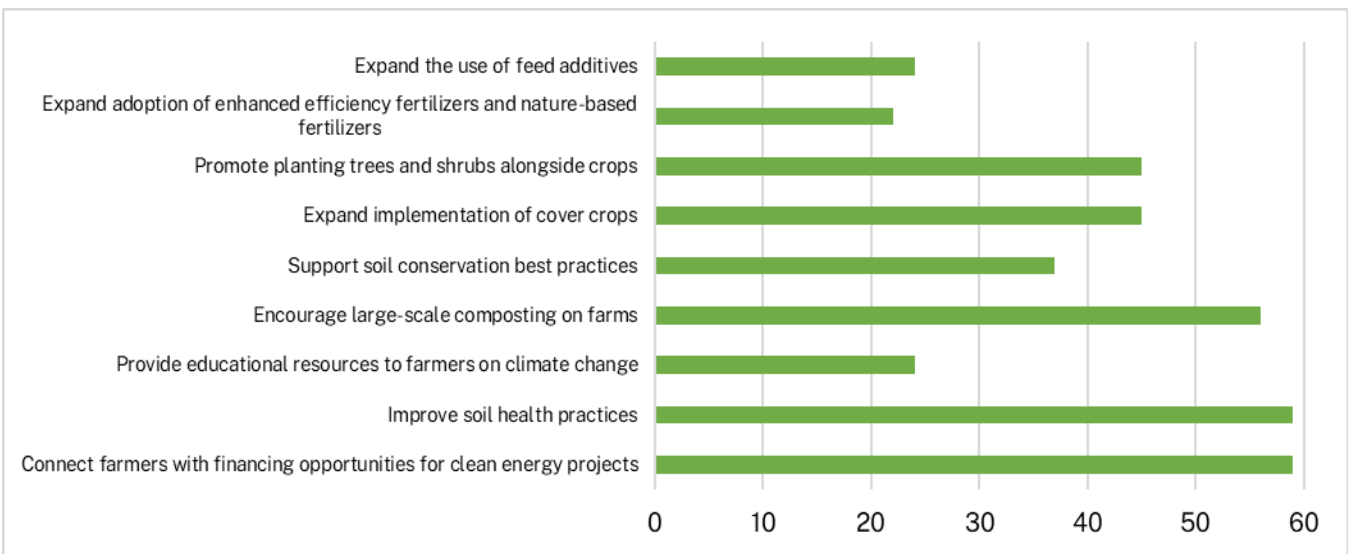
Figure 16. To what extent do you support the following actions to reduce non-food waste in Connecticut?



Agriculture Sector

The agriculture sector survey questions focused on potential actions to reduce emissions from the agriculture sector while supporting Connecticut's farming communities. Respondents identified top priorities for climate friendly agriculture management practices and also expressed interest in supporting regenerative and organic farming.

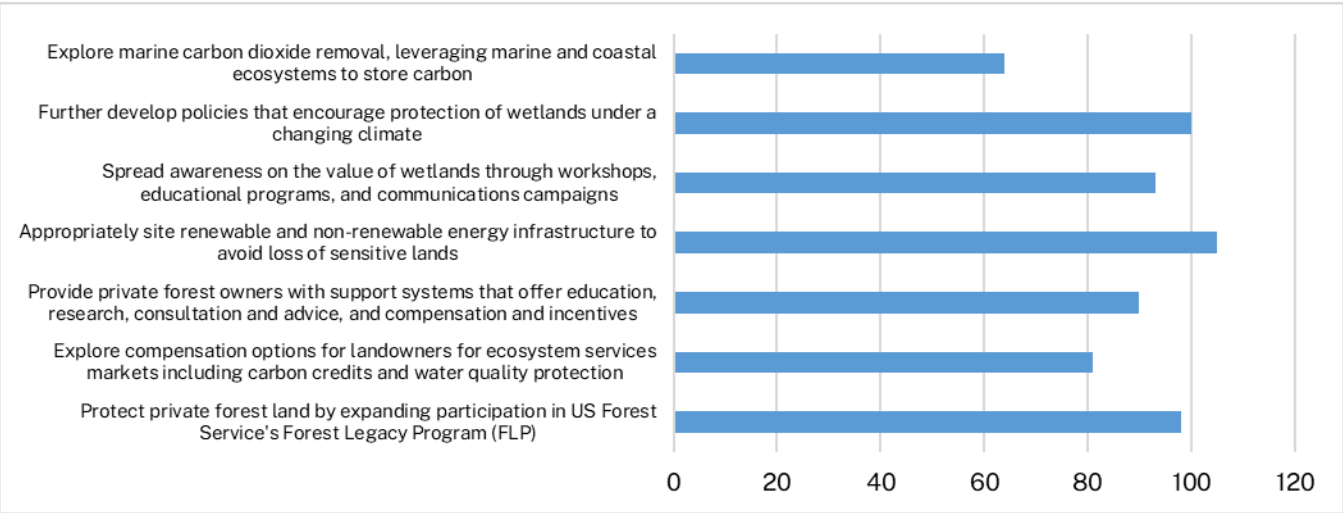
Figure 17. Which of the following actions do you consider to be the top three priorities for increasing climate friendly agriculture management practices?



Natural and Working Lands Sector

The natural and working lands sector survey questions focused on understanding priorities to protect forests, wetlands, and natural areas in the state. Respondents identified which land conservation actions they support and ranked potential urban tree canopy improvement strategies. Respondents also emphasized the importance of restoration efforts in addition to conservation.

Figure 18. Which of the following actions do you support to increase the protection and conservation of natural and working lands?



Industrial Stakeholder Outreach

A summary of the feedback received during the three industrial stakeholder meetings is provided in Table 10.

Table 10. Summary of Industrial Stakeholder Feedback

Stakeholder Feedback	
Motivators	• Corporate mandates from leadership • Alignment with Science Based Targets Initiative or other emission reduction targets • Pressure from customers, shareholders, and other stakeholders • Cost-saving opportunities • Energy efficiency improvements • Service continuity
Barriers	• High implementation costs and lack of sufficient funding or incentives • Lack of knowledge on available financing options and existing programs • Lack of peer networks and forums to exchange best practices • Limited internal staff capacity and technical resources to plan, manage, and implement decarbonization projects • Aging infrastructure that limits retrofit or fuel switching options • Data gaps (e.g., lack of unit-level metering or disaggregated energy data)

Stakeholder Feedback

Needs

- Uncertainty about performance, costs, and safety of emerging technologies (e.g., CCUS, hydrogen fuels)
- Limited tools, data, and internal capacity to develop robust business cases for decarbonization investments, including quantification of costs, savings, risks, and returns
- Economic incentives and financial support
- Technical assistance for planning and implementing complex decarbonization technologies
- Workforce development and training
- Decision-support tools to develop compelling business cases for decarbonization
- Peer-to-peer learning and knowledge-sharing opportunities

Interagency and Intergovernmental Coordination Meetings

Meetings with other state agencies and Connecticut COGs that contributed to the development of the CCAP are summarized in Table 11.

Table 11. Summary of Interagency and Intergovernmental Meetings

Meeting Name/Topic	Meeting Date(s)	Represented Agencies and Stakeholders
State and MSA CCAP Status Update Meetings	February 3, 2025 April 1, 2025 June 3, 2025 July 1, 2025 August 5, 2025 January 6, 2026 March 3, 2026	Capitol Region Council of Governments (CRCOG), Lower Connecticut River Valley Council of Governments (RiverCOG), South Central Regional Council of Governments (SCRCOG), Naugatuck Valley Council of Governments (NVCOG), Western Connecticut Council of Governments (WestCOG), Connecticut Metropolitan Council of Governments (MetroCOG), Northwest Hills Council of Governments (NHCOG), Northeastern Connecticut Council of Governments (NECCOG), Southeastern Connecticut Council of Governments (SECOG)
SIPRAC Meetings	April 10, 2025 June 12, 2025 August 14, 2025 October 9, 2025 March 12, 2026	CT DEEP Bureau of Air Management, Clean Cities Collaborative, US EPA, US DOT, Massachusetts Department of Environmental Protection, Rhode Island Department of Environmental Management, municipal government representatives, Industry representatives (Environment, Health & Safety, Compliance, Program Management), Consultants, Environmental Attorneys, Non-governmental Organizations (Save the Sound, Conservation Law Foundation, American Lung Association, Acadia Center, Environment Connecticut)

Meeting Name/Topic	Meeting Date(s)	Represented Agencies and Stakeholders
CEEJAC Meetings	March 17, 2025 June 26, 2025 September 29, 2025 March 30, 2026 May 6, 2026	CTDEEP Office of Equity and Environmental Justice, CEEJAC Members
Electric Power Measures Review	January 27, 2025	CT DEEP Bureau of Energy & Technology Policy
Waste Measures Review	January 27, 2025	CT DEEP Bureau of Materials Management & Compliance Assurance
Agriculture Measures Review	February 6, 2025	Connecticut Department of Agriculture
Buildings Measures Review	February 27, 2025	CT DEEP Bureau of Energy & Technology Policy
Transportation Modeling Review	February 28, 2025	CT DEEP Bureau of Air Management
Public Engagement Planning	April 29, 2025	CT DEEP Office of Equity & Environmental Justice
Electric Power Sector Discussion	August 5, 2025	CT DEEP Bureau of Energy & Technology Policy
Agriculture and Natural and Working Lands Discussion	August 6, 2025	Connecticut Department of Agriculture
Electric Power Sector Discussion	September 30, 2025	CT DEEP Bureau of Energy & Technology Policy
Transportation Sector Discussion	October 1, 2025	CT DEEP Bureau of Air Management
Waste Sector Discussion	October 2, 2025	CT DEEP Bureau of Materials Management & Compliance Assurance
Agriculture and Natural and Working Lands Discussion	October 6, 2025	CT DEEP Bureau of Natural Resources, CT DEEP Bureau of Materials Management & Compliance Assurance
Electric Power Sector Discussion	October 31, 2025	CT DEEP Bureau of Energy & Technology

Meeting Name/Topic	Meeting Date(s)	Represented Agencies and Stakeholders
Natural and Working Lands Modeling Results Presentation	November 14, 2025	CT DEEP Bureau of Natural Resources, CT DEEP Bureau of Air Management, CT DEEP Office of Environmental Review & Strategic Initiatives
Industry and Low Carbon Fuels Modeling Results Presentation	November 17, 2025	CT DEEP Bureau of Air Management, CT DEEP Bureau of Energy & Technology Policy
Buildings Modeling Results Presentation	November 19, 2025	CT DEEP Bureau of Energy & Technology Policy
Waste Modeling Results Presentation	November 21, 2025	CT DEEP Bureau of Materials Management & Compliance Assurance
Transportation Sector Discussion	December 1, 2025	Connecticut Department of Transportation
Electric Power Sector Discussion	December 2, 2025	CT DEEP Bureau of Energy & Technology Policy
CCAP Development Coordination on Workforce Assessment and Benefits Analysis	January 21, 2026	CRCOG, RiverCOG, NVCOG, WestCOG, MetroCOG
CCAP Development Coordination on Workforce Assessment and Benefits Analysis	January 22, 2026	SCRCOG
Workforce Analysis Discussion	January 16, 2026 January 23, 2026	Connecticut Department of Economic and Community Development, Connecticut Office of Workforce Strategy
Benefits Analysis	February 3, 2026	CT DEEP Office of Capital Projects, CT DEEP Office of Equity & Environmental Justice
Workforce Coordination Meetings	February 24, 2026 March 10, 2026 March 24, 2026 April 7, 2026 April 21, 2026	Connecticut Office of Workforce Strategy, CT DEEP Bureau of Energy & Technology Policy



APPENDIX 2: BAU RESULTS AND METHODOLOGY

This appendix describes the results and methodology used to project forward GHG emissions for the state of Connecticut under a BAU scenario. The BAU projection is used as the baseline from which the GHG emission reduction measures were modeled in this plan. Along with evolving macroeconomic trends and market drivers, the BAU reflects the current state and federal policy landscape, including the phase-out of federal EV and clean energy tax incentives under the One Big Beautiful Bill Act of 2025, proposed increases to federal fuel efficiency standards applicable to cars and trucks,⁵¹ and the proposed repeal of the Clean Air Act 111(b) and (d) regulations.⁵² The BAU was projected forward from a 2023 inventory base year unless otherwise noted. Sector-specific methodologies used to project emissions through 2050 under the BAU scenario are detailed below. A summary of projected emissions under the BAU scenario are presented in Table 12.

Table 12. Connecticut’s Projected BAU Emissions by Sector (MMTCO₂e)

Sector	2030	2040	2050
Transportation	13.71	11.32	10.82
Buildings	11.76	11.05	10.48
Electric Power	1.85	1.63	1.55
<i>Transportation</i>	<i>0.06</i>	<i>0.15</i>	<i>0.20</i>
<i>Buildings</i>	<i>1.60</i>	<i>1.33</i>	<i>1.22</i>
<i>Industrial</i>	<i>0.19</i>	<i>0.15</i>	<i>0.13</i>
Industrial	2.62	2.29	2.31
Natural Gas Leakage	0.24	0.23	0.22
Waste	1.43	1.39	1.36
Agriculture	0.27	0.28	0.28
Gross Emissions	31.88	28.19	27.02
Natural and Working Lands	-4.77	-4.62	-4.47
Net Emissions	27.12	23.57	22.55

⁵¹ United States Department of Transportation. [President Trump & Transportation Secretary Sean P. Duffy Unveil New “Freedom Means Affordable Cars” Initiative to Reset Fuel Economy Standards](#). December 3, 2025.

⁵² “Repeal of Greenhouse Gas Emissions Standards for Fossil Fuel-Fired Electric Generating Units.” Proposed Rule. June 11, 2025. United States Environmental Protection Agency, https://www.epa.gov/system/files/documents/2025-06/12674-01-oar_carbon-pollution-standards-repeal-nrpm_proposal_20250611_clean_v3_0.pdf.

Transportation

The transportation sector includes GHG emissions from on-road light-duty vehicles, on-road heavy-duty vehicles, nonroad vehicles, aviation, marine vessels, and rail. Connecticut's BAU scenario for on-road and nonroad activity was developed using the EPA Motor Vehicle Emissions Simulator (MOVES5) emissions model.⁵³ The basis for projecting marine and rail activity was the US Energy Information Administration's (EIA) 2025 Annual Energy Outlook.⁵⁴ Aviation emissions were projected using the FAA Terminal Area Forecast.⁵⁵ Details by subsector are included below.

- **On-road.** Emissions from light-duty and heavy-duty on-road vehicles were projected using EPA's MOVES5 model. The analysis assumed the implied ZEV sales curves from Rocky Mountain Institute's Energy Policy Simulator Repeal scenario,⁵⁶ representing a scenario where key EPA standards and IRA tax credits are repealed. The resulting emissions were calibrated using a scaling factor that aligns 2022 emissions output from MOVES5 with the state's 2022 inventory emissions. 2022 was used as the starting point (instead of 2023) because detailed state inventory data for the transportation sector was only available through 2022.
- **Nonroad.** Emissions from nonroad vehicles were projected using the MOVES5 nonroad module for Connecticut. Nonroad emissions were calibrated using a scaling factor that aligns 2022 emission output from MOVES5 with the state's 2022 inventory emissions.
- **Rails and Marine.** Emissions from rail and marine were projected using year-over-year growth rates in energy consumption from AEO 2025. Rail emissions were further broken out into freight and passenger rail emissions using data for fuel use per passenger, ton miles, and passenger miles.^{57,58}
- **Aviation.** Emissions from aviation were projected based on FAA's enplanement forecasts for state active airports in the National Plan of Integrated Airport Systems.⁵⁹

Residential and Commercial Buildings

The residential and commercial building sector includes GHG emissions from the combustion of fossil fuels used in residential and commercial buildings. Emissions from residential and commercial buildings were projected forward using AEO 2025 for the New England region.⁶⁰ Specifically, annual growth rates by fuel type and sector for 2024-2050 were calculated using AEO 2025 and then applied to fuel-specific emissions estimates from the state's 2023 inventory. The 2024-2025 growth rate was applied to grow emissions from 2023 to 2024, as actual 2023 emissions were not available in AEO.

To disaggregate emissions from new buildings from the existing building stock, the annual growth in new residential and commercial buildings was first estimated. Growth in new residential buildings was estimated

⁵³ "Latest Version of Motor Vehicle Emission Simulator (MOVES)," United States Environmental Protection Agency, <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>.

⁵⁴ "Annual Energy Outlook 2025," United States Energy Information Administration, <https://www.eia.gov/outlooks/aeo/>.

⁵⁵ Terminal Area Forecast," United States Federal Aviation Administration, <https://taf.faa.gov/>.

⁵⁶ "Energy Policy Simulator," Rocky Mountain Institute, <https://energypolicy.solutions/simulator/connecticut/en>.

⁵⁷ "Connecticut State Rail Plan (2022-2026)," Connecticut Department of Transportation, https://portal.ct.gov/dot/-/media/dot/plans-projects-studies/plans/state_rail_plan/ctsrp2022-2026v20221130.pdf.

⁵⁸ "Freight Analysis Framework," Oak Ridge National Laboratory, https://faf.ornl.gov/faf5/dtt_total.aspx.

⁵⁹ "National Plan of Integrated Airport Systems (NPIAS) – Current," Federal Aviation Administration, https://www.faa.gov/airports/planning_capacity/npias/current.

⁶⁰ "Annual Energy Outlook 2025," United States Energy Information Administration, <https://www.eia.gov/outlooks/aeo/>.

using state population growth projection data⁶¹ along with person-per-household census estimates.⁶² Growth in new commercial buildings was projected based on state commercial square footage estimates from the National Laboratory of the Rockies's (NLR) ComStock dataset⁶³ along with labor growth projection data.⁶⁴ Using building growth projections as an input, energy utilization in new buildings was then calculated using ICF's proprietary Energy Codes tool, which estimates usage based on continued code updates, improving equipment efficiencies, and changes to the state's share of new multi-family home construction over time. As a final step, energy usage in new buildings by year was converted to emissions using emission factors from EPA's GHG Emission Factors Hub.⁶⁵ These emissions were subtracted from total projected emissions to derive projected emissions from the existing building stock.

Electric Power

The electric power sector includes GHG emissions from electricity consumption within the state, including electricity supplied by power plants located outside of the state. ICF used the Integrated Planning Model (IPM) to project emissions from electricity consumption under the BAU scenario. The model evaluates the most cost-effective mix of technologies (e.g., renewables, gas, nuclear) to meet demand subject to environmental and operational limits. Outputs include emissions, generation, and capacity by fuel and generator type, in addition to electricity prices and system costs.

IPM's inputs and constraints include energy and peak demand; fuel prices; technology performance and costs; energy and capacity market revenues; and policies including Renewable Portfolio Standards, tax incentives, carbon markets (e.g., RGGI), and EPA regulations. In the model, consistent assumptions were applied across ISO New England (ISO-NE) to capture existing state and federal policies, including renewable portfolio standards, carbon trading programs or state limits on power sector emissions, and federal tax incentives for new clean electricity generating resources. Standard criteria (ISO-NE reporting, interconnection queue data, project research) were used to identify planned new generating projects and planned retirements in the ISO-NE region.

Key data sources for technology costs and performance include the 2024 NLR Annual Technology Baseline⁶⁶ for clean energy plus adjustments for federal tax incentives, if modeled (e.g., Section 45 tax credits); EIA's AEO⁶⁷ for conventional technologies; and EPA v6.22 IPM⁶⁸ scenario assumptions for some inputs, like carbon capture and storage retrofits costs. Under the BAU, federal EPA Clean Air Act 111(b) and (d) regulations⁶⁹ were not modeled, and federal tax incentives for eligible technology types follow the adjusted (shortened) phase-out schedule as set by the One Big Beautiful Bill Act.⁷⁰

⁶¹ "Connecticut Town Population Projections, 2015-2040," Connecticut State Data Center, https://data.ct.gov/Government/Connecticut-Town-Population-Projections-2015-2040/p6hp-fnp7/about_data.

⁶² "US Census Bureau QuickFacts: Connecticut," United States Census Bureau, <https://www.census.gov/quickfacts/fact/table/CT/EDU685222>.

⁶³ "ComStock Public Datasets," National Laboratory of the Rockies, <https://comstock.NLR.gov/page/datasets>.

⁶⁴ "CT Long Term Employment Projections 2000–2055," S&P Global, provided by Connecticut Department of Labor.

⁶⁵ "Emission Factors for Greenhouse Gas Inventories," United States Environmental Protection Agency, <https://www.epa.gov/system/files/documents/2025-01/ghg-emission-factors-hub-2025.pdf>.

⁶⁶ "2024 Electricity ATB Technologies and Data Overview," United States National Laboratory of the Rockies, <https://atb.NLR.gov/electricity/2024/index>.

⁶⁷ "Assumptions to the Annual Energy Outlook 2023: Oil and Gas Supply Module," United States Energy Information Administration, https://www.eia.gov/outlooks/aeo/assumptions/pdf/OGSM_Assumptions.pdf.

⁶⁸ "Documentation for Post-IRA 2022 Reference Case," United States Environmental Protection Agency, <https://www.epa.gov/power-sector-modeling/documentation-post-ira-2022-reference-case>.

⁶⁹ "Final Carbon Pollution Standards to Reduce Greenhouse Gas Emissions from Power Plants," United States Environmental Protection Agency, <https://www.epa.gov/system/files/documents/2024-04/cps-presentation-final-rule-4-24-2024.pdf>.

⁷⁰ "Beginning of Construction Requirements for Purposes of the Termination of Clean Electricity Production Credits and Clean Electricity Investment Credits for Applicable Wind and Solar Facilities," United States Internal Revenue Service, <https://www.irs.gov/pub/irs-drop/n-25-42.pdf>.

For projected peak and energy demand, the 2025 Capacity, Energy, Loads, and Transmission (CELT) Load Forecast⁷¹ was used as a baseline and extended through 2050 based on a 3-year growth rate. The CELT forecast was adjusted for two components, electric vehicles and heat pumps, to align with the transportation and building sector BAU assumptions.

Electricity emissions for the sector were calculated in alignment with the state's 2023 GHG Inventory methodology, which estimates the emissions associated with the electricity consumed in the state, first counting in-state nuclear generation and RPS-eligible generation in the region (assuming clean electricity in line with the renewable electricity credits (RECs) expected to be retired for the state program). Electricity consumption was based on projections from the other end-use sectors. To calculate consumption-based emissions from electricity consumed in the state, an annual average import-weighted emissions factor was developed using IPM outputs for net imports and regional grid emissions intensity. This weighted emissions factor was applied consistently across all end-use sectors to estimate emissions associated with electricity consumption, including electric vehicles, electrified buildings, and industrial electrification.

Industrial

The industrial sector includes GHG emissions from industrial building energy use and industrial processes, including use of hydrofluorocarbons (HFCs) as substitutes for ozone-depleting substances and semiconductor manufacturing emissions. Industrial sector emissions, excluding emission from HFCs and semiconductor manufacturing, were projected forward using subsector-specific information from DOE's Industrial Decarbonization Roadmap (2022).^{72,73} Facility-level, point-source emissions for covered industrial facilities in Connecticut were first obtained from the EPA's Greenhouse Gas Reporting Program (GHGRP) and were used to estimate emissions and energy use by fuel type.⁷⁴ Facility-level totals were disaggregated by fuel using data from the EIA's Manufacturing Energy Consumption Survey (MECS),⁷⁵ with subsector adjustments applied based on North American Industry Classification System (NAICS) codes. Because GHGRP does not capture small industrial sources, reported emissions were scaled to align with the state's 2023 inventory. The DOE Industrial Decarbonization Roadmap was then used to project forward industry- and fuel-specific consumption and emissions trends, providing a reference case trajectory of industrial sector emissions in the absence of additional decarbonization measures.

HFCs are substitutes for ozone-depleting substances (ODS), commonly used as refrigerants and in industrial processes. HFC emissions were projected forward from the state's 2022 baseline using population growth projections. 2022 was used as the starting point (instead of 2023) because default data for ODS substitutes was only available in the EPA's State Inventory Tool (SIT) through 2022.⁷⁶ These projections were then adjusted downward to account for the phasedown of HFCs under the AIM Act. Annual reductions were calculated based on projected national emissions of HFCs under a baseline scenario from the EPA's technical

⁷¹ "Load Forecast," ISO New England, <https://www.iso-ne.com/system-planning/system-forecasting/load-forecast>.

⁷² "Industrial Decarbonization Roadmap," United States Department of Energy, Industrial Efficiency & Decarbonization Office, <https://www.energy.gov/sites/default/files/2022-09/Industrial%20Decarbonization%20Roadmap.pdf>.

⁷³ "Industrial Decarbonization Roadmap and Context," United States Department of Energy, <https://www.energy.gov/sites/default/files/2024-12/itiac-march-2024-cresko-industrial-decarb-roadmap.pdf>.

⁷⁴ "Greenhouse Gas Reporting Program (GHGRP) – Facility-Level Data Portal," United States Environmental Protection Agency, <https://ghgdata.epa.gov/ghgp/>.

⁷⁵ "Manufacturing Energy Consumption Survey (MECS), 2018 – Data Tables. Table 1.1: Consumption of Energy for All Purposes (First Use), by Manufacturing Industry and Region," US Energy Information Administration, <https://www.eia.gov/consumption/manufacturing/data/2018/>.

⁷⁶ "State Inventory and Projection Tool (Version 2025.1)," United States Environmental Protection Agency, <https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool>.

report, *Global Non-CO₂ Greenhouse Gas Emission Projections & Mitigation Potential: 2020-2080*.⁷⁷ These reductions were applied to the population-based projected emissions for Connecticut to calculate projected state emissions under the BAU.

Semiconductor manufacturing emissions were held constant relative to the 2022 inventory since there are no known plans to build new manufacturing facilities within the state. 2022 was used as the starting point (instead of 2023) because default data for semiconductor manufacturing was only available in the EPA's SIT through 2022.

Natural Gas Leakage

The natural gas leakage sector includes GHG emissions from leakages in the state's natural gas transmission and distribution systems. No emissions from production processes or storage are assumed to occur within Connecticut. The BAU was based on a linear extrapolation of historical trends from the state's inventory. Transmission pipeline data were only available from 1990-2019 and the state's inventory assumes that transmission pipeline mileage, and therefore leakage emissions, were constant from 2019 through 2023. Therefore, transmission pipeline emissions were projected forward from 2023 using the annual linear trendline change in emissions from 1990-2019. For natural gas distribution system leakage, emissions were projected forward using the 2018-2023 trend from the state's inventory.

Waste

The waste sector includes GHG emissions from landfills, solid waste combustion, and wastewater treatment. Emissions were projected for waste treated in-state (Scope 1) as well as for waste treated out-of-state (Scope 3).⁷⁸

- **Landfills.** Connecticut no longer has any active in-state municipal solid waste landfills, therefore the BAU assumes that no waste will be landfilled within the state in the future. However, waste that was previously landfilled in the state will continue to generate emissions. Emissions from in-state landfills were projected forward using EPA's SIT Projection Tool (PT),⁷⁹ which relies on the first order decay method to quantify emissions, building off the in-state historical landfill data used to prepare the state's 2023 inventory.
- **Combustion.** Emissions from the combustion of waste in-state were derived by first projecting forward the quantity of waste combusted within the state. Historical data on the quantity of waste combusted in-state was provided by DEEP. The amount of waste combusted in 2023 was assumed to remain constant into the future based on the assumption that existing combustion facilities within the state are operating at capacity. Emissions per ton of waste, which is based on EPA's SIT, was also assumed to remain constant into the future.
- **Out-of-state waste treatment.** For waste that is landfilled and combusted out-of-state, future quantities were derived by first projecting forward the total quantity of waste generated in-state in 2023 using population projections from EPA's SIT. The amount of waste sent out-of-state was then calculated by subtracting out the amount of waste landfilled and combusted in-state. This out-of-state waste was disaggregated into landfilled waste (90%) and combusted (10%) based on DEEP estimates informed by historical data. Emissions from waste landfilled out-of-state was estimated

⁷⁷ "Global Non-CO₂ Greenhouse Gas Emission Projections & Mitigation Potential: 2020-2080," United States Environmental Protection Agency, <https://www.epa.gov/global-mitigation-non-co2-greenhouse-gases/global-non-co2-greenhouse-gas-emission-projections-0>.

⁷⁸ Emissions from waste that is exported and disposed of outside the state are not included in the state's inventory or the BAU totals.

⁷⁹ "State Inventory and Projection Tool (Version 2025.1)," United States Environmental Protection Agency, <https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool>.

using EPA's SIT PT using the state of Ohio as a proxy for all out-of-state waste. Ohio was selected as a proxy because it receives the highest percentage of Connecticut's exported waste.⁸⁰ Emissions from waste combusted out-of-state were estimated using the derived quantities of waste combusted and the emissions factor derived from SIT.

- **Wastewater.** EPA's SIT PT was used to project forward emissions from wastewater treatment. EPA's SIT PT uses a linear trend of national historical data, apportioned based on the state's population, to estimate future emissions.

Agriculture

The agriculture sector includes GHG emissions from enteric fermentation, manure management, agricultural soils, liming, urea, and field burning of agricultural residues.

- **Enteric fermentation.** Emissions from enteric fermentation were estimated based on projected livestock population. Livestock population data was obtained for 2023 from EPA's SIT and projected based on the US Department of Agriculture (USDA) Baseline Projections rates of change.^{81,82} Emissions were then calculated using the most recent US per-head emissions factors from EPA's US Greenhouse Gas Inventory.⁸³ The per-head emission factors are assumed to remain constant into the future as the per-head emissions factor has stabilized in recent years.
- **Manure management.** Emissions from manure management were similarly derived using projected livestock population and per-head emissions factors from the 2022 US GHG Inventory.
- **Agricultural soils.** N₂O emissions from agricultural soils were estimated using projecting livestock populations as well as future crop production for key residue crops based on the USDA National Agricultural Statistics Service (NASS) data,⁸⁴ and future fertilizer application. Production-related activity data projections were based on rates of change developed from historical trends or the USDA Baseline Projections rates of change.⁸⁵ Fertilizer rates of change were based on historical trends from SIT fertilizer data. For estimating N₂O from grazing animals and manure-based fertilizer sources, the percentage of manure in each manure management system was held constant based on 2022 EPA SIT values. These values were used to project emissions from daily spread, manure deposited onto pasture, and per-head nitrogen excretion factors.
- **Liming, dolomite, and urea application.** Projections for liming, dolomite, and urea application were based on historical trends using activity data obtained from EPA SIT, as well as US GHG Inventory emission factors as detailed above. Emissions projections for field burning of agricultural residues were based on the crop production data from USDA NASS as derived for agricultural soils estimates

⁸⁰ "2023 Solid Waste Disposal & Diversion Report," State of Connecticut Department of Energy and Environmental Protection, https://portal.ct.gov/-/media/deep/reduce_reuse_recycle/data/2023/diversion_report_2025-final.pdf?rev=78610edcd6684ae59b1f206cd05cbee&hash=F926D538AA54875F9F1BB76259695F1D.

⁸¹ "Industrial Decarbonization Roadmap and Context," United States Department of Energy, <https://www.energy.gov/sites/default/files/2024-12/itiac-march-2024-cresko-industrial-decarb-roadmap.pdf>.

⁸² "2025 Baseline Projections," United States Department of Agriculture, <https://www.usda.gov/about-usda/general-information/staff-offices/office-chief-economist/world-agricultural-outlook-board/baseline-projections>.

⁸³ "Inventory of US Greenhouse Gas Emissions and Sinks, 1990-2022," United States Environmental Protection Agency, <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>.

⁸⁴ "National Agricultural Statistics Service," United States Department of Agriculture, <https://quickstats.nass.usda.gov/>.

⁸⁵ "2025 Baseline Projections, United States Department of Agriculture," <https://www.usda.gov/about-usda/general-information/staff-offices/office-chief-economist/world-agricultural-outlook-board/baseline-projections>.

and relevant parameters from Chapter 11 of the 2019 Refinement to the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories.⁸⁶

Natural and Working Lands

Natural and working lands include forests and woodlands, grasslands and shrublands, croplands and rangelands, wetlands, and urban green spaces. The natural and working lands sector takes into account the ability of plants and soils to store and sequester, as well as account for the effects of land cover change, such as deforestation, afforestation, and urbanization. For each natural and working lands subsector, land cover data from the National Land Cover Database⁸⁷ (NLCD) was analyzed from 1990 to 2024, which provides consistent land cover classes and full coverage for Connecticut. Land cover was projected from 2025 to 2050 using the average year-over-year percent change for each land cover class from the last 15 years (2009–2024), while maintaining Connecticut’s total land area. Ratios of inventory subsector to land cover type were used to establish relationships between emissions/sequestration and the landscape.

Connecticut state law sets a goal of protecting nearly 700,000 acres of the state’s land base as open space.⁸⁸ The state has already achieved over 77% of this goal, with an additional 154,072 acres remaining to be converted to open space.⁸⁹ Open space was assumed to include the following land cover types: Deciduous Forest, Evergreen Forest, Mixed Forest, Shrub/Scrub, Grassland/Herbaceous, Woody Wetlands, and Emergent Herbaceous Wetlands. The remaining acreage (approximately 6,000 acres per year) was assumed to be reallocated from developed land to these open space classes based on their current share of total land cover. These assumptions were used to adjust the NLCD land cover projections, and the average historical inventory subsector to land cover type ratios were applied to the new projections.

Changes in emissions from projected changes in forest land and urban tree cover were based on adjusted NLCD land cover data that includes the state’s open land statute and historical inventory for the past 15 years. As Connecticut does not landfill yard trimmings or food waste, emissions from this subsector were held at zero. Due to high uncertainty in underlying data, agricultural soil sequestration was held flat at 2023 levels. N₂O emissions from settlement soils were also held flat, as these soils have shown consistent values since 2014.

⁸⁶ “Chapter 11: N₂O Emissions from Managed Soils, and CO₂ emissions from Line and Urea Application,” 2019 Refinement to the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch11_Soils_N2O_CO2.pdf.

⁸⁷ “Annual NLCD,” Multi-Resolution Land Characteristics (MRLC) Consortium, <https://www.mrlc.gov/>.

⁸⁸ “Sec. 23-8. Open spaces for recreation,” Connecticut General Assembly, https://www.cga.ct.gov/current/pub/chap_447.htm#sec_23-8.

⁸⁹ “Governor Lamont Announces State Grants To Protect 2,270 Acres of Open Space and Create Six New Community Green Spaces,” State of Connecticut, https://portal.ct.gov/governor/news/press-releases/2025/07-2025/governor-lamont-announces-state-grants-to-protect-open-space?language=en_US.



APPENDIX 3: MEASURE MODELING METHODOLOGY

Connecticut's CCAP identifies 17 GHG emissions reduction measures that could reduce GHG emissions from the transportation, residential and commercial buildings, power, industrial, waste, agriculture, and natural and working lands sectors. This appendix documents the analysis conducted to estimate the GHG emissions reduction potential of each measure, as compared to the BAU scenario. These measures do not represent every potential strategy Connecticut could use to reduce GHG emissions. Rather, these measures offer a potential pathway for comprehensively addressing GHG emissions in Connecticut and achieving the state's GHG emissions reduction planning targets.

Modeling Approach by Measure

Measure 1: Reduce Vehicle Miles Traveled (VMT)

This measure is defined by a reduction in vehicle miles traveled (VMT) of on-road light-duty vehicles within the state. Modeled activities include expanding and improving public transit, increasing transit-oriented development, and expanding micromobility.

Modeling Approach

The Trip Reduction Impacts of Mobility Management Strategies (TRIMMS) 4.0 tool was used to calculate VMT reductions resulting from changes in trip costs and travel times. TRIMMS model 4.0 is a Visual Basic application spreadsheet model designed to estimate the impacts of a broad range of transportation demand initiatives.⁹⁰ TRIMMS calculates an overall reduction due to bundled policies based on elasticities built into the tool. Reduced transit costs relative to auto-travel, priced workplace parking in applicable regions, and reductions in transit and active transportation travel times all shift mode share away from personal vehicle use toward public transit and active modes. TRIMMS incorporates regional specific inputs, baseline trip costs and times, and existing VMT shares to estimate the percentage change in VMT resulting from these policy interventions.

Based on TRIMMS outputs, a VMT reduction schedule was developed assuming a 5.29% VMT reduction by 2050. For 2030, a 3.53% VMT reduction was applied, which is consistent with the target proposed by Connecticut Department of Transportation to reduce VMT per person by 5% by 2030 compared to 2019. Reductions were assumed to begin in 2026 and were linearly interpolated in interim years to meet the 2030 and 2050 planning targets. These VMT reduction percentages were then applied to the projected light-duty VMT, after ZEV adoption was modeled as part of Measure 2, to estimate the expected decrease in energy consumption and emissions.⁹¹

⁹⁰ [Mobility Lab TRIMMS 4.0](#)

⁹¹ This sequencing is important to avoid double-counting reductions; VMT reductions from EVs do not lead to emission reductions but do have other quality of life and place co-benefits.

Table 13. Measure 1 Modeling Data Sources

Activity or Data Point	Source
Regional inputs	2020 Census and 2020 American Community Survey
Current trip cost and time	Replica 2025
VMT share	Replica 2025
2030 VMT Goal	Connecticut DOT's 2030 VMT Goal and Strategies

Key Assumptions

To evaluate potential VMT reduction strategies in Connecticut, the following set of TRIMMS policies related to public transit improvement, transit-oriented development, and expanded micromobility options were modeled:

- Priced workplace parking in urban areas, where reasonable
- 40% decrease in transit, pedestrian, and bike trip time in urban areas
- 30% decrease in transit, pedestrian, and bike trip time in non-urban areas
- \$0.03 mileage-based user fee (increased trip cost for auto-drive alone, auto-rideshare, and vanpool)

Table 14 describes the connection between potential actions to reduce VMT that Connecticut can take and the TRIMMS policies integrated in the model.

Table 14. Interpretation of Connection Between Potential Actions and TRIMMS Policies

Action / Strategy	Primary Supporting Policy from TRIMMS	Interpretation of Connection
Expanding and improving public transit	\$0.03 mileage-based user fee	This policy makes driving more expensive and impacts the economic decision to choose transit over a personal vehicle, which is the primary goal of improving transit.
	30% decrease in transit, pedestrian, and bike trip time in non-urban areas	This policy directly addresses the convenience and speed of transit, which is a major barrier to adoption in non-urban areas where travel distances are longer.
Increasing transit-oriented development	Priced urban workplace parking	Transit-oriented development creates density and accessibility. Parking pricing is a powerful tool to manage the demand for driving within these dense, urban areas, thereby reinforcing the goals of the development.
	40% decrease in transit, pedestrian, and bike trip time in urban areas	This policy enhances the quality and speed of the non-auto modes (transit, walking, biking) that transit-oriented development is designed to maximize, making living and working in these areas more appealing.

Action / Strategy	Primary Supporting Policy from TRIMMS	Interpretation of Connection
Expanding micromobility	40% decrease in transit, pedestrian, and bike trip time in urban areas	This policy is a direct improvement to the infrastructure and experience for the modes (bike/pedestrian) that define micromobility, making them faster, safer, and more competitive with driving for short trips.
	30% decrease in transit, pedestrian, and bike trip time in non-urban areas	While the VMT impact may be smaller than in urban areas, this policy improves the non-auto network in less dense areas, encouraging the use of micromobility for first-mile/last-mile connections to regional transit.

Limitations

TRIMMS uses regional-average trip characteristics to estimate mode and VMT change and thus does not capture regional variation. TRIMMS also relies on the resulting change from policy decisions, rather than the policy itself. For example, TRIMMS leverages changes in trip or access time instead of using miles of expanded transit routes or number of new stops. Therefore, all TRIMMS inputs are representative assumptions.

Measure 2: Expand Vehicle Electrification, EV Infrastructure, and Zero- and Low-Carbon Fuels in the On-Road Transportation Sector

This measure is defined by an increase in the use of electric vehicles and zero- and low-carbon fuels in on-road vehicles. Modeled activities include accelerated adoption of light-, medium-, and heavy-duty electric vehicles, investments in EV supply equipment (EVSE), and increased use of zero- and low-carbon fuels such as hydrogen and RD.

Modeling Approach

Light-Duty Vehicle Electrification

The analysis used ICF's proprietary Python-based CO₂Sight Turnover Projections for On-Road Transportation (TPORT) tool that models the adoption of ZEVs. This tool integrates the existing EPA Motor Vehicle Emission Simulator (MOVES) 5 database to establish a baseline of existing vehicle population and emission rates. By applying a user-defined sales curve, TPORT models the transition toward ZEVs by calculating the annual replacement of internal combustion engine vehicles (ICEVs) with newer battery electric (BEV) and plug-in hybrid (PHEV) alternatives. For this analysis, the curve was calibrated to align with the target of achieving 80% ZEV penetration in the light-duty fleet by 2050, with an interim milestone of 20% ZEVs on the road by 2030. For each model year, fractions of VMT were allocated across different powertrain types based on their projected sales curves.

The resulting energy consumption for new ZEVs was estimated by multiplying the shifted VMT by ZEV-specific energy efficiency values sourced from MOVES5, US DOE's fuel economy, and other relevant datasets. Similarly, the energy consumption of displaced ICEV was estimated using ICEV-specific energy efficiency factors. The VMT, energy, and associated emissions results from the TPORT model were then calibrated using 2023 Connecticut VMT reported by Federal Highway Administration and the state's 2022 GHG Inventory emissions baseline.

Annual charging infrastructure needs (i.e., number of chargers) necessary to support the modeled vehicle electrification projection were also estimated using Alternative Fuels Data Center’s EVI-Pro Lite. These estimates were compared against Connecticut’s existing infrastructure deployment goals to identify potential gaps.

MHDV Electrification

Similar to the light-duty vehicle (LDV) electrification approach, ICF’s proprietary CO₂Sight TPORT model was used to model MHDV electrification to project ZEV sales trajectories in alignment with the Multi-State Medium-and Heavy-Duty Zero-Emission Vehicle Memorandum of Understanding (MHDV MOU), which targets 100% ZEV sales by 2050 and an interim goal of 30% by 2030. In addition, the analysis aligns with Connecticut’s statewide goal of transitioning the public bus fleet to 100% BEBs by 2035.

Low-Carbon Fuel Vehicles

GHG emission reductions resulting from the gradual integration of RD into the fuel supply for on-road vehicles was modeled by assuming that using RD will result in a 65% reduction in carbon intensity compared to conventional diesel, based on California’s Low-Carbon Fuel Standard (LCFS) average. The modeled RD phase-in was assumed to begin in 2031, ramping up to fully replace conventional diesel by 2050.

Table 15. Measure 2 Modeling Data Sources

Activity or Data Point	Source
Baseline VMT, electricity consumption, fuel consumption, and emissions	EPA Motor Vehicle Emission Simulator version 5 (MOVES5)
Projected VMT, electricity consumption, fuel consumption, and emissions after ZEV sales	ICF’s TPORT model
Daily charging infrastructure needs	Alternative Fuels Data Center’s EVI-Pro Lite
2022 VMT for model calibration	Federal Highway Administration’s Highway Statistics
RD carbon intensity reduction	Alternative Fuels Data Center

Key Assumptions

LDV Electrification

- The following Connecticut-specific goals were reflected in the modeled pathway:
 - 80% of on-road LDVs are ZEVs by 2050, resulting in a total of 2.5 million ZEVs, with an interim target of 20% ZEVs on the road by 2030.
 - 7,356 EVSE ports deployed for workplace & light-duty fleets.
- PHEVs represent 19% of all ZEV sales.
- ZEV activity/use/life is identical to an ICEV.

MHDV Electrification

- The following Connecticut-specific goals were reflected in the modeled pathway:
 - 100% of MHDV sales are ZEV by 2050, with an interim target of 30% ZEV sales by 2030 (MHDV MOU).
 - State bus fleet transitions to 100% BEB by 2035.

- FCEVs represent 10% of all ZEV sales.
- Hydrogen consumption is contingent on hydrogen availability.

Low-Carbon Fuel Vehicles

- RD begins phasing into the fuel supply in 2031.
- 100% of diesel fuel is replaced with RD by 2050.
- 65% lower carbon intensity for RD compared to conventional diesel (per LCFS average).

Limitations

ZEV adoption is related to EV charger adoption and accessibility. If EV purchases are incentivized but EV charging infrastructure is not enhanced, actual EV adoption may be lower than projected. The opposite is also true – if EV charging infrastructure is made more widespread but EV purchases are not incentivized, actual EV adoption may be lower than projected. Actual ZEV adoption may also be lower than projected if the demand for ZEVs outpaces the supply of ZEVs on the market, particularly for MHDVs, which are an emerging technology. As supply chains develop for these vehicles and become more robust, this limitation is expected to decrease over time.

Measure 3: Decarbonize the Nonroad Transportation Sector, Including Ports, Airports, and Rail

This measure is defined by an increase in the use of electric vehicles and zero- and low-carbon fuels in nonroad vehicles, including nonroad equipment, marine vessels, aviation, and locomotives. Modeled activities include the adoption of sustainable aviation fuel (SAF), decarbonization of off-road equipment, electrification of ferries, and efficiency improvements and electrification in rail infrastructure.

Modeling Approach

Nonroad

Emission reductions from the gradual integration of RD into the diesel fuel supply for off-road vehicles and equipment were modeled by assuming a transition that begins in 2031, with RD incrementally replacing 100% of the diesel supply by 2050. Based on California's LCFS average, a 65% carbon intensity reduction factor was applied to the share of diesel converted to RD.

Marine

Emission reductions from electrifying both state- and privately-operated ferry routes were estimated by assuming full electrification of two seasonal ferries crossing the Connecticut River and three interstate ferry routes. Electrification was assumed to begin in 2030, with full conversion achieved by 2040. Baseline diesel emissions were derived from existing operating schedules and average diesel consumption rates for diesel-powered vessels. Diesel consumption during transition was estimated based on remaining diesel-powered vessels throughout the electrification period. Electricity consumption was projected by converting diesel energy throughput into equivalent megawatt-hours and applying an efficiency factor to account for the higher performance of electric drivetrains over internal combustion engines. Net emissions were then derived by applying appropriate emission factors based on fuel type and energy use.

Aviation

GHG reductions resulting from the phased introduction of SAF into the jet fuel supply were modeled based on the assumption that SAF will begin penetrating the supply in 2032, reaching nearly 100% SAF by 2050.⁹²

⁹² SAF is a chemical equivalent to conventional jet fuel, but the carbon emissions are considered biogenic because they were recently sequestered by its feedstock, typically a crop, waste oil, or other biomass.

Connecticut’s SAF volumes were estimated by applying the state’s proportional share of national Jet.A fuel consumption to projected SAF availability. A Connecticut-specific SAF production tax credit of 1.62 dollar per gallon was applied to encourage adoption levels sufficient to minimize aviation-related emissions. Because the SAF market is still emerging, RD was used as a proxy for applying time-series analysis of historical profitability and production lags due to similar feedstocks, technologies, and incentive structures. Forecasts of SAF profitability draw on projected feedstock costs, operating expenses, crude oil prices, and federal credit values, enabling estimation of future SAF production and associated emissions reductions.

Rail

GHG reductions from electrifying passenger rail operations were modeled by assuming a transition begins in 2031, with full corridor electrification achieved by 2045. Diesel consumption under the BAU scenario was linearly converted to electricity over this time period using a conversion factor derived from the US Department of Transportation (USDOT) diesel and electric fuel efficiencies, 1,788 btu per passenger miles and 960 btu per passenger miles, respectively. Electric trains are generally more efficient due to higher efficiency and regenerative braking.

For freight rail, RD adoption was modeled to begin in 2031 and increase gradually until it fully displaces conventional diesel by 2050.

Table 16. Measure 3 Modeling Data Sources

Activity or Data Point	Source
RD carbon intensity reduction	Alternative Fuels Data Center
Diesel and electric ferries specifications	Case of Comparing Electric and Diesel-Powered Ferries
RD historical growth	California Air Resources Board
Price of wholesale diesel	US Energy Information Agency (EIA)
Price of biomass-based diesel	Oil Price Information Service (OPIS)
Price of LCFS credit	California Air Resources Board
Price of soybean oil	Fastmarkets
Diesel and electric rail efficiency	Railroad Energy Intensity and CAP Emissions

Key Assumptions

- RD begins phasing into the nonroad fuel supply in 2031, replacing 100% of diesel fuel by 2050.
- 65% lower carbon intensity for RD compared to conventional diesel.
- Electrification of ferry routes begins in 2030 with full transition by 2040.
- Charging infrastructure will be available to electrify ferries by 2040.
- The ferry schedule remains unchanged through 2050.
- SAF blending incentive begins in 2032 and is designed to achieve nearly 100% SAF in the jet fuel supply by 2050.
- Electrification of passenger rail lines begins in 2031 and with full transition of all corridors by 2045.
- Adoption of low-carbon fuels for freight rail begins in 2031, with 100% of diesel fuel replaced with RD by 2050.

Limitations

Nonroad

The assumption of 65% reduction in carbon intensity is based on California's LCFS average. The actual carbon intensity reduction could be different for Connecticut depending on the feedstocks used to produce renewable diesel.

Marine

Lack of data on existing ferry operations only allowed for a high-level assessment of emissions reduction. The analysis assumes that ferries use the same amount of fuel for the same distance traveled, and the fuel efficiency stays the same over time. In addition, external factors could impact the implementation outcome of this measure, such as available charging infrastructure, local electric grid capacity, funding to purchase ferries, and available ferry operators and maintenance staff who are trained in operating an electric ferry.

Aviation

There are currently key differences between RD and SAF. Under incentives like the California LCFS, diesel is an obligated fuel. This creates a two-fold financial benefit for refiners who blend RD by 1) avoiding a compliance deficit by producing less diesel and 2) generating a tradable credit by blending RD. In contrast, jet fuel is not an obligated fuel. Blending SAF only generates credit and does not avoid any deficits. This distinction essentially doubles the incentive value of RD compared to SAF, making the rapid expansion of RD far more lucrative for regulated parties. The current modeling accounts for this by awarding RD the full value of both avoided deficits and credits, which inflates its calculated profitability. Consequently, when the model projects SAF production outlooks, it essentially demands that SAF incentives rise to the same dual-value levels seen in the RD market to justify production.

Another key difference between RD and SAF is in their current blend limits. Over the course of RD's rapid expansion, the fuel was certified to be blended to 100% levels, meaning there was no regulatory limit for diesel purchased at the pump from being entirely renewable. The safety considerations inherent in the aviation sector make the process for such certification much more complex. Today almost all SAF pathways are certified for 50% blends. Given the low percentage of SAF in the market today, this is not a barrier to expansion in the industry, but at the levels contemplated in this study, certification will have to be granted for 100% blends by the mid-2030s.

Implicit in the analysis was an assumption that initial volumes of SAF production will be produced using hydroprocessed esters and fatty acids (HEFA) pathways. Currently HEFA is the only pathway that produces SAF at commercial scale, although there have been significant developments for other pathways. The analysis assumed that Fischer Tropsch (FT) pathways do not reach commercial viability during the forecast period and that alcohol to jet pathways develop in a similar pattern to HEFA. Faster than anticipated technological development of FT pathways could result in outcomes different from the current analysis.

Rail

The diesel and electric energy efficiency values used in the analysis are based on trains already in existence. Future electric trains may be designed differently than trains that are in operation today. Also, the assumption of 65% reduction in carbon intensity is based on California's LCFS average. The actual carbon intensity reduction could be different for Connecticut depending on the feedstocks used to produce RD.

Measure 4: Increase Energy Efficiency in Existing Residential and Commercial Buildings

This measure is defined by a decrease in energy consumption through improved efficiency in existing residential and commercial buildings. Modeled activities include the expansion of weatherization programs based on state goals and efficient equipment adoption.

Modeling Approach

Energy consumption and GHG emission reductions from efficiency upgrades in existing buildings were modeled using ICF's proprietary Distributed Energy Resources (DER) Planner tool. DER Planner simulates changes in energy consumption and associated emissions by modeling retrofit measures including building envelope improvements (e.g., insulation, air sealing, windows), the conversion of space and water-heating equipment to high-efficiency alternatives, building controls, efficient appliances, and lighting.

For this measure, technology adoption trajectories were based on the National Laboratory of the Rockies's (NLR) Electrification Futures Study (EFS) high-adoption scenario, with adjustments to reflect targets from Connecticut's 2022–2024 Conservation & Load Management Plan. Energy savings from efficiency measures were estimated based on Connecticut-specific building stock data from NLR's ResStock and ComStock datasets. These datasets use statistical sampling and high-performance computing to simulate detailed building characteristics at the county-level. For each building type, savings from energy efficiency measures were evaluated using ICF's CO₂Sight measures database and ResStock/ComStock upgrade packages.

Table 17. Measure 4 Modeling Data Sources

Activity or Data Point	Source
Residential building stock and energy savings	NLR ResStock v2024.2
Commercial building stock and energy savings	NLR ComStock v2024.1
Equipment performance, lifetimes, and costs	EIA 2023 Technology Forecast Updates
Equipment performance, lifetimes, and costs	NLR National Residential Efficiency Measures Database
Equipment turnover calculations and results	ICF's DER Planner tool

Key Assumptions

- Technology adoption curves were based on the EFS high-adoption scenario, adjusted to reflect the following targets from Connecticut's 2022–2024 Conservation & Load Management Plan:
 - By 2030, 80% of residential units are weatherized.
 - Replacement of inefficient electric resistance space- and water-heating systems with high-efficiency renewable thermal technologies were modeled at a scale sufficient to achieve a 1–2 million MWh reduction in electricity consumption.
- Systems were assumed to be either replaced in kind, upgraded to more efficient models, or converted to electric alternatives as they reach the end of their useful life.
- Measures included the conversion of space and water-heating equipment to high-efficiency alternatives, building envelope improvements, heating, ventilation, and air conditioning (HVAC) controls, efficient appliances and lighting.

Limitations

This analysis incorporated several assumptions and data constraints that introduce uncertainty into the modeled results. While these simplifications were necessary to maintain analytical consistency across datasets, they may not fully capture real-world variation in building stock characteristics, technology adoption behavior, and market dynamics.

The modeling assumed consistent adoption rates within each residential building type. In practice, adoption is likely to vary between single-family and multi-family residences due to differences in decision-making, financing, and retrofit feasibility. For example, multi-family retrofits often involve centralized HVAC systems that require coordination among property owners and tenants and typically entail higher upfront costs. This limitation is especially relevant in Connecticut's large cities like Bridgeport, New Haven, and Stamford, where multi-family housing comprises a larger share of the residential stock.

Both ResStock and ComStock are based primarily on 2018 building stock and energy use data. Although they remain the most comprehensive national datasets available, the lag in baseline year introduces uncertainty when representing the current building stock composition, efficiency levels, and technology mix. Additionally, technology adoption curves draw heavily from NLR's 2017 EFS, which may not fully capture more recent market dynamics and policy developments.

Additionally, baseline energy use from ComStock was found to be lower than commercial fuel consumption reported in Connecticut's GHG Inventory, which is common, as ComStock does not reflect all available building types. To reconcile this difference, building samples from ComStock were weighted to align with baseline fuel consumption. This adjustment assumes that a subset of commercial buildings in Connecticut is underrepresented in ComStock. However, if the gap reflects fuel use from sources outside ComStock's scope, the weighting may misattribute energy use and overstate emissions reduction potential.

Measure 5: Increase Electrification in Existing Residential and Commercial Buildings

This measure is defined by the accelerated conversion of energy-consuming equipment from non-electric sources of energy to electricity in existing residential and commercial buildings. Modeled activities include electrified equipment adoption, including the expansion of heat pumps.

Modeling Approach

Energy consumption and GHG emission reductions from increasing electrification in existing buildings were modeled using ICF's proprietary DER Planner tool. DER Planner models changes in energy use and emissions by simulating retrofit measures focused on the conversion of fossil fuel end uses to electric alternatives, including space heating systems, water-heating systems, cooking equipment, and appliances.

Technology adoption trajectories were based on NLR's EFS high-adoption scenario, with adjustments to reflect Connecticut-specific policies and program goals. Energy savings from electrification measures were estimated based on Connecticut-specific building stock data from NLR's ResStock and ComStock datasets. These datasets use statistical sampling and high-performance computing to simulate detailed building characteristics at the county-level. For each building type, savings from electrification measures were evaluated using ICF's CO₂Sight measures database and ResStock/ComStock upgrade packages.

Table 18. Measure 5 Modeling Data Sources

Activity or Data Point	Source
Residential building stock and energy savings	NLR ResStock v2024.2
Commercial building stock and energy savings	NLR ComStock v2024.1
Equipment performance, lifetimes, and costs	EIA 2023 Technology Forecast Updates
Equipment performance, lifetimes, and costs	NLR National Residential Efficiency Measures Database
Equipment turnover calculations and results	ICF's DER Planner tool

Key Assumptions

- Technology adoption curves were based on NLR's EFS high-adoption scenario, with adjustments to reflect Connecticut-specific policies and program goals.
- Heat pumps comprise 65% of residential space heating, cooling, and water-heating equipment sales by 2030 and 90% by 2040, consistent with targets established by the New England Heat Pump Accelerator.
- Systems were assumed to be either replaced in kind, upgraded to more efficient models, or converted to electric alternatives as they reach the end of their useful life.
- Measure includes end-of-life electrification for space heating, water-heating, cooking, and drying end uses.

Limitations

In addition to the limitations outlined under Measure 4, deep electrification will require concurrent grid upgrades in order to support additional electrical power loading and to avoid customer outages. Emissions reductions from electrification are highly dependent on continued decarbonization of the electric power supply. Without further investment in and market adoption of renewable generating equipment, the modeled emissions savings are highly unlikely to be achieved through building equipment electrification alone.

Measure 6: Maximize Energy Efficiency in New Residential and Commercial Buildings

This measure is defined by a decrease in energy consumption in new residential and commercial buildings. Modeled activities include adoption and implementation of energy-efficient building codes, along with the voluntary adoption of green building "stretch" codes.

Modeling Approach

GHG emissions reductions from new construction were estimated based on projected improvements in building energy codes. New building modeling was performed using ICF's proprietary Energy Codes tool, which layers in code energy savings estimates from Pacific Northwest National Laboratory (PNNL) efficiency studies. The modeling assumed that the state adopted updates to the International Energy Conservation Code (IECC) and the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) 90.1 standards at regular intervals through 2050, with code compliance assumed for all new buildings based on a 30-year measure life. Connecticut already requires energy code updates every three years, which was modeled as part of the BAU scenario. New building growth projections were based on provided population and labor forecasts for the state.

To model further new building efficiency, a portion of new buildings were assumed to meet an optional green buildings “stretch code,” reflecting tighter efficiency standards and net-zero readiness. This was modeled as meeting Passive House requirements for residential buildings and reaching an ENERGY STAR score of 90 for commercial buildings.

Table 19. Measure 6 Modeling Data Sources

Activity or Data Point	Source
Standard and stretch energy code quantification	PNNL cost-effectiveness studies for IECC and ASHRAE codes, Passive House standards , ENERGY STAR estimates , and ICF’s Energy Codes tool
Heat pump efficiency growth	NLR 2018 Electrification Futures Study
Residential and commercial buildings growth rate	CT State Population Projections from the CT State Data Center; “CT Long-Term Employment Projections 2000–2055” Excel file from S&P Global, provided by Connecticut Department of Labor; NLR’s ComStock datasets

Key Assumptions

- New buildings adhere to IECC and/or ASHRAE 90.1 standards.
- Energy code requirements continue to progress in line with State statute.
- The residential green buildings standard corresponds to Passive House standards, reflecting all-electrified homes meeting a 13.6 kBtu/ft² site energy use intensity (EUI) and decreasing in line with energy code progression. Green buildings code participation is expected to increase by 1.5% annually, growing to 37.5% of new homes by 2050.
- The commercial green buildings standard corresponds to achieving a Portfolio Manager ENERGY STAR score of 90, reflecting all-electrified buildings meeting a 33.6 kBtu/ft² site EUI and decreasing in line with energy code progression. Green buildings code participation is expected to increase by 1.5% annually, growing to 37.5% of new homes by 2050.
- Multi-family residential building energy usage is 50% of single-family usage.
- Multi-family buildings represent 45% of newly constructed homes in 2024, growing to 75% by 2050.
- Heat pump efficiency growth is based on the moderate advancement scenario from 2018 NLR EFS.

Limitations

New buildings projections are heavily dependent upon household and commercial square footage growth rates. Changes to these rates will correspond to similar changes in emissions reductions. Commercial square footage growth rates were estimated based on population growth across the region. More detailed studies into labor growth, including the types of projected employment and their correspondence to commercial building growth may give a more accurate estimation of square footage growth.

New buildings modeling was simplified by only accounting for the fuel usage and EUI per residential home or commercial square foot. In actuality, there are numerous types of housing (detached versus attached single-family homes, multi-family buildings with a variety of units, etc.) as well as many different types of commercial buildings (offices, hospitals, schools, industry, etc.) that the modeling could not reasonably

account for. As such, deviations in energy usage based on the growth rates of different types of buildings are to be expected. EUI is also a simplified annual metric that does not take into account specific building equipment types. The modeling assumed that increases in equipment efficiencies are expected to continue, but future energy consumption may be higher if this assumption changes (for example, due to state/federal policies, economic/technological limitations, or other barriers).

The projected split between single-family and multi-family housing in the region will also affect the energy consumption of new buildings. Further, state policies as well as demographic/land usage shifts have the potential to alter these projected trends.

Measure 7: Maximize Electrification in New Residential and Commercial Buildings

This measure is defined by the accelerated adoption of electric energy-consuming equipment in new residential and commercial buildings. Modeled activities include increased market adoption along with implementation of zero-emission equipment standards/codes.

Modeling Approach

In addition to the efficiency modeling in new buildings, ICF’s Energy Codes tool also models a range of broad new building electrification, with a growing share of new buildings estimated to be all-electric. The modeling incorporated a fossil fuel phase-out in new residential and commercial buildings, supported by the state’s heat pump and decarbonization targets. The modeling also incorporated increasing efficiency trends for electric equipment (heat pumps and water heaters) based on projected trends from NLR’s EFS.

Table 20. Measure 7 Modeling Data Sources

Activity or Data Point	Source
Energy code quantification	PNNL cost-effectiveness studies for IECC and ASHRAE codes; and ICF’s Energy Codes tool
Heat pump efficiency growth	NLR 2018 Electrification Futures Study
Residential and commercial buildings growth rate	CT State Population Projections from the CT State Data Center; “CT Long-Term Employment Projections 2000–2055” Excel file from S&P Global, provided by Connecticut Department of Labor; NLR’s ComStock datasets

Key Assumptions

- Heat pump efficiency growth is based on the moderate advancement scenario from the 2018 NLR EFS.
- Residential electrification rates grow at 2% annually until 2035, when 95% of new buildings transition to all-electric construction, growing to 100% by 2040.
- Commercial electrification rates grow at 2% annually until 2040, when 95% of new buildings transition to all-electric construction, growing to 100% by 2045.

Limitations

The transition toward all-electric new construction will likely require state action, though increasing heat pump efficiencies and decreasing costs will drive adoption. Changes to timelines or adoption rates will affect the results of this modeling. A lack of investment in heat pump technology will also slow efficiency

improvement and emissions reductions. Similarly, higher funding toward research and development will likely increase efficiency rates and can accelerate emissions reductions in the modeling.

Measure 8: Expand Grid-Scale Clean Energy Resources

This measure is defined by the expansion of grid-scale clean energy generation in Connecticut. The analysis was built on existing state policies, including the Renewable Portfolio Standard (RPS) and participation in the RGGI, and models an accelerated transition to a zero-carbon electricity system. Modeled activities include the deployment of grid-scale renewable energy resources — such as offshore wind, nuclear, solar photovoltaics, and battery storage — as well as associated changes to the electricity generation mix and power imports.

Modeling Approach

This analysis utilized the Integrated Planning Model, a cost-optimized capacity expansion and dispatch model that simulates operation of the North American electric power sector through 2050 under policy, technology, and market constraints. IPM determines the least-cost mix of generation and storage resources needed to meet electricity demand while satisfying emissions limits, reliability requirements, and existing policies.

For the analysis, IPM was calibrated for Connecticut and the broader ISO New England (ISO-NE) region for generation, capacity, and CO₂ emissions based on EIA historical data for 2023 and 2024. Model inputs included electricity demand and peak load, fuel prices, technology costs and performance characteristics, energy and capacity market revenues, and applicable state and regional policies (including the RPS, RGGI, and federal tax incentives). Outputs include generation, capacity, emissions, electricity prices, and net electricity imports by year.

To represent a zero-carbon grid outcome, a net-zero emissions constraint was applied to in-state electricity generation. Under this constraint, in-state power plant emissions decline to zero by 2040. Because Connecticut imports a portion of its electricity from the broader ISO-NE region, emissions associated with imported electricity were also assumed to be zero starting in 2040.

To calculate consumption-based emissions from electricity consumed in the state, an annual average import-weighted emissions factor was developed using IPM outputs for net imports and regional grid emissions intensity. This weighted emissions factor was applied consistently across all end-use sectors to estimate emissions associated with electricity consumption, including EVs, electrified buildings, and industrial electrification.

Electricity demand inputs reflected baseline load growth from the 2025 CELT forecast, adjusted to incorporate incremental load impacts from other sectors. Electrification assumptions from the transportation and building sector BAUs were integrated into the CELT projections for heat pumps and EV load impacts.

For the mitigation pathway, load changes from measure modeling activities across all end-use sectors were applied to the BAU. As a result, annual energy and peak demand are 44% and 71% higher in the mitigation pathway compared to the BAU in 2050. The main driver of peak demand growth is building electrification, particularly in winter:

- Connecticut switches to winter peaking beginning in 2035 as heating demand rises. In 2050, building electrification accounts for 68% of peak during the system's peak hour.
- Behind-the-meter solar, energy efficiency measures, and managed EV charging help moderate peak demand impacts.

Table 21. Measure 8 Modeling Data Sources

Activity or Data Point	Source
Clean energy technology costs	NLR 2024 Annual Technology Baseline, Moderate Case ; offshore wind and new nuclear used the average of the Advanced and Moderate Cases
Conventional technology costs	EIA Annual Energy Outlook, 2025 Reference Case
Base load forecast	2025 CELT load forecast
Load impacts from building efficiency, electrification, and EVs	NLR EVI-Pro Lite ; LBNL HEVI LOAD , NLR Electrification Futures Study load profiles, NLR ResStock and ComStock load profiles, EPA 2022 Reference Case DG PV generation profile

Key Assumptions

- Electricity demand growth is based on the CELT forecast used in the BAU scenario and adjusted to reflect modeled impacts from end-use sector modeling:
 - Industrial: shaped using NLR EFS Medium/Moderate load profiles
 - Building Electrification and Energy Efficiency: shaped based on ResStock and ComStock hourly load profiles
 - Transportation Electrification: shaped using NLR’s EVI-Pro Lite and LBNL’s HEVI-LOAD tools, with LDV charging profiles adjusted to assume managed charging to mitigate system peak demand spikes
- Connecticut meets 100% of its in-state electricity demand with clean energy resources by 2040 and achieves net.zero greenhouse gas emissions from in-state power plants by 2040.
- Capital and operating costs for clean energy technologies follow the NLR’s 2024 Annual Technology Baseline (Moderate Case). For offshore wind and new nuclear, the average of the Advanced and Moderate Cases was used.
- Conventional generation technology costs follow the US EIA’s Annual Energy Outlook 2025 Reference Case.
- The model allows a range of compliance options, including offshore wind, nuclear, solar photovoltaics, and battery storage.
- Low-carbon fuels such as RNG and hydrogen are not assumed to be deployed at scale in the power sector and are prioritized for higher-value uses in the industrial and transportation sectors.

Limitations

Electric sector modeling is subject to significant uncertainty related to future technology costs, fuel prices, policy implementation, transmission availability, and regional market dynamics. This analysis represents a single, internally consistent pathway rather than a full exploration of alternative grid futures. Actual outcomes may differ depending on the pace of technology deployment, changes in regional electricity markets, federal policy developments, and infrastructure constraints. In particular, the availability and timing of transmission upgrades, offshore wind development, and the commercialization of technologies like small modular reactors could materially affect the resource mix and import patterns modeled in this measure.

Measure 9: Deploy Distributed Clean Energy Resources

No additional modeling was done to quantify the impacts of this measure. The BAU projections for distributed solar were based on the CELT 2025 Load Forecast, which showed significant growth in distributed solar for the state. Therefore, no additional distributed solar was assumed beyond the BAU levels.

Measure 10: Decarbonize Industrial Processes through Energy Efficiency, Electrification, and Low-Carbon Fuels

This measure is defined by a decrease in energy consumption and increased use of electric equipment and low-carbon fuels by the industrial sector. Modeled activities include advancing industrial electrification by converting fossil fuel-based processes to electric alternatives; creating incentive programs to transition from boilers to industrial heat pumps where feasible (e.g., in food, paper, and chemical industries for low- and medium-temperature applications); installing on-site renewable energy systems and deploying smart grid management technologies, battery storage, and distributed energy resources to enhance flexibility and reduce carbon emissions; increasing the use and production of hydrogen and other low-carbon fuels, including biofuels, biogas, and RNG; reducing industrial process emissions through implementation of best available technologies; lowering emissions from compressed air systems and equipment leaks through more stringent efficiency and performance standards; and providing energy efficiency incentives and technical assistance to accelerate replacement of existing equipment with high-efficiency technologies.

Modeling Approach

Connecticut's industrial sector is composed of a mix of industries. The range of industrial activity includes traditional manufacturing, aerospace and defense, and large institutions that operate on an industrial scale. Natural gas midstream production is also a major point-source emissions contributor from centralized combustion systems and are categorized under the industrial sector. Traditional manufacturing sectors include food and paper production, such as snack food manufacturing, paper mills, and corrugated box facilities. Aerospace and defense manufacturing is also a prominent cluster, with facilities engaged in aircraft assembly, engine and engine parts production, and auxiliary equipment manufacturing. Large institutions not captured in the commercial sector, such as biotechnology research laboratories and national security sites, operate at an industrial scale with significant energy use for heating, cooling, and specialized processes, and are included in this sector.

Within these subsectors, opportunities for decarbonization vary: efficiency upgrades and fuel switching are particularly relevant in traditional manufacturing such as food and paper production; electrification of machining and finishing processes is suited to aerospace and defense manufacturing; and electrification or fuel switching can reduce emissions from large institutional facilities with campus-scale energy systems.

An industry-specific approach was applied to model these interventions, using facility-level GHG emissions data from EPA's GHGRP and industry average energy consumption patterns from EIA's MECS. The modeling aligned with the 'Near-Zero' adoption pathway from DOE's Industrial Decarbonization Roadmap (2022). The Near-Zero pathway assumes maximum feasible efficiency gains, near-complete fuel substitution with low-carbon options, widespread electrification of processes wherever technically feasible, and deployment of industry-specific process changes (e.g., clinker substitution in cement, transition to electric arc furnaces in steel).

Table 22. Measure 10 Modeling Data Sources

Activity or Data Point	Source
Energy consumption	2018 EIA MECS Survey Data Table 1.1 By Manufacturing Industry and Region
Industrial subsector	2022 NAICS Codes
GHG emissions	2023 EPA GHG Reporting Program Data (GHGRP)
Energy and emissions reductions	DOE's Industrial Decarbonization Roadmap

Key Assumptions

- The analysis focuses on industrial facilities reported under the EPA GHGRP, representing Connecticut's largest point-source emitters. Modeled subsectors include those present in the GHGRP dataset and mapped via NAICS codes in the model (e.g., chemicals, primary metals, nonmetallic mineral products, food manufacturing, paper, and petroleum refining where applicable). These subsectors are treated using representative, subsector-average assumptions, and smaller industrial sources are not explicitly modeled.
- Facility-level emissions are derived from GHGRP and allocated to fuels using subsector energy profiles based on US EIA MECS data. These fuel shares are assumed to be representative of Connecticut industries and are used to estimate baseline energy demand and emissions by fuel type.
- Energy efficiency is modeled as a gradual reduction in total energy demand over time, applied proportionally across fuels and based on trajectories from the DOE Industrial Decarbonization Roadmap 2022.
- Electrification is applied to a portion of combustion-based energy demand in each subsector, increasing over time based on predefined adoption trajectories with associated efficiency gains relative to fossil fuel systems.
- Selected fossil fuels (e.g., fuel oils, coal, and hydrocarbon gas liquids) are partially replaced over time with lower-carbon alternatives using subsector-specific adoption rates,

Limitations

The analysis incorporated several simplifying assumptions to represent complex systems within a consistent, statewide framework. Energy consumption and emissions were modeled at the subsector level using industry average representative fuel mixes and technology adoption curves rather than plant-level process detail. This approach was used to align with available data (GHGRP, MECS) and the DOE Roadmap pathway while maintaining analytical tractability. These simplifications limit precision for industries with high heterogeneity in process energy needs (e.g., chemicals, food manufacturing). Refining this analysis will require incorporating process-specific models or direct facility data to better capture temperature, technology, and utilization variability. Also, given that the analysis relies on facility-level data from the GHGRP, which does not capture all industrial emissions sources in Connecticut and required alignment with the state GHG Inventory, additional uncertainty exists due to differences in reported values.

The modeling relied on public datasets that may not fully capture Connecticut-specific industrial operations or recent efficiency improvements. GHGRP data excludes facilities below reporting thresholds, while MECS

data are aggregated at the regional or national level. The results are also sensitive to several external drivers that could significantly influence industrial decarbonization outcomes, including:

- Energy prices (particularly natural gas and electricity), which affect fuel switching economics.
- Technology readiness.
- Federal and state policies (e.g., tax incentives, industrial grant programs, emissions standards) that shape adoption rates.
- Economic and production shifts in key sectors that may change industrial activity levels and energy intensity. As these drivers evolve, the modeled cost and emissions trajectories could vary substantially from the central estimates presented here.

Measure 11: Expand Carbon Capture, Utilization, and Storage (CCUS) at Industrial Facilities

This measure is defined by the installation of CCUS at industrial facilities with fossil fuel combustion and/or process-related emissions. Modeled activities include the adoption of carbon capture technologies by industries that have limited ability to electrify or switch to low-carbon fuels, along with incentive programs and policies to support deployment. The measure also recognizes that facilities with high-purity, consistent CO₂ streams are often identified as strong candidates for CCUS, such as cement and lime plants, ethanol production, hydrogen production, and certain pulp and paper facility types.

Modeling Approach

Building off Measure 10, a subsector-specific approach was applied to CCUS adoption at industrial facilities. CCUS adoption was modeled in alignment with the Near-Zero adoption pathway from DOE’s Industrial Decarbonization Roadmap (2022) and other supporting literature. Strong CCUS candidates are characterized by large, centralized emissions (e.g., large smokestacks), limited opportunities for alternative fuels or electrification, and relatively high emissions (i.e., above 100,000 MTCO₂ in 2050). In this analysis, these characteristics informed which subsectors were considered more suitable for CCUS. Modeling assumptions for CCUS adoption were applied at the subsector level, rather than prescribed to specific facilities, to represent CCUS potential across relevant Connecticut subsectors. The resulting assumptions reflect differences in technology adoption across these subsectors, with primary metals manufacturing associated with the highest adoption rates, and other subsectors (e.g., paper, food, transportation equipment manufacturing) reflecting lower adoption levels.

Table 23. Measure 11 Modeling Data Sources

Activity or Data Point	Source
Energy consumption	2018 EIA MECS Survey Data Table 1.1 By Manufacturing Industry and Region
Industrial subsector	2022 NAICS Codes
GHG emissions	2023 EPA GHG Reporting Program Data (GHGRP)
Energy and emissions reductions	DOE’s Industrial Decarbonization Roadmap

Key Assumptions

- CCUS adoption was modeled based on the DOE Industrial Decarbonization Roadmap (2022) Near-Zero pathway and other supporting literature.
- 8-10 year research and development runway before deployment.
- 87.5% capture rate applied only to CO₂ emissions.
- Ratio of CO₂ emission to other GHGs known in the base year is assumed to remain constant.

Limitations

This approach is subject to several limitations related to data availability and methodological assumptions. The analysis relies on facility-level data from the GHGRP, which does not capture all industrial emissions sources in Connecticut and required alignment with the state's GHG Inventory, introducing additional uncertainty due to differences in reported values. CCUS potential was assessed at the NAICS subsector level using literature-based adoption rates, rather than at the individual facility-level, and therefore does not reflect site-specific technical feasibility, infrastructure availability, or economic considerations. Additionally, adoption rates were applied uniformly across subsectors based on literature values, which may not fully capture variation in emissions profiles or operational characteristics within each subsector. As a result, the estimated emissions reductions should be interpreted as indicative of technical potential rather than a projection of actual CCUS deployment.

Measure 12: Reduce Emissions from the Disposal of Organic Solid Waste

This measure is defined by reductions in emissions from organic solid waste achieved through waste reduction and diversion.

Modeling Approach

Connecticut's waste composition report from 2015 was used to determine what percentage of landfilled waste is organic. Combining this percentage with the assumed percent of organic waste diverted in that year, the total amount of organic waste diverted was calculated and subtracted from the BAU waste tonnage. All diversion was assumed to occur from waste sent out-of-state. The updated waste tonnage was input into EPA's State Inventory Tool (SIT) Projection Tool to recalculate emissions from landfilling and incineration. These emissions were compared to the BAU emissions to determine emission reductions from increased organics diversion.

Table 24. Measure 12 Modeling Data Sources

Activity or Data Point	Source
Percent of landfilled/incinerated waste that is organic	2015 State-wide Municipal Solid Waste Composition and Characterization Study
Used to calculate emissions	EPA State Inventory Tool Projection Tool

Key Assumptions

- 80% of compostable waste that is currently landfilled or combusted will be diverted by 2050, increasing linearly from 0% in 2029.

Limitations

The SIT and Projection Tool assume the composition of all landfilled waste is the same. The tools do not allow for variation to the waste composition. This limitation of the tools may result in an underestimation of emission reductions for this measure as organic waste generates more methane when landfilled than non-organic waste.

Measure 13: Reduce Emissions from the Disposal of Non-Organic Solid Waste

This measure is defined by reductions in emissions from non-organic solid waste achieved through waste reduction and diversion. Modeled activities include: the diversion of non-organic waste achieved through implementation of an extended producer responsibility program for consumer packaging, investments in and expansion of recycling programs, and establishment of waste-reduction incentive programs.

Modeling Approach

Connecticut’s waste composition report from 2015 was used to determine what percentage of landfilled non-organic waste could be diverted to recycling. Combining this percentage with the assumed percent of recyclable waste diverted in that year, the total amount of non-organic waste diverted was calculated and subtracted from the BAU waste tonnage. All diversion was assumed to occur from waste sent out-of-state. The updated waste tonnage was input into the SIT Projection Tool to recalculate emissions from landfilling and incineration. These emissions were compared to the BAU emissions to determine emission reductions.

Table 25. Measure 13 Modeling Data Sources

Activity or Data Point	Source
Percent of landfilled/combusted waste that is recyclable	2015 State-wide Municipal Solid Waste Composition and Characterization Study
Used to calculate emissions	EPA State Inventory Tool Projection Tool

Key Assumptions

- 80% of recyclable waste that is currently landfilled or combusted will be diverted from landfill by 2050, increasing linearly from 0% in 2029.

Limitations

The SIT and SIT Projection Tool assume the composition of all landfilled waste is the same. The tools do not allow for variation to the waste composition. This limitation of the tools may result in an overestimation of emission reductions for this measure as recyclable waste generates less methane when landfilled than non-recyclable waste.

Measure 14: Increase Soil Carbon Sequestration and Reduce Emissions from Agricultural Soils

This measure is defined by an increase in soil carbon sequestration and reduced emissions from agricultural soils. Modeled activities include increased adoption of cover crops and nitrification inhibitors in fertilizer application.

Modeling Approach

Cover Crops

The modeling assumed increased adoption of cover crops begins in 2026 and will continue through to the end of the projected time series, 2050. Historical US Department of Agriculture (USDA) NASS crop production data were used for key crops to project applicable acres for cover crop adoption. The annual adoption percentage was multiplied by annual projected crop acres to estimate applicable acres for cover cropping. The applicable acres were the same for the BAU and mitigation pathway but the level of adoption of cover crops differed. The 2017 adoption level of 19% of total crop acres to cover crops for 2025 and an average annual change in adoption of 3.8% to project future adoption. The maximum adoption (80% of total projected crop acres) is reached in 2050. Mitigation modeling assumed cover crop adoption rates were consistent across farms and crops, and that cover crops were a mix of legume and non-legume species.

A per-acre soil organic carbon (SOC) sequestration and N₂O emission reduction factor was applied to applicable acres to estimate net emissions and removals from increased adoption of cover crops. Further, because cover cropping required additional machinery use for seeding and harvesting, the modeling estimated the additional cover crop scenario fossil fuel emissions from diesel fuel combustion. Diesel fuel combustion emission factors (MTCO₂e) from EPA and gallons of fuel use per acre from USDA marginal abatement cost curve (MACC) data, were combined with a scheduled transition to RD were used to estimate cover crop fuel use. The adoption of RD was aligned with transportation sector assumptions.

Table 26. Measure 14 Modeling Data Sources – Cover Crops

Activity or Data Point	Source
Harvested cropland acres	USDA NASS Quick Stats
Cover crop adoption rate	Cover Crop Trends, Programs, and Practices in the United States
Soil carbon sequestration and N ₂ O reduction factor	USDA MACC Report (2023)
Diesel fuel use per acre for planting and cultivating	USDA MACC Report (2023)
Diesel fuel combustion emission factor	EPA Emission Factors for GHG Inventories
Average reduction in carbon intensity of diesel	Alternative Fuels Data Center: RD

Nitrification Inhibitors

The modeling assumed increased adoption of nitrification inhibitors begins in 2026 and continues through to the end of the projected time series, 2050. A 4% annual increase in applicable acres receiving NIs to a maximum adoption of NIs on 80% of applicable acres was assumed. The baseline adoption for corn acres is 12.5% with maximum adoption reached in 2042.

The rate of nitrogen application in pounds per acre was projected for 2018 through 2050, based on 1990 to 2017 historical rate data. The rate (lbs./acre) is crop-specific. National crop-specific adoption rates were assumed for 2025 based on USDA data for 2017 adoption. Adoption rates for NI application on corn acres assumed an annual 4% increase until a maximum adoption rate of 80% is reached.

USDA NASS data was used to project crop areas and fertilizer application rates and applied USDA crop-specific percent reduction factors per kg of nitrogen (N) to NI-treated fertilizer to estimate emissions reductions under the BAU and mitigation pathway. The model incorporated a 10% reduction in total nitrogen inputs due to improved nitrogen use efficiency (NUE) based on the 2023 [USDA MACC](#) report (which translates directly to a 10% reduction in estimated N₂O emissions). N₂O emissions were calculated using [IPCC](#) and [US GHGI](#) aligned emission factors. For direct and indirect emissions, annual metric tons of nitrogen from synthetic fertilizer applied was estimated based on the rate and applicable acres.

Table 27. Measure 14 Modeling Data Sources – NIs

Activity or Data Point	Source
Crop planted area	USDA NASS Quick Stats
Percent of acreage with N application	Fertilizer Use and Price Economic Research Service
Quantity of nitrogen fertilizer applied	Fertilizer Use and Price Economic Research Service
Nitrification inhibitor application rate	Agricultural Resource Management Survey (ARMS), USDA. Farm Financial and Crop Production Practices - Tailored Reports: Crop Production Practices
Percent reduction in N ₂ O expected from NI application	USDA MACC Report (2023)
N ₂ O emissions factors from direct and indirect sources	Intergovernmental Panel on Climate Change (IPCC) 2019 Refinement, Chapter 11: N₂O Emissions from Managed Soils, and CO₂ Emissions from Lime and Urea Application

Key Assumptions

Cover Crops

- Assumed current adoption of cover crops on 19% of applicable crop acres in Connecticut based on USDA Cover Crops Report and inclusion of expert knowledge from the Connecticut Department of Agriculture.
- Assumed 3.8% annual adoption increase, reaching a maximum of 80% adoption by 2050.
- Applicable crop acres exclude pasture as the mitigation pathway is intended to offset synthetic nitrogen fertilizer nitrous oxide emissions from key field crops.
- Utilized Soil Carbon Sequestration and N₂O Reduction Factor from USDA MACC Report.
- Assumed current and future RD adoption in agriculture, in alignment with RD adoption in the transportation sector.
- Assumed cover crop adoption rates are consistent across farms and crops, and that cover crops are a mix of legume and non-legume species.

Nitrification Inhibitors

- Average planted crop acres rates of change from USDA NASS were used as they were considered most representative of the observed trend of decreasing planted acres of key field crops in more recent years, due to urbanization. Estimated rates of change from USDA NASS data were determined due to potential data artifacts leading to unrealistic trends.

- National average crop-specific fertilizer application rates were utilized in place of state-specific values as state-level rates were not available.
- A 41% percent reduction was assumed in N₂O from NI application for corn based on USDA MACC Report.
- USDA MACC Report provided average emission reduction factors, developed based on academic literature.
- Reduction in total N inputs of 10% due to enhanced NUE based on USDA MACC Report.
- Current adoption of NIs estimated based on DEEP and Connecticut Department of Agriculture data on planted acres and acres with NI application.
- Increased adoption of NIs over time: Maximum adoption reaches 80% for corn in 2042.

Limitations

Cover Crops

Soil carbon sequestration and N₂O reduction emission factors for the New England region were derived from published USDA reports on cover cropping systems and feasibility. The modeling assumed that 75% of cover crops are non-legume species, while 25% are legumes—an oversimplification of Connecticut’s cover cropping landscape, yet broadly representative of US and regional adoption practices. The modeling assumed that sequestration depended on the rate of adoption and assumed all acres planted that are not pastureland are available for cover cropping in any given year.

Additional fuel use is 0.92 gallons per acre for planting and cultivating activities, which results in 9.7 kgs CO₂e per cover crop acre emitted from fuel use based on EPA GHG Emission Factor Hub emission data. The modeling implemented a scheduled phase-in of 100% RD by 2050, partially offsetting additional cover crop scenario fossil fuel emissions, and in alignment with transportation sector modeling.

Future cover crop adoption rates may fluctuate based on policy incentives and agricultural market dynamics. The ten-year harvested acreage rate of change was chosen as the most representative of future trends, reflecting expected declines due to increasing urbanization. These projections align with USDA Baseline Projections estimates for national crop area changes.

Sequestration depends on weather in any given year—if there is limited precipitation due to drought, crops will not grow, and SOC will not be sequestered. There may be increasing droughts and other relevant weather events due to climate change in the future. Heavy precipitation events will spike N₂O emissions which would negate some of the net sequestration.

Nitrification Inhibitors

Current NI adoption rates were estimated with USDA National data, which may not fully capture all NI applications in Connecticut. Crop planted acreage projections assumed a gradual decrease over time, based on historical production trends but may not account for urbanization trends that may occur in future, or shifts in consumer demand and therefore agricultural production.

Measure 15: Reduce Methane Emissions from Livestock and Manure

This measure is defined by the reduction in methane emissions from livestock and manure management. Modeled activities include expanded use of feed additives and increased adoption of anaerobic digesters.

Modeling Approach

Feed Additives

Emissions avoided due to adoption of the FDA-approved feed additives Monensin and 3-nitrooxypropional (3-NOP) were estimated at levels scientifically proven to reduce enteric fermentation emissions. The proportion of cattle population that both feed additives are relevant for was assumed to be 100% of feedlot and foraging cattle, excluding calves which are not typically fed this type of additive. Feed additive adoption was assumed to begin in 2026 and continue through to the end of the projected time series, 2050.

The SIT BAU livestock population data and per-head (kg CH₄/head/year) emissions factors were used to model enteric methane emissions under the BAU and mitigation pathway, specifically focused on foraging cattle, feedlot cattle, and dairy cattle. Due to the differing per-head emissions factors for different livestock systems, beef cattle population data was further disaggregated for mitigation modeling, into the feedlot and foraging proportion of cattle (both groups excluding calves), using state-specific population proportions from the SIT and US National GHG Inventory. Future livestock population estimates from 2022 to 2050 were projected using national average annual growth rates from the USDA Baseline Projections which account for production, national market trends, and international trade trends among other factors.

The measure assumes phased adoption of Monensin from 2026–2035, ramping up from 3% to 30%. Due to current cost and consumer perception barriers, the measure assumes adoption of 3-NOP from 2035–2050, ramping up from 5% to 100% (100% adoption is reached in 2046). There is insufficient scientific evidence to estimate that impacts on enteric fermentation emissions would be additive if implemented at the same time (science may eventually prove they are additive but current modeling is conservative).

For Monensin, literature suggests a per-head emission reduction of 3%, while for 3-NOP the emission reduction is 38.5%. Per-head emissions factors for both the Monensin and 3-NOP adoption were estimated for all livestock groups, and the applicable populations were multiplied by the proportion receiving either Monensin or 3-NOP depending on the year, and the respective feed additive emission reduction factor. This was added to the remaining proportion of the applicable population that did not receive any mitigation feed additive, which was multiplied by the standard per-head emission factor.

Table 28. Measure 15 Modeling Data Sources – Feed Additives

Activity or Data Point	Source
Livestock population data	USDA NASS Quick Stats
Enteric fermentation emission factors	Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2022, US EPA
Monensin and 3-NOP GHG emissions reduction potential	Marginal Abatement Cost Curve Estimate Methodology Report Full adoption of the most effective strategies to mitigate methane emissions by ruminants can help meet the 1.5 °C target by 2030 but not 2050
Monensin and 3-NOP adoption rate	An evaluation of emerging feed additives to reduce methane emissions from livestock

Anaerobic Digesters

The modeling estimated annual methane emission reductions from expanded adoption of anaerobic digesters on Connecticut dairy operations. Methane emissions from manure management were calculated using a Tier 2 approach consistent with the US GHG Inventory Annex 3B methodology: $\text{CH}_4 \text{ (kg)} = \text{VS} \times B_0 \times \text{MCF} \times 0.662$, where VS represents annual volatile solids excreted per animal which already accounts for the typical animal mass, B_0 is the maximum methane-producing capacity, MCF is the methane conversion factor for a given manure management system, and 0.662 is the density of methane at 25°C. Volatile solids and MCF values were sourced from the 2024 US GHG Inventory, using Connecticut state-specific values. Historical values (1990–2022) were projected through 2050 using 10-year average rates of change.

Mitigation modeling is focused on dairy cattle only. Eligible dairy cattle are defined as those on farms with 200 or more head, estimated at approximately 76% of Connecticut's total milking cow population based on USDA NASS 2022 Connecticut farm size data, as farms of less than 200 head are unlikely to have an anaerobic digester. Livestock population projections were developed using Connecticut-specific historical population data from the US GHG Inventory time series. Future livestock population estimates from 2022 to 2050 were projected using national average annual growth rates from the USDA Baseline Projections which account for production, national market trends, and international trade trends among other factors, the same method used for feed additives population data.

BAU emissions were estimated for dairy cow manure in anaerobic lagoon and liquid/slurry and deep pit systems—the two manure management system (MMS) types suitable for conversion to anaerobic digester management. These systems account for approximately 38% of total Connecticut dairy manure (32% in anaerobic lagoon and 6% in liquid/slurry and deep pit systems), based on US GHGI Annex 3B Table A-160. Current AD adoption was estimated at 3%, based on expert input from Connecticut DEEP, and corroborated by the EPA Livestock Anaerobic Digester Database, which identifies four operational dairy digesters in Connecticut: Fort Hill Farms, Freund Farm, Hytone Farm, and Oakridge Dairy.

The mitigation pathway modeled the incremental installation of seven new ADs from 2026 through 2032, starting with the largest eligible farms and prioritizing anaerobic lagoon manure before liquid/slurry manure. Two large-farm digesters (approximately 1,750 dairy cows each) were assumed to come online in 2026 and 2027, serving anaerobic lagoon manure. Three mid-sized farm digesters (approximately 350 dairy cows each) were assumed online in 2028, 2029, and 2030, also serving lagoon manure. Two additional mid-sized farm digesters (350 dairy cows) serving liquid/slurry and deep pit manure were assumed online in 2031 and 2032. This schedule was informed by analysis of the CT Farm Energy Anaerobic Digester Roadmap (2016) and the Connecticut CAFO Feasibility Study.

Emission reductions were calculated annually as the difference between BAU volatile solids-based emissions (for manure not managed in ADs) and the mitigation pathway emissions, where VS diverted to ADs was removed from the anaerobic lagoon and liquid/slurry MMS pools. Under AD management the methane conversion factor is treated as zero, consistent with US GHGI conventions, reflecting near-complete methane capture.

Table 29. Measure 15 Modeling Data Sources – ADs

Activity or Data Point	Source
Livestock population data (head)	USDA NASS Quick Stats USDA Baseline Projections (ROC)
National and CT specific estimation parameters and data	US GHGI, 2024. Annex 3 Part B
Farm size inventory data	USDA NASS Quick Stats
Current AD adoption and manure eligible for AD conversion	Expert Opinion, Gabriele Frigon and EPA AgSTAR Database EPA SIT Ag Module

Key Assumptions

Feed Additives

- Assumed adoption rates were applicable to 100% of beef forage cattle, beef feedlot cattle (excluding calves), and dairy cattle. This broad applicability reflects the potential for sector-wide implementation once adoption barriers are addressed.
- Assumed that effects of Monensin and 3-NOP are not additive due to lack of consensus of research on combined feed additives and associated effects, therefore when 3-NOP adoption ramps up, assume zero effect from Monensin.
- Monensin is assumed to be market-ready with low implementation costs. Adoption ramps from 3% in 2026 to 30% by 2035.
- 3-NOP is FDA-approved but faces consumer and cost-related barriers. ICF assumed adoption begins in 2036, increasing from 5% to the maximum of 100% reached in 2046 and maintained through 2050.
- The assumed adoption curves reflect realistic market penetration based on regulatory status, economic feasibility, and producer behavior.

Anaerobic Digesters

- Current anaerobic digester adoption in Connecticut is approximately 3%, based on expert input from Connecticut DEEP (Gabrielle Frigon) and corroborated by the EPA Livestock Anaerobic Digester Database.
- Only dairy cattle are modeled for anaerobic digester adoption. Swine operations are excluded due to smaller Connecticut-specific farm size, lower population and anticipated smaller impact on total manure related emissions from AD adoption.
- Manure eligible for AD conversion comes from two MMS types: anaerobic lagoon (32% of dairy manure) and liquid/slurry and deep pit (6% of dairy manure), totaling 38% of total Connecticut dairy manure, based on US GHGI Annex 3B Table A-160.
- Only dairy farms with 200 or more milking cows are assumed economically viable for AD adoption. This threshold corresponds to approximately 76% of Connecticut's milking cow population, based on USDA NASS 2022 Connecticut farm size inventory data.
- VS are sourced from US GHGI Annex 3B Table A-158 (Connecticut state-specific values) and projected through 2050 using 10-year average rates of change.

- MCF are sourced from US GHGI Annex 3B Table A-163 (Connecticut state-specific, liquid MMS) and projected through 2050 using 15-year average rates of change.
- Maximum methane-producing capacity (B_0) is $0.24 \text{ m}^3 \text{ CH}_4/\text{kg VS}$, consistent with US GHGI data for dairy cattle.
- Methane density at 25°C is $0.662 \text{ kg CH}_4/\text{m}^3 \text{ CH}_4$, consistent with the US GHGI constant.
- The AD implementation schedule assumes seven new digesters installed from 2026 to 2032: two large-farm digesters (~1,750 cows each) from anaerobic lagoon systems in 2026 and 2027; three mid-sized farm digesters (~350 cows each) from anaerobic lagoon systems in 2028, 2029, and 2030; and two mid-sized farm digesters from liquid/slurry and deep pit systems in 2031 and 2032.

Limitations

Feed Additives

The analysis assumed that 100% of beef forage cattle, beef feedlot cattle (excluding calves), and dairy cattle are eligible for feed additive treatment. In practice, variability in farm management practices, regional feed availability, and animal health considerations may limit full adoption. This simplification was used to estimate the maximum technical potential of the measure and can be refined with more granular, region-specific adoption data.

The model conservatively assumed that the methane-reducing effects of Monensin and 3-NOP were also not additive, despite emerging evidence suggesting potential synergy. This simplification avoids overestimating emissions reduction potential in the absence of definitive scientific consensus. As more peer-reviewed studies become available, this assumption should be revisited to improve accuracy.

Monensin is market-ready and is low cost and adoption is assumed from 2026-2035. 3-NOP is FDA-approved; however, consumer hesitation and cost barriers remain which deter producers from implementation, therefore the model conservatively assumed widespread adoption beginning only in 2036-2050. These projections do not account for potential disruptions such as supply chain issues, regulatory changes, or shifts in consumer demand. While these assumptions provide a structured framework for long-term planning, future iterations could incorporate dynamic adoption models based on economic or behavioral drivers.

GHG reduction percentages per animal are based on literature averages, which may not reflect performance under diverse real-world conditions (e.g., diet composition, animal genetics, climate).

Anaerobic Digesters

The emission modeling is limited to dairy cattle only. Potential emission reductions from swine or other livestock operations were not modeled due to smaller farm size, and lack of relevance of AD to those livestock types.

Volatile solids and MCF projections through 2050 are based on historical average rates of change derived from the US GHGI time series, rather than mechanistic or scenario-driven projections. Actual future trends in VS and MCF may differ from historical patterns.

MMS distribution percentages (percent of dairy manure in anaerobic lagoon vs. liquid/slurry and deep pit systems) are derived from the national US GHGI most recent available modeled data from the cattle enteric fermentation model at the time of modeling, which may not fully reflect Connecticut-specific manure management practices.

The AD implementation schedule (2026–2032) represents an illustrative adoption trajectory informed by consultation with Connecticut DEEP and available feasibility data. It is not a policy-binding or market-driven forecast. It is intended to illustrate the higher end of manure emission mitigation that would be possible with strong incentives for dairy farmers.

Co-digestion with off-farm organic waste (e.g., food scraps), which could increase biogas yields and improve cost-effectiveness, was not included in the GHG emission modeling.

Measure 16: Increase Protection and Conservation of High-Carbon Coastal Habitats, Wetlands, Grasslands, and Forests

This measure is defined by an increase in carbon sequestration through the protection and conservation of Connecticut’s natural and working lands, including high-carbon coastal habitats, wetlands, grasslands, and forests. Modeled activities include improving the land management and increasing the total area of protected lands.

Modeling Approach

Land cover and land cover change data were available from the NLCD. In some cases, land cover within the state was analyzed by sub-type to account for land cover types that exhibit large variations in carbon stock density (e.g., a deciduous versus mixed conifer forest). The land cover types and sub-types were mapped to carbon stock densities. Changes in management or cover type were calculated to determine the corresponding effects on ecosystem carbon stock.

The analysis compared baseline carbon stocks (1990-2022) with the mitigation pathway using:

- Carbon stock calculations for forests and wetlands including above-ground biomass, below-ground biomass, and SOC with a 1.3 improvement factor for the mitigation pathway;
- IPCC 2006 guidance ratios for biomass-to-carbon conversions (0.50 for forests/wetlands) and root-to-shoot ratios; and
- Linear transition modeling from 2030-2050 assuming full implementation of improved management practices by 2050.

Table 30. Measure 16 Modeling Data Sources

Activity or Data Point	Source
Forest biomass	USDA Forest Service Forest Biomass Geodata
Soil carbon stock	USDA NRCS Gridded Soil Survey Geographic (gSSURGO) Database
Land cover data	NLCD Land Cover (LndCov)
Land cover change	NLCD Land Cover Change (LndChg)
Improvement factor	IPCC 2006 Guidance for Grasslands

Key Assumptions

- Improved land management practices start in 2030 and are applied to 25% of forest lands and 25% of wetlands by 2050. All land area in each land cover type was assumed to be eligible for improved management. It is important to note that the modeling does not distinguish between private and

public land ownership; all forest and wetland areas are treated uniformly as eligible for improved management.

- A land management improvement factor of 1.3 was applied for all forest types converted to protected/managed lands. This factor was derived from the IPCC 2006 guidance for grasslands default improvement management factor which estimates changes in carbon due to land use and management.
- 1,236 acres of forests and 40 acres of wetlands are conserved every year, starting in 2026. Conserved lands are classified as land cover previously classified as settlement land converted from forest or wetlands.
- Land cover trends reflect a projected 2% increase from the BAU in forested lands by 2050. This gain in forest area is assumed to be offset by a corresponding reduction in the expansion of developed lands, representing a shift in anticipated land conversion patterns.
- Carbon stocks are assumed to be steady 20 years after the most recent land cover and/or land management change.

Limitations

It was assumed that all areas of forests and wetlands would remain constant due to maximally effective conservation measures, and that all areas were available to implement improved land management practices. The assumed improvement factor was imprecise and limited differentiation by improvement practice. Land conversion to or from the four modeled categories would affect the outcomes of this analysis. The conservation of forests were applied to the different categories at the same rate.

Measure 17: Increase and Manage Urban Tree Canopy

This measure is defined by an increase in tree canopy across urban regions in Connecticut. Modeled activities include tree planting and the establishment of oak regeneration and tree canopy restoration programs.

Modeling Approach

This measure quantified additional carbon sequestration from planting trees in urban areas in Connecticut. A spatial analysis was conducted to identify available planting areas within urban census-defined areas of the state. This was based on existing land cover and tree canopy data from the NLCD tree canopy data set. Priority areas were identified based on canopy cover deficits, socioeconomic factors, and potential carbon sequestration benefits.

The approach estimated total sequestration by calculating the increase in urban tree canopy cover using geospatial data and applying sequestration rates from the 2023 US GHG Inventory. The analysis modeled a tree canopy goal to increase tree cover in communities as defined in CGS § 32.9p(b) with less than 40% canopy cover by 5% by 2050. Tree planting targets were set to align with local sustainability goals where applicable. The analysis used a 2023 Connecticut dataset as the basis for identifying tree canopy cover in communities as defined in CGS § 32.9p(b) tree canopy cover. The tree canopy baseline was found by using the 2023 NLCD tree canopy layer. Implementation of this measure would result in a 9% increase in average urban tree canopy. This increased tree canopy area was multiplied by carbon sequestration potential rates from the 2023 US GHG Inventory.

Table 31. Measure 17 Modeling Data Sources

Activity or Data Point	Source
Tree canopy cover	2023 NLCD Tree Canopy
Communities as defined in CGS § 32.9p(b)	2023 CT shapefile
Carbon sequestration potential of urban trees	2023 US GHG Inventory Report Table 6-125

Key Assumptions

- Tree planting only occurs within communities as defined in CGS § 32.9p(b) with a baseline tree cover of less than 40%. In these communities, urban tree canopy increases by 5% by 2050.
- No loss of existing urban tree canopy statewide.

Limitations

The modeling assumed all urban areas could support increased canopy, which may not reflect on-the-ground constraints (e.g., impervious surfaces, land use conflicts). Sequestration rates were generalized and may not reflect species-specific or site-specific variability. The modeling did not account for potential canopy loss due to development, pests, or climate impacts. The analysis assumed linear growth in canopy area, which may not reflect actual implementation timelines. The cost modeling result was revised to reflect local program knowledge and an understanding that NRCS data better reflects rural environments, rather than urban tree costs.

Sector Planning Targets

CT DEEP identified the following planning targets for reductions by sector based on the results of the modeling by measure. These planning targets are the resulting emissions reductions or increased sequestration resulting from measure implementation in the mitigation pathway. In addition to the identified reduction planning targets in Table 32, CT DEEP has also identified a planning target of 20% and 42% increased sequestration from the natural and working lands sector by 2040 and 2050, respectively, that would be needed to meet the state's economy-wide GHG emissions reduction planning targets.

Table 32. Emissions Reduction Planning Targets (%) by Sector

Sector	2030	2040	2050
Transportation	-31%	-66%	-82%
Buildings	-14%	-43%	-78%
Electric Power	-83%	-100%	-100%
Industrial	-37%	-65%	-77%
Waste	-13%	-15%	-17%
Agriculture	-17%	-28%	-38%



APPENDIX 4: GREENHOUSE GAS EMISSIONS REDUCTION MEASURES

This appendix provides detailed information on each of the 17 GHG emissions reductions measures included in this CCAP. Information provided includes geographic applicability, GHG mitigation potential, key implementing agencies, authority to implement, costs, potential funding sources, implementation schedule and activity milestones, and metrics for tracking progress.

- **Measure 1:** Reduce vehicle miles traveled (VMT).
- **Measure 2:** Expand vehicle electrification, EV infrastructure, and zero- and low-carbon fuels in the on-road transportation sector.
- **Measure 3:** Decarbonize the nonroad transportation sector, including ports, airports, and rail.
- **Measure 4:** Increase energy efficiency in existing residential and commercial buildings.
- **Measure 5:** Increase electrification in existing residential and commercial buildings.
- **Measure 6:** Maximize energy efficiency in new residential and commercial buildings.
- **Measure 7:** Maximize electrification in new residential and commercial buildings.
- **Measure 8:** Expand grid-scale clean energy resources.
- **Measure 9:** Deploy distributed clean energy resources.
- **Measure 10:** Decarbonize industrial processes through energy efficiency, electrification, and low-carbon fuels.
- **Measure 11:** Expand carbon capture, utilization, and storage (CCUS) at industrial facilities.
- **Measure 12:** Reduce emissions from the disposal of organic solid waste.
- **Measure 13:** Reduce emissions from the disposal of non-organic solid waste.
- **Measure 14:** Increase soil carbon sequestration and reduce emissions from agricultural soils.
- **Measure 15:** Reduce methane emissions from livestock and manure.
- **Measure 16:** Increase protection and conservation of high-carbon coastal habitats, wetlands, grasslands, and forests.
- **Measure 17:** Increase and manage urban tree canopy.

Measure 1: Reduce vehicle miles traveled (VMT).

This measure aims to reduce VMT by expanding and improving public transit, active transportation, and micromobility options through targeted investments in alternative transportation infrastructure. It builds on Connecticut's existing transit systems and complete streets efforts. In addition to reducing GHG emissions, this measure delivers co-benefits including improved air quality, reduced traffic congestion, enhanced mobility options, and increased safety and access for residents.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 33 provides the emissions reduction potential from reducing VMT from 2025 through 2050.

Table 33. Measure 1 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.37	0.32	0.25	0.20	0.16

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DOT
- Municipalities
- COGs
- Tribal Nations

Authority to Implement and Milestones to Obtain Implementation Authority

CT DOT is authorized under CGS § 13b3 to plan, fund, design, construct, operate, and coordinate public transit systems and services, including bus and rail, engage in long range and multimodal transportation planning, and implement transit projects using state and federal funds in cooperation with municipalities and regional partners. The specific authority for each current state funding program is included in the funding Table 35 below.

Municipalities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and developing incentive-based programs, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 34. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 34. Cumulative Net Adoption Costs for Measure 1

Cost	2025-2050
Reduce VMT	\$\$\$

Potential Funding Sources

Table 35 summarizes potential funding sources identified for activities under this measure.

Table 35. Potential Funding Sources for Measure 1

Funding Source		Funding Focus Related to Measure
Federal	Carbon Reduction Program	Complete streets roadway improvements for pedestrians and bicyclists; rail transit improvements
	FRA NEC Funding	Railroad improvements
State	Community Connectivity Grant Program (CCGP) (CGS § 13b-34a)	Improvements for pedestrians and bicyclists
	Microtransit Pilot Program (Public Act 26-21)	Pilot program supporting on demand microtransit services

Implementation Schedule and Milestones

Table 36 provides activity milestones for reducing VMT for 2030, 2040, and 2050.

Table 36. Activity Milestones for Measure 1

Activity	2030	2040	2050
Percent of LDV VMT reduced from BAU	3.5%	4.4%	5.3%

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Miles of bike lanes and active transport infrastructure installed
- ✓ VMT per capita
- ✓ Annual reduction in VMT
- ✓ Increase in public transportation frequency and coverage
- ✓ Transit ridership
- ✓ Number of bus stops added
- ✓ Number of micromobility programs launched

Measure 2: Expand vehicle electrification, EV infrastructure, and zero- and low-carbon fuels in the on-road transportation sector.

This measure aims to accelerate the deployment of EVs, expand EV charging infrastructure, and increase the use of zero- and low-carbon fuels for on-road vehicles. It builds on Connecticut’s existing EV incentives, charging programs, and clean transportation policies focused on electrifying on-road transportation. Beyond reducing GHG emissions, this measure improves air quality, lowers exposure to harmful pollutants, supports job creation in EV installation and maintenance, and reduces fuel and maintenance costs for drivers.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 37 provides the emissions reduction potential from EV expansion and increased zero- and low-carbon fuel use in on-road vehicles from 2025 through 2050.

Table 37. Measure 2 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.17	1.20	2.70	3.97	4.99	5.86

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP
- Municipalities
- COGs
- Tribal Nations
- Utilities

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP has broad authority CGS § 22a-174 to prevent, control, and abate air pollution, including pollution from mobile sources such as motor vehicles. CT DEEP also has authority under CGS § 22a-20 to provide incentives for purchase of battery electric, plugin hybrid electric, fuel cell electric vehicles, and electric bicycles under the CHEAPR program. CGS § 22a-201d authorizes DEEP to establish and administer grant programs providing matching or supplemental funds for zero-emission vehicles, electric-vehicle charging equipment, and associated technical assistance. The specific authority for each current state funding program is included in the funding Table 39 below.

Municipalities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and developing incentive-based programs, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

PURA has the authority under CGS § 16-244dd to select CT DEEP, Connecticut Green Bank, electric distribution companies (utilities), and/or other third parties to implement light-duty or medium-duty electric vehicle charging programs.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 38. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures

where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 38. Cumulative Net Adoption Costs for Measure 2

Cost	2025-2050
On-Road Vehicle Electrification	\$\$\$\$
On-Road Low Carbon Fuels	\$\$\$

Potential Funding Sources

Table 39 summarizes potential funding sources identified for activities under this measure.

Table 39. Potential Funding Sources for Measure 2

Funding Source		Funding Focus Related to Measure
Federal	NEVI Program	Alternative Fuel Corridor build out and community charging infrastructure
	FTA Low or No Emission Grant Program	BEB and charging infrastructure
	Clean Heavy-Duty Vehicle Program	School buses and vocational vehicle Class 6 and Class 7 ZEV replacements
	CSB Rebates Program	School bus ZEV or low-emission vehicle replacements
	Carbon Reduction Program (CRP)	BEB and charging infrastructure funding
State	Alternative Fuel Infrastructure Tax Credit	Qualified AFV fueling property installed in qualified locations
	Battery Electric Bus Program (CGS § 6a-67d)	Abatement of diesel emissions by having at least 30% of all buses purchased or leased by the state be ZEV buses by 2030
	CHEAPR (CGS § 22a-20, 22a.201d, and 22a-202)	Rebates to purchase or lease eligible new or used battery electric (BEV) or plug-in hybrid electric (PHEV)
Utility	PURA EV Charging Program	Residential and commercial EV charging ports
Other	Volkswagen Settlement Environmental Mitigation Trust	Abatement of diesel emissions through on-road and nonroad vehicle and equipment replacement
	Mutual Security Credit Union	EV loan for residents in Fairfield, Litchfield, and New Haven counties

Implementation Schedule and Milestones

Table 40 provides activity milestones for EV expansion and increased zero- and low-carbon fuel use in on-road vehicles for 2030, 2040, and 2050.

Table 40. Activity Milestones for Measure 2

Activity	2030	2040	2050
EV Sales LDV	68%	100%	100%
EV Sales MHDV	30%	65%	100%
Share of LDV population that is BEV or PHEV	18%	66%	99%
Share of MHDV population that is BEV, PHEV, or FCEV	7%	30%	69%
% low carbon fuel consumption	0%	17%	31%
Cumulative number of LDV EV chargers installed (thousands) ⁹³	390	980	1,254
Cumulative number of MHDV EV chargers installed (thousands)	5.5	25.6	57.9

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Percentage of public fleet transitioned to ZEVs
- ✓ Number of ZEVs registered statewide each year
- ✓ Participation in EV incentive programs
- ✓ Number of public chargers installed
- ✓ Number of medium- and heavy-duty ZEVs deployed
- ✓ Number of state buses transitioned to BEB
- ✓ Consumption of low carbon fuels

Additionally, CTDOT currently maintains the EValuateCT dashboard, a resource that provides data and information on EV adoption and charging in Connecticut. This dashboard is one tool that is used to track vehicle adoption, number of charging stations, and other demographics about EV owners and operators.⁹⁴

Measure 3: Decarbonize the nonroad transportation sector, including ports, airports, and rail.

This measure aims to decarbonize the nonroad transportation sector by advancing equipment electrification and cleaner fuel use at ports, airports, rail, and other nonroad applications. It builds on Connecticut's diesel reduction initiatives and ongoing efforts to modernize nonroad equipment. In addition to GHG emissions reductions, this measure improves local air quality, reduces noise pollution, and delivers public health benefits to nearby communities.

⁹³ Values are inclusive of level 1 and level 2 charges installed at single family and multi-unit dwellings, private workplace level 2, public level 2, and public DCFC charges.

⁹⁴ Atlas Public Policy. (n.d.). *Evaluate CT*. Retrieved from <https://atlaspolicy.com/public/evaluatect>

Geographic Location

Statewide.

GHG Mitigation Potential

Table 41 provides the emissions reduction potential from nonroad transportation decarbonization from 2025 through 2050.

Table 41. Measure 3 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.00	0.80	0.98	1.10	1.22

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DOT and CT Port Authority
- Municipalities
- COGs
- Tribal Nations

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP has broad authority under CGS § 22a.174 to prevent, control, and abate air pollution from mobile sources, including nonroad and off-road engines and equipment. CGS 22a.201d also authorizes CT DEEP to establish and administer grant programs to reduce diesel emissions by funding zero-emission and low-emission equipment, including associated infrastructure. CGS §§ 13b grants CT DOT authority over railroads and railways and state port and marine terminal facilities. This section offers CT DOT limited regulatory authority over railroads on both public and private rail properties in Connecticut, but large swaths are pre-empted by Federal regulations. CGS Chapter 264a – Connecticut Port Authority § 15-3li. Memorandum of understanding with the Department of Transportation and the Treasurer transferred ownership of ports and harbors to the CT Port Authority.

Municipalities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and developing incentive-based programs, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 42. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 42. Cumulative Net Adoption Costs for Measure 3

Cost	2025-2050
Nonroad Low Carbon Fuels	\$\$
Port Decarbonization	\$\$
Sustainable Aviation Fuels	\$\$\$
Passenger Rail Electrification	\$\$\$
Freight Rail Low Carbon Fuels	\$\$

Potential Funding Sources

Table 43 summarizes potential funding sources identified for activities under this measure.

Table 43. Potential Funding Sources for Measure 3

Funding Source	Funding Focus Related to Measure
Federal	FAA ZEV Program
	Electric maintenance equipment and charging station for Tweed-New Haven Airport (HVN)
	FRA NEC Funding
	Railroad improvements, including catenary structures used by electric trains
	Carbon Reduction Program (CRP)
	Transit emissions reduction; train and rail improvement projects
	EPA Clean Ports Program
	Electric equipment, charging infrastructure, and renewable energy storage systems for port operations
Other	Volkswagen Settlement's Environmental Mitigation Trust
	Abatement of diesel emissions through on-road and nonroad vehicle and equipment replacement

Implementation Schedule and Milestones

Table 44 provides activity milestones for nonroad transportation decarbonization for 2030, 2040, and 2050.

Table 44. Activity Milestones for Measure 3

Activity	2030	2040	2050
Share of SAF consumption over total jet fuel consumption ⁹⁵	0%	99.7%	90%

⁹⁵ The percentage of SAF in the jet fuel supply varies over time as total jet fuel consumption grows faster than SAF production. Although absolute SAF production increases through 2050, it does not keep pace with overall demand growth.

Activity	2030	2040	2050
Share of renewable diesel in offroad equipment	0%	50%	100%
Percent of renewable diesel consumption in offroad equipment	0%	12%	29%
Percent of renewable diesel consumption in freight rail	0%	26%	100%
Percent of diesel locomotives electrified	0%	67%	100%
Percent of diesel ferries electrified	10%	100%	100%

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Amount of SAF used at local airports
- ✓ Number of ferries electrified
- ✓ Miles of rail track electrified
- ✓ Number of low-carbon freight rail
- ✓ Number of low-carbon fuel nonroad equipment

Measure 4: Increase energy efficiency in existing residential and commercial buildings.

This measure aims to improve energy efficiency in existing residential and commercial buildings through energy-saving retrofit and upgrade programs. It builds on Connecticut's long-standing efficiency programs including utility-administered initiatives. Beyond reducing GHG emissions, this measure lowers energy bills, improves indoor comfort, reduces peak electricity demand, and enhances building performance and affordability.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 45 provides the emissions reduction potential from increased energy efficiency in existing residential and commercial buildings from 2025 through 2050.

Table 45. Measure 4 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.18	0.46	0.86	1.16	1.40

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP
- Municipalities/ Municipal Utilities

- Tribal Nations
- Investor-Owned Utilities

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP is currently authorized to administer programs that can support increased energy efficiency in existing buildings, if energy efficiency meets the statutory program criteria. DEEP's related authority in this area generally falls under the following chapters of the Connecticut General Statutes: Chapter 446c - Air Pollution Control, Chapter 283 - Telephone, Gas, Power and Water Companies, Chapter 295 - Energy Planning, and Chapter 298 - Energy Utilization and Conservation. The specific authority for each current state funding program or guiding plan is included in the funding Table 47 below. CT DEEP is also authorized to administer federal funds that can support energy efficiency. CT DEEP is authorized to review and approve a plan for energy efficiency and market transformation electrification programs that provide system benefits

CT DEEP is authorized to conduct planning that guides program and policy implementation across the agency that could support increased energy efficiency in existing buildings including the following plan:

- Comprehensive Energy Strategy (CGS § 16a-3d) that examines future energy needs in the state and identifies opportunities to reduce costs for ratepayers, ensure reliable energy availability, and mitigate public health and environmental impacts of Connecticut's energy use, such as greenhouse gas (GHG) emissions and emissions of criteria air pollutants.

Municipalities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and developing incentive-based programs that promote electric readiness or expedite permitting for projects that achieve green building certifications, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 46. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 46. Cumulative Net Adoption Costs for Measure 4

Cost	2025-2050
Increase energy efficiency in existing residential and commercial buildings	\$

Potential Funding Sources

Table 47 summarizes potential funding sources identified for activities under this measure.

Table 47. Potential Funding Sources for Measure 4

Funding Source		Funding Focus Related to Measure
Federal	Home Energy Rebates–Efficiency & Electrification & Home Electrification and Appliances Rebate	Energy efficiency and electrification rebates for homes
	New England Heat Pump Accelerator CPRG Implementation Grant	Residential heat pumps
	DOE Weatherization Assistance Program	Increase energy efficiency of homes owned or occupied by low-income persons, reduce total residential energy expenditures, and improve health and safety
State	Housing Environmental Improvement Revolving Loan and Grant Fund (CGS § 8-240a)	Energy efficiency upgrades/retrofits in single-family and multi-family homes
Other	Regional Greenhouse Gas Initiative (RGGI) (CGS § 22a-200c)	Energy efficiency initiatives, renewable energy projects, energy bill rebates
	Conservation & Load Management Plan/Ratepayer Funds collected on electric and/or natural gas bills (CGS § 16-245m)	Energy efficiency and demand management programs for residences and businesses, in-home energy assessments, energy efficiency upgrades, heat pumps, and renewable energy for residential and commercial buildings

Implementation Schedule and Milestones

Table 48 provides activity milestones for increased energy efficiency in existing residential and commercial buildings for 2030, 2040, and 2050.

Table 48. Activity Milestones for Measure 4

Activity	2030	2040	2050
Number of residential homes with building shell improvements installed annually ⁹⁶	18,808	37,561	41,977
Number of smart thermostats installed annually in residential homes ⁹⁷	11,364	27,253	30,250

⁹⁶ Building shell improvements is defined as sufficient building envelop improvements to meet DEEP's draft weatherization definition as described in [Evaluation R2029](#).

⁹⁷ In 2026, state energy efficiency programs plan to install about 20,000 smart thermostats.

Activity	2030	2040	2050
Portion of commercial building space with a new smart thermostat installed since 2026	8%	33%	79%
Portion of commercial building space with upgraded envelope (e.g., wall insulation, roof insulation, new windows) since 2026	5%	18%	31%
Portion of commercial building space with a new hybrid air source heat pump installed since 2026	2%	14%	37%
Portion of commercial building space with lighting controls installed since 2026	4%	18%	38%

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Number of households and commercial buildings weatherized per year
- ✓ Net energy savings from incentivized energy and load reduction measures
- ✓ Number of energy audits completed
- ✓ Amount of funding distributed for weatherization and efficiency programs (state and federal)

Measure 5: Increase electrification in existing residential and commercial buildings.

This measure aims to increase electrification in existing buildings by supporting the transition from fossil fuel equipment and systems to efficient electric technologies. It builds on Connecticut's existing electrification incentives and clean heating and cooling programs. In addition to reducing GHG emissions, this measure improves indoor air quality, enhances building safety, and can increase resilience when paired with energy efficiency and distributed energy resources.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 49 provides the emissions reduction potential from increased electrification in existing residential and commercial buildings from 2025 through 2050.

Table 49. Measure 5 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.45	1.31	2.63	4.20	5.92

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP
- Municipalities

- COGs
- Tribal Nations
- Utilities

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP is currently authorized to administer programs that could support increased electrification in existing buildings, if electrification meets the program criteria such as providing an energy efficiency benefit. DEEP's related authority in this area generally falls under the following chapters of the Connecticut General Statutes: Chapter 446c - Air Pollution Control, Chapter 283 - Telephone, Gas, Power and Water Companies, Chapter 295 - Energy Planning, and Chapter 298 - Energy Utilization and Conservation. The specific authority for each current state funding program is included in the funding Table 51 below. CT DEEP is also authorized to administer federal funds that can support electrification.

CT DEEP is authorized to conduct planning that guides program and policy implementation across the agency that could support increased electrification in existing buildings including the following plans:

- Comprehensive Energy Strategy (CGS § 16a-3d) that examines future energy needs in the state and identifies opportunities to reduce costs for ratepayers, ensure reliable energy availability, and mitigate public health and environmental impacts of Connecticut's energy use, such as GHG emissions and emissions of criteria air pollutants; and
- Heat Pump Plan (CGS § 16a-40n) for the installation of efficient heat pumps for affordable heating and cooling systems in the state.

Municipalities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and developing incentive-based programs that promote electric readiness, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 50. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 50. Cumulative Net Adoption Costs for Measure 5

Cost	2025-2050
Increase electrification in existing residential and commercial buildings	\$\$\$

Potential Funding Sources

Table 51 summarizes potential funding sources identified for activities under this measure.

Table 51. Potential Funding Sources for Measure 5

Funding Source		Funding Focus Related to Measure
Federal	Home Energy Rebates–Efficiency & Electrification & Home Electrification and Appliances Rebate	Energy efficiency and electrification rebates for homes
	New England Heat Pump Accelerator CPRG Implementation Grant	Residential heat pumps
State	Heat Pump State Bond Funds (Public Act 25-174)	Authorized \$25 million in state bond funds for supporting the cost-effective deployment of heat pumps for thermal needs throughout the state
Other	Ratepayer Funds collected on electric and/or natural gas bills / Conservation & Load Management Program (CGS § 16-245m)	Energy efficiency and demand management programs for residences and businesses, in-home energy assessments, energy efficiency upgrades, heat pumps, and renewable energy for residential and commercial
	Connecticut Green Bank Clean Energy Financing and Incentives (CGS § 16-245n)	Home energy & resilience upgrades, energy storage, and C-PACE
	Regional Greenhouse Gas Initiative (RGGI) (CGS § 22a-200c)	Energy efficiency initiatives, renewable energy projects, energy bill rebates

Implementation Schedule and Milestones

Table 52 provides activity milestones for increased electrification in existing residential and commercial buildings for 2030, 2040, and 2050.

Table 52. Activity Milestones for Measure 5

Activity	2030	2040	2050
Number of induction and electric resistance range installed annually in residential homes	5,841	14,582	22,224
Number of air-source heat pumps installed annually in residential homes	20,500	40,828	45,537
Number of ground-source heat pumps installed annually in residential homes	275	574	672
Number of heat pump water heaters installed annually in residential homes	21,280	64,161	86,316

Activity	2030	2040	2050
Portion of commercial building space with new electric kitchen equipment installed since 2026	4%	24%	70%
Portion of commercial building space with new air-source heat pumps installed since 2026	5%	25%	70%
Portion of commercial building space with new ground-source heat pumps installed since 2026	1%	2%	4%
Portion of commercial building space with new hot water air-source heat pumps installed since 2026	3%	30%	84%

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Market share of electrified systems compared to fossil fuel systems
- ✓ Number of households and commercial buildings electrified per year
- ✓ Amount of funding distributed for electric appliance and equipment rebates or incentives (state and federal)

Measure 6: Maximize energy efficiency in new residential and commercial buildings.

This measure aims to achieve high levels of energy efficiency in new residential and commercial construction. It builds on Connecticut's adoption of increasingly stringent building energy codes aligned with national standards, as well as existing incentive and technical assistance programs for high-performance buildings. Co-benefits include improved indoor comfort, reduced operating costs, and reduced energy demand.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 53 provides the emissions reduction potential from maximizing energy efficiency in new residential and commercial buildings from 2025 through 2050.

Table 53. Measure 6 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.00	0.00	0.01	0.01	0.02

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP
- Municipalities
- Tribal Nations

- Utilities

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP is currently authorized to administer programs that could support maximizing energy efficiency in new buildings, if such actions meet the statutory program criteria. DEEP's related authority in this area generally falls under the following chapters of the Connecticut General Statutes: Chapter 446c-Air Pollution Control, Chapter 283-Telephone, Gas, Power and Water Companies, Chapter 295-Energy Planning, and Chapter 298-Energy Utilization and Conservation. The specific authority for each current state funding program is included in the funding Table 55 below. CT DEEP is also authorized to administer federal funds that can support energy efficiency in new buildings. The State Building Inspector and Codes and Standards Committee is required to adopt the latest model building code within 18 months of release under the following Connecticut General Statute: Title 29-Public Safety and State Police, Chapter 541-Building, Fire and Demolition Codes. Fire Marshals and Fire Hazards. Safety of Public and Other Structures, Section 29-252.

CT DEEP is authorized to conduct planning that guides program and policy implementation across the agency that could support maximized energy efficiency in new buildings including the following plan:

- Comprehensive Energy Strategy (CGS § 16a-3d) that examines future energy needs in the state and identifies opportunities to reduce costs for ratepayers, ensure reliable energy availability, and mitigate public health and environmental impacts of Connecticut's energy use, such as greenhouse gas (GHG) emissions and emissions of criteria air pollutants.

Municipalities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and developing incentive-based programs that promote electric readiness or expedite permitting for projects that achieve green building certifications, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 54. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 54. Cumulative Net Adoption Costs for Measure 6

Cost	2025-2050
Maximize energy efficiency in new residential and commercial buildings.	\$

Potential Funding Sources

Table 55 summarizes potential funding sources identified for activities under this measure.

Table 55. Potential Funding Sources for Measure 6

Funding Source		Funding Focus Related to Measure
Federal	Home Energy Rebates–Home Electrification and Appliances Rebate	Energy efficiency and electrification rebates for homes
Other	Regional Greenhouse Gas Initiative (RGGI) (CGS § 22a-200c)	Energy efficiency initiatives, renewable energy projects, energy bill rebates
	Ratepayer Funds collected on electric and/or natural gas bills / Conservation & Load Management Program (CGS § 16a-245m)	Energy efficiency and electrification technical support and financial incentives, demand management programs for residences and businesses

Implementation Schedule and Milestones

Table 56 provides activity milestones for maximizing energy efficiency in new residential and commercial buildings for 2030, 2040, and 2050.

Table 56. Activity Milestones for Measure 6

Activity	2030	2040	2050
Cumulative number of smart thermostats installed in new residential homes since 2026	6,169	14,274	24,387

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Number of new buildings constructed to high efficiency standards
- ✓ Net energy savings from incentivized energy and load reduction measures
- ✓ EUI per square foot of new construction
- ✓ Number of new construction projects exceeding minimum code requirements

Measure 7: Maximize electrification in new residential and commercial buildings.

This measure aims to maximize electrification in new buildings through initiatives that support efficient electric technologies for space heating, water heating, and cooking. This measure supports Connecticut's clean energy goals and building policies by avoiding future emissions from fossil fuel systems. In addition to GHG reductions, this measure improves indoor air quality, reduces long-term costs, and supports resilience when combined with clean energy and storage.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 57 provides the emissions reduction potential from maximizing electrification in new residential and commercial buildings from 2025 through 2050.

Table 57. Measure 7 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.000	0.000	0.001	0.001	0.002	0.003

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP
- Municipalities
- COGs
- Tribal Nations
- Utilities

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP is currently authorized to administer programs that could support maximizing electrification in new buildings, if such actions meet the statutory program criteria. DEEP's related authority in this area generally falls under the following chapters of the Connecticut General Statutes: Chapter 446c-Air Pollution Control, Chapter 283-Telephone, Gas, Power and Water Companies, Chapter 295-Energy Planning, and Chapter 298-Energy Utilization and Conservation. The specific authority for each current state funding program is included in the funding Table 59 below. CT DEEP is also authorized to administer federal funds that can support electrification in new buildings. CGS § 16a-38k provides authority for designing and implementing high performance building standards for state facilities. CGS § 29-252 states that the purpose of the state building code shall include promoting and ensuring that such buildings and structures are designed and constructed in such a manner as to conserve energy and, wherever practicable, facilitate the use of renewable energy resources.

CT DEEP is authorized to conduct planning that guides program and policy implementation across the agency that could support maximized electrification in new buildings including the following plans:

- Comprehensive Energy Strategy (CGS § 16a-3d) that examines future energy needs in the state and identifies opportunities to reduce costs for ratepayers, ensure reliable energy availability, and mitigate public health and environmental impacts of Connecticut's energy use, such as greenhouse gas (GHG) emissions and emissions of criteria air pollutants; and
- Heat Pump Plan (CGS § 16a-40n) for the installation of efficient heat pumps for affordable heating and cooling systems in the state.

Municipalities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and developing incentive-based programs that promote electric readiness, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 58. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 58. Cumulative Net Adoption Costs for Measure 7

Cost	2025-2050
Maximize electrification in new residential and commercial buildings.	\$

Potential Funding Sources

Table 59 summarizes potential funding sources identified for activities under this measure.

Table 59. Potential Funding Sources for Measure 7

Funding Source		Funding Focus Related to Measure
Federal	Home Energy Rebates–Home Electrification and Appliances Rebate	Energy efficiency and electrification rebates for homes
State	Heat Pump State Bond Funds (Public Act 25-174))	Authorized \$25 million in state bond funds for supporting the cost-effective deployment of heat pumps for thermal needs throughout the state
Other	Regional Greenhouse Gas Initiative (RGGI) (CGS § 22a-200c)	Energy efficiency initiatives, renewable energy projects, energy bill rebates
	Ratepayer Funds collected on electric and/or natural gas bills / Conservation & Load Management Program (CGS § 16a-245m)	Energy efficiency and electrification technical support and financial incentives, demand management programs for residences and businesses

Implementation Schedule and Milestones

Table 60 provides activity milestones for maximizing electrification in new residential and commercial buildings for 2030, 2040, and 2050.

Table 60. Activity Milestones for Measure 7

Activity	2030	2040	2050
Number of induction and electric resistance range installed annually in new residential homes ⁹⁸	562	700	1,011
Number of air-source heat pumps installed annually in new residential homes	522	651	940
Number of ground-source heat pumps installed annually in new residential homes	39	49	71
Number of heat pump water heaters installed annually in new residential homes	562	700	1,011

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Number of new residential units built to all-electric standards
- ✓ Number and type of heat pumps installed in new residential and commercial buildings

Measure 8: Expand grid-scale clean energy resources.

This measure aims to expand grid-scale clean energy resources, including large-scale renewable generation and energy storage, to meet Connecticut's statutory clean energy goals. It builds on existing procurement programs and regional clean energy initiatives to reach a net-zero grid by 2040. Co-benefits include increased grid reliability, enhanced resilience during extreme weather events, reduced exposure to volatile fuel prices, and support for in-state clean energy jobs.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 61 provides the emission reduction potential from the expansion of grid-scale clean energy resources from 2025 through 2050. In the near term, electrification increases electricity demand and slightly increases power sector emissions; over time, as the grid becomes cleaner, lower-carbon electricity enables net emissions reductions even as electrification expands.

Table 61. Measure 8 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	(0.04)	(0.14)	(0.30)	2.10	2.29	2.28

⁹⁸ Based on 2025 new construction energy efficiency program results in Connecticut, the 2030 values shown in this table are likely already being achieved. In 2025, the C&LM new construction program supported 4,923 new all electric residential units getting built.

Key Implementing Agencies

- State agencies or quasi-public agencies, including the CT DEEP
- Municipalities
- COGs
- Tribal Nations

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP's related authority to expanding grid-scale clean energy sources generally falls under the following chapters of the Connecticut General Statutes: Chapter 446c-Air Pollution Control, Chapter 283-Telephone, Gas, Power and Water Companies, Chapter 295-Energy Planning, and Chapter 298-Energy Utilization and Conservation. The specific authority for each current state funding program is included in the funding Table 63 below. CT DEEP has authority to conduct and oversee procurement of renewable energy resources and zero-carbon electricity generating resources in Chapter 295-Energy Planning. CT DEEP is also authorized to administer federal funds that can support grid-scale clean energy. PURA provides regulatory oversight of the utilities for implementation of energy programs, procurements, and grid investments.

CT DEEP is authorized to conduct planning that guides program and policy implementation across the agency that could support expanded grid-scale clean energy resources including the following plans:

- Comprehensive Energy Strategy (CGS § 16a-3d) that examines future energy needs in the state and identifies opportunities to reduce costs for ratepayers, ensure reliable energy availability, and mitigate public health and environmental impacts of Connecticut's energy use, such as greenhouse gas (GHG) emissions and emissions of criteria air pollutants; and
- Integrated Resources Plan (CGS § 16a-3a) that includes an assessment of the future electric needs and a plan to meet those future needs. It is "integrated" in that it looks at both demand side (conservation, energy efficiency, etc.) resources as well as the more traditional supply side (generation/power plants, transmission lines, etc.) resources in making its recommendations on how best to meet future electric energy needs in the state.

Municipalities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and developing incentive-based programs, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 62. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario. The cost assumptions are heavily dependent on many variables including but not limited to federal programs, inflation, and cost of materials.

Table 62. Cumulative Net Adoption Costs for Measure 8

Cost	2025-2050
Expand grid-scale clean energy resources	\$\$\$

Potential Funding Sources

Table 63 summarizes potential funding sources identified for activities under this measure.

Table 63. Potential Funding Sources for Measure 8

Funding Source		Funding Focus Related to Measure
Federal	Grid Resilience State/Tribe Formula Grant Program	Grid modernization, power grid resilience
	Grid Resilience and Innovation Partnership (GRIP) – Grid Innovation Program (GIP)	Grid flexibility and resilience
Other	Regional Greenhouse Gas Initiative (RGGI) (CGS § 22a-200c)	Renewable energy projects
	Ratepayer funds collected on electric bills/ Solicitation of Class I renewable energy resources and zero carbon electricity generating resources (CGS § 16a-3f, 16a-3g, 16a-3h, 16a-3j, 16a-3m, 16a-3n, 16a-3p)	DEEP procurement of grid-scale clean energy projects to meet the state’s electric supply needs

Implementation Schedule and Milestones

Table 64 provides activity milestones for the expansion of grid-scale clean energy resources for 2030, 2040, and 2050.

Table 64. Activity Milestones for Measure 8

Activity	2030	2040	2050
Installed offshore wind capacity (MW)	304	304	777
Installed onshore wind and solar capacity (MW)	662	1,065	2,939
Installed nuclear capacity (MW)	2,102	2,469	3,302
Percentage of in-state generation from clean energy sources	58%	100%	100%

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ MW of offshore wind capacity procured and operational

- ✓ MW of grid-scale renewable and clean energy capacity installed
- ✓ Percentage of in-state resources that are zero-carbon
- ✓ Percent of retail sales served by clean energy resources

Measure 9: Deploy distributed clean energy resources.

This measure aims to increase deployment of cost-effective distributed clean energy resources, such as rooftop solar, distributed wind, energy storage, and microgrids through incentives and financing programs. It builds on Connecticut's existing distributed generation and net metering programs. Beyond GHG reductions, this measure improves energy security, enhances resilience during outages, lowers energy costs for participants, and supports localized economic development.

Geographic Location

Statewide.

GHG Mitigation Potential

As the BAU projections for distributed solar were based on the CELT 2025 Load Forecast, which showed significant growth in distributed solar for the state, no additional distributed solar was assumed beyond the BAU levels and therefore there are no GHG reductions associated with this measure in the mitigation pathway.

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP and Connecticut Green Bank
- Municipalities
- COGs
- Tribal Nations
- Utilities

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP's related authority to deploying distributed clean energy sources generally falls under the following chapters of the Connecticut General Statutes: Chapter 446c - Air Pollution Control, Chapter 283 - Telephone, Gas, Power and Water Companies, Chapter 295 - Energy Planning, and Chapter 298 - Energy Utilization and Conservation. The specific authority for each current state funding program is included in the funding Table 65 below. CT DEEP is also authorized to administer federal funds that can support deployment of distributed clean energy resources. PURA provides regulatory oversight of the utilities for implementation of energy programs, procurements, and grid investments. The Connecticut Green Bank was established under CGS § 16-245n and authorized to use public funds to finance and facilitate clean energy projects.

PURA has the authority under CGS § 16-244dd to select CT DEEP, Connecticut Green Bank, electric distribution companies (utilities), and/or other third parties to implement a non-residential renewable energy program, a residential renewable energy program, and a shared clean energy facility program.

CT DEEP is authorized to conduct planning that guides program and policy implementation across the agency that could support deployed distributed clean energy resources including the following plan:

- Comprehensive Energy Strategy (CGS § 16a-3d) that examines future energy needs in the state and identifies opportunities to reduce costs for ratepayers, ensure reliable energy availability, and mitigate

public health and environmental impacts of Connecticut's energy use, such as greenhouse gas (GHG) emissions and emissions of criteria air pollutants.

Municipalities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and developing incentive-based programs, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Costs

Not applicable.⁹⁹

Potential Funding Sources

Table 65 summarizes potential funding sources identified for activities under this measure.

Table 65. Potential Funding Sources for Measure 9

Funding Source		Funding Focus Related to Measure
Federal	Grid Resilience State/Tribe Formula Grant Program	Grid modernization, power grid resilience
State	DEEP's Microgrid and Resilience Grant and Loan Program (CGS § 16-243y)	Local distributed energy generation for critical facilities
Utility	Residential Renewable Energy Solutions Program (CGS § 16-244z)	Compensation for residents for power produced from residential distributed generation systems and Renewable Energy Certificates
	Non-Residential Renewable Energy Solutions Program (CGS § 16-244z)	Compensation for non-residential owners for power produced from distributed energy resources provided to the electric grid
	Statewide Shared Clean Energy Facility (SCEF) Program (CGS § 16-244z)	Provides locally generated, renewable, low-carbon clean energy available to selected customers who are income-eligible or who cannot install solar on their home
Other	Connecticut Green Bank Smart-e Loan Program (CGS § 16-245n)	Low-interest financing for renewable energy home improvements
	Energy Storage Solutions Program (CGS § 16-243ee)	Provides residential and commercial customers with incentives to install energy storage at their home or business and to use energy storage to the benefit of the grid and electric customers

⁹⁹ No incremental costs are shown for this measure as distributed solar deployment is fully captured in the BAU scenario based on the CELT forecast. These installations primarily represent customer-sited investments, with upfront costs borne by participating households and businesses and offset over time through energy savings and resilience benefits.

Funding Source	Funding Focus Related to Measure
Regional Greenhouse Gas Initiative (RGGI) (CGS § 22a-200c)	Renewable energy projects

Implementation Schedule and Milestones

Table 66 provides activity milestones for increased deployment of distributed clean energy resources based on the 2025 ISONE CELT Load Forecast, which includes projections through 2034.

Table 66. Activity Milestones for Measure 9

Activity	2025	2030	2034
Installed behind the meter PV capacity, nameplate rating (MW)	1,125	1,966	2,551

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ MW of distributed solar capacity installed annually
- ✓ Number of community/shared solar projects implemented
- ✓ Number of EVs participating in V2G programs
- ✓ Number of homes and businesses with battery storage systems
- ✓ Number of microgrids developed for critical facilities (schools, hospitals, emergency shelters)

Measure 10: Decarbonize industrial processes through energy efficiency, electrification, and low-carbon fuels.

This measure aims to reduce GHG emissions from industrial processes by improving energy efficiency, electrifying where feasible, and deploying low-carbon fuels and technologies. It builds on existing state energy programs to increase efficiency and decarbonize equipment and systems and identifies funding and technical assistance opportunities. In addition to emissions reductions, this measure improves industrial competitiveness, lowers operating costs, and supports workforce development.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 67 provides the emissions reduction potential from the decarbonization of industrial processes from 2025 through 2050.

Table 67. Measure 10 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.52	0.92	1.00	1.18	1.34

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP and Connecticut Green Bank
- Industrial facility owners and operators
- Utilities

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP has the authority to regulate, permit, limit, and prohibit air pollution statewide, including adopting emissions standards, issuing permits, enforcing compliance, and implementing market-based programs pursuant to CGS §§ 22a170 through 22a191, with core authority established in CGS § 22a174. CT DEEP also has the authority to implement clean energy and energy efficiency programs and can incorporate decarbonization strategies into future energy strategies at the state level. The Connecticut Green Bank was established under CGS § 16-245n and authorized to use public funds to finance and facilitate clean energy projects. The specific authority for each current state funding program is included in the funding Table 69 below.

Private companies and operators may implement energy efficiency upgrades, process improvements, fuel switching, and renewable energy use through voluntary or incentive-based programs.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 68. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 68. Cumulative Net Adoption Costs for Measure 10

Cost	2025-2050
Decarbonize industrial processes through energy efficiency, electrification, and low-carbon fuels	\$\$

Potential Funding Sources

Table 69 summarizes potential funding sources identified for activities under this measure.

Table 69. Potential Funding Sources for Measure 10

Funding Source		Funding Focus Related to Measure
Other	Regional Greenhouse Gas Initiative (RGGI) (CGS § 22a-200c)	Energy efficiency initiatives, renewable energy projects
	C-PACE CT Green Bank Financing (CGS § 16-245n)	Commercial/industrial energy efficiency upgrades and renewable energy systems financing

Funding Source	Funding Focus Related to Measure
Ratepayer Funds collected on electric and/or natural gas bills / Conservation & Load Management Program (CGS § 16a-245m)	Energy efficiency and demand management for businesses, including industrial process improvements, electrification readiness, renewable energy for commercial buildings, and heat pump adoption

Implementation Schedule and Milestones

Table 70 provides activity milestones for the decarbonization of industrial processes for 2030, 2040, and 2050.

Table 70. Activity Milestones for Measure 10

Activity	2030	2040	2050
Annual natural gas consumption by industry (MMBTU)	17,043,487	12,343,862	8,348,566
Percent of low carbon fuels used in industry (hydrogen and RNG) ¹⁰⁰	19%	36%	59%

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Number of industrial facilities participating in energy efficiency, electrification or low-carbon fuel programs
- ✓ Natural gas consumption by industrial facilities
- ✓ Adoption of low-carbon fuels at industrial facilities
- ✓ Participation in federal industrial decarbonization programs

Measure 11: Expand carbon capture, utilization, and storage (CCUS) at industrial facilities.

This measure focuses on deploying CCUS technologies at industrial facilities to reduce emissions from energy-intensive processes that rely on fossil fuels or biomass. While Connecticut currently has limited CCUS deployment, this measure would advance pilot projects and technology integration. Co-benefits include preserving industrial activity while reducing emissions, creating clean technology jobs, and positioning the state as a leader in emerging decarbonization solutions.

Geographic Location

Statewide.

¹⁰⁰ In early projection years, nearly all of the low carbon fuels are allocated towards industrial processes. The state's low natural gas usage for industrial processes (~13% of total state usage) combined with this allocation strategy leads to a relatively higher value for low carbon fuels as a percentage of total gas usage. The total low carbon fuel percentage value on an economy-wide level for the state in 2030 is 4%.

GHG Mitigation Potential

Table 71 provides the emissions reduction potential from expanding CCUS technologies at industrial facilities from 2025 through 2050.

Table 71. Measure 11 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.00	0.02	0.09	0.14	0.16

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP and Connecticut Green Bank
- Industrial facility owners and operators
- Academic institutions

Authority to Implement and Milestones to Obtain Implementation Authority

This measure will primarily rely on incentives, voluntary programs, and partnerships between different authorities and CT DEEP. Industrial facility owners can collaborate with DEEP to launch these programs and install CCUS technologies. Implementation of this measure would rely on voluntary adoption by industrial facility owners, supported by state-led incentives, technical assistance, and partnerships coordinated by CT DEEP. Industrial facilities would be responsible for evaluating, piloting, and deploying CCUS technologies as part of site-specific decarbonization strategies. CT DEEP can support implementation through program design, convening, and alignment with federal funding opportunities, while coordination with federal agencies, green banks, and other financing entities can provide capital support and risk reduction for early projects.

Technology providers, project developers, and research institutions can support feasibility analysis, pilot demonstrations, workforce development, and knowledge sharing to advance CCUS deployment. As with industrial electrification measures, successful implementation depends on facility-level investment decisions enabled by public incentives and technical support, rather than direct state ownership or operation of infrastructure.

Academic institutions can provide technical assistance and education to support implementing this measure in the community. The specific authority for each current state funding program is included in the funding Table 73 below.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 72. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 72. Cumulative Net Adoption Costs for Measure 11

Cost	2025-2050
Expand CCUS at industrial facilities	\$\$

Potential Funding Sources

Table 73 summarizes potential funding sources identified for activities under this measure.

Table 73. Potential Funding Sources for Measure 11

Funding Source		Funding Focus Related to Measure
Federal	Federal 45Q tax credit under the IRA	CCUS credits
	DOE Loan–Industrial Decarbonization Projects	Large-scale industrial decarbonization project loans
	48C Advance Manufacturing Tax Credit	Industrial facility retrofits credits and decreased carbon intensity credits
Other	CT Green Bank (CGS § 16-245n)	Development of carbon-neutralizing technologies investments

Implementation Schedule and Milestones

Table 74 provides activity milestones for expanding CCUS technologies at industrial facilities for 2030, 2040, and 2050.

Table 74. Activity Milestones for Measure 11

Activity	2030	2040	2050
Annual industrial sector CO ₂ reductions from CCUS	-	12%	32%

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Number of CCUS projects implemented
- ✓ Tons of CO₂ captured and stored or utilized by CCUS technologies
- ✓ Number of research pilot projects completed

Measure 12: Reduce emissions from the disposal of organic solid waste.

This measure aims to reduce emissions from organic waste disposal by expanding composting, food scrap collection, and other organic diversion programs. It builds on Connecticut’s existing waste reduction and

circular economy initiatives. In addition to lowering methane emissions, this measure reduces disposal costs, creates compost products, supports local agriculture, and increases public awareness of waste reduction.

Geographic Location

Statewide.

GHG Mitigation Potential

The waste sector GHG reduction measures modeled for this CCAP are assumed to only result in the reduction of emissions from waste that is exported and treated outside of Connecticut. Emissions from waste that is treated outside the state are considered Scope 3 emissions and are not included within the state's inventory boundary, which only captures Scope 1 waste sector emissions. Since the reductions quantified in this CCAP are relative to the state's baseline inventory (i.e., Scope 1 emissions), there are no Scope 1 GHG emissions reductions associated with Measure 12. Scope 3 GHG emissions reductions were calculated for reference. The Scope 3 emissions reduction potential for Measure 12 (in MTCO₂e) are 2,610 in 2030, 36,381 in 2040, and 70,827 in 2050.

Key Implementing Agencies

- State agencies or quasi-public agencies, including the CT DEEP and the Connecticut Department of Economic and Community Development (CT DECD)
- Municipalities
- Regional waste authorities
- COGs
- Nonprofit organizations and community groups
- Food recovery and redistribution programs

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP has authority under CGS § 22a208 over solid waste management, including planning, regulation, permitting, and enforcement. This authority applies to recycling, composting, anaerobic digestion, and other organics processing. CGS § 22a228(b) establishes Connecticut's integrated waste management hierarchy, which prioritizes source reduction, reuse, recycling, and composting over waste disposal. CGS § 22a226e authorizes and directs DEEP to implement and enforce a statewide program requiring large generators of food scraps and other source-separated organic materials to reduce, donate, or recycle organics through composting, anaerobic digestion, or similar processing. The specific authority for each current state funding program is included in the funding Table 76 below.

Municipalities, regional waste authorities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and adopting local policies and ordinances, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Nonprofit organizations and community groups may implement their own programs and initiatives (e.g., food recovery and redistribution programs).

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 75. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 75. Cumulative Net Adoption Costs for Measure 12

Cost	2025-2050
Reduce emissions from the disposal of organic solid waste.	\$\$

Potential Funding Sources

Table 76 summarizes potential funding sources identified for activities under this measure.

Table 76. Potential Funding Sources for Measure 12

Funding Source		Funding Focus Related to Measure
Federal	CFWR Cooperative Agreements	Composting and food waste-reduction planning
State	Sustainable Materials Management Grant Program (CGS § 16-244bb)	Development of food scrap collection and unit-based pricing programs, and other reduction, recycling, and diversion programs
Other	Sustainable Connecticut	Technical and financial assistance

Implementation Schedule and Milestones

Table 77 provides activity milestones for reducing emissions from the disposal of organic solid waste for 2030, 2040, and 2050.

Table 77. Activity Milestones for Measure 12

Activity	2030	2040	2050
Increase in the amount of organic waste diverted annually from disposal relative to 2023 (tons)	37,000	428,000	857,000

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Tons of organic waste generated and diverted through composting

- ✓ Tons of food waste generated and composted
- ✓ Number of municipal and regional composting facilities established or expanded
- ✓ Number of waste diversion programs created
- ✓ Participation rate in residential and commercial organics recycling programs

Measure 13: Reduce emissions from the disposal of non-organic solid waste.

This measure aims to reduce emissions from landfilling and incineration of non-organic solid waste by increasing recycling, reuse, and material recovery. It builds on Connecticut's existing recycling policies to increase diversion. Co-benefits include reduced waste disposal costs, strengthened recycling markets, and job creation in materials management sectors.

Geographic Location

Statewide.

GHG Mitigation Potential

The waste sector GHG reduction measures modeled for this CCAP are assumed to only result in the reduction of emissions from waste that is exported and treated outside of Connecticut. Emissions from waste that is treated outside the state are considered Scope 3 emissions and are not included within the state's inventory boundary, which only captures Scope 1 waste sector emissions. Since the reductions quantified in this CCAP are relative to the state's baseline inventory (i.e., Scope 1 emissions), there are no GHG emissions reductions associated with Measure 13. Scope 3 GHG emissions reductions were calculated for reference. The Scope 3 emissions reduction potential for Measure 13 (in MTCO₂e) are 1,084 in 2030, 15,115 in 2040, and 29,426 in 2050.

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP
- Local governments and regional waste authorities
- Private sector partners
- Waste haulers
- Nonprofit and grassroots organizations

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP has authority under CGS § 22a-208 over solid waste management, including planning, regulation, permitting, and enforcement. This authority applies to recycling, composting, anaerobic digestion, and other organics processing. CGS § 22a-228(b) establishes Connecticut's integrated waste management hierarchy, which prioritizes source reduction, reuse, recycling, and composting over waste disposal. CGS § 22a-241b authorizes CT DEEP to require source separation and recycling of designated recyclable materials, establish recycling requirements for municipalities and generators, and adopt implementing regulations. CGS § 22a-241 also establishes a municipal solid waste recycling program and authorizes municipalities to require source separation of recyclables, operate local recycling programs, purchase or lease collection equipment, and expand recycling services for residents and businesses, consistent with the statewide solid waste management plan.

Municipalities, regional waste authorities, COGs, and tribal governments are authorized to support and implement projects within their jurisdictions by planning and adopting local policies and ordinances, owning or leasing property and infrastructure, entering into contracts and intergovernmental agreements, applying for and administering state and federal funds, coordinating regionally, and delivering or partnering on relevant projects and programs consistent with state law and applicable regulatory requirements.

Private waste-hauling companies and operators must comply with state regulations and may implement process improvements and programs to further reduce non-organic solid waste. Nonprofit organizations, grassroot organizations must also comply with state regulations, and may implement their own programs and initiatives to increase recycling, reuse, and material recovery.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 78. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 78. Cumulative Net Adoption Costs for Measure 13

Cost	2025-2050
Reduce emissions from the disposal of non-organic solid waste.	\$\$

Potential Funding Sources

Table 79 summarizes potential funding sources identified for activities under this measure.

Table 79. Potential Funding Sources for Measure 13

Funding Source		Funding Focus Related to Measure
Federal	EPA Consumer Recycling Education and Outreach Grant Program	Local waste management infrastructure, recycling programs, and public education

Implementation Schedule and Milestones

Table 80 provides activity milestones for reducing emissions from the disposal of non-organic solid waste for 2030, 2040, and 2050.

Table 80. Activity Milestones for Measure 13

Activity	2030	2040	2050
Increase in the amount of non-organic waste diverted annually from disposal relative to 2023 (tons)	15,000	178,000	356,000

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Tons of non-organic waste generated and diverted through recycling
- ✓ Participation rate in municipal recycling programs
- ✓ Number of public outreach programs initiated
- ✓ Number of waste diversion programs created
- ✓ Participation in waste-reduction incentive programs
- ✓ Number of automated recycling systems implemented

Measure 14: Increase soil carbon sequestration and reduce emissions from agricultural soils.

This measure aims to increase carbon sequestration in agricultural soils and reduce emissions by expanding climate-smart land management practices. It builds on existing state programs that prioritize soil health and agricultural resilience. In addition to GHG mitigation, this measure improves soil productivity, water retention, and farm resilience to droughts and extreme weather.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 81 provides the emissions reduction potential from agricultural soils from 2025 through 2050.

Table 81. Measure 14 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.00	0.01	0.01	0.01	0.01

Key Implementing Agencies

- State agencies or quasi-public agencies, including the Connecticut Department of Agriculture (CT DoAg) and CT DEEP
- USDA Natural Resources Conservation Service (NRCS)
- UConn Soil Analysis Lab
- Local nonprofits and community organizations
- Farmers and agricultural producers

Authority to Implement and Milestones to Obtain Implementation Authority

CT DoAg is authorized under CGS § 22-1 to promote the economic viability of agriculture, protect agricultural and aquacultural resources, preserve farmland, and administer grants, incentive programs, and technical assistance. CT DoAg can also coordinate funding allocation with federal agencies such as USDA NRCS, which also administers its own federal funding programs. USDA has the authority to provide technical and financial assistance for climate smart agricultural practices and farmers and producers can utilize these state and federal resources and make decisions to adopt technologies and participate in incentive programs.

Academic institutions may provide technical assistance, research, and education on soil-management best practices. Farmers and agricultural producers may adopt best practices to increase soil sequestration. Local nonprofits and community organizations may develop educational programs to share and implement best practices for soil carbon sequestration. Academic institutions can provide technical assistance and education to support implementing this measure in the community.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 82Table 34. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 82. Cumulative Net Adoption Costs for Measure 14

Cost	2025-2050
Increase soil carbon sequestration and reduce emissions from agricultural soils	\$

Potential Funding Sources

Table 83 summarizes potential funding sources identified for activities under this measure.

Table 83. Potential Funding Sources for Measure 14

Funding Source		Funding Focus Related to Measure
Federal	NRCS Climate-Smart Agriculture Programs	Climate-smart mitigation activities
	NRCS Agricultural Conservation Easement Program	Protect and restore working farms and ranches with conservation easements
	NRCS Environmental Quality Incentives Program	Technical assistance for conservation plan development and covers some costs of conservation plan development

Implementation Schedule and Milestones

Table 84 provides activity milestones for increasing soil carbon sequestration and reducing emissions from agricultural soils for 2030, 2040, and 2050.

Table 84. Activity Milestones for Measure 14

Activity	2030	2040	2050
Cropland with cover crops (acres)	22,825	49,006	51,295

Activity	2030	2040	2050
Percent of nitrification inhibitor adoption on fertilized acres	32%	60%	80%

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Number of acres with cover cropping implemented
- ✓ Acres under reduced or no-till management
- ✓ Total farms participating in climate-smart programs
- ✓ Number of workshops, field days, and technical assistance sessions held to introduce producers to community supported agriculture (CSA)
- ✓ Number of acres with nitrification inhibitors in fertilizer applied

Measure 15: Reduce methane emissions from livestock and manure.

This measure aims to reduce methane emissions from livestock operations through practices such as anaerobic digesters, improved manure management, and climate-smart livestock strategies. It builds on current state and federal funding and technical assistance programs for farmers. Co-benefits include renewable energy generation, improved nutrient management, reduced odors, and increased financial stability for agricultural operations.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 85 provides the emissions reduction potential from livestock from 2025 through 2050.

Table 85. Measure 15 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.04	0.05	0.07	0.10	0.10

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DoAg
- Local nonprofits and community organizations
- Farmers and agricultural producers
- USDA NRCS
- University of Connecticut and other academic institutions

Authority to Implement and Milestones to Obtain Implementation Authority

CT DoAg is authorized under CGS § 22-1 to promote the economic viability of agriculture, protect agricultural and aquacultural resources, preserve farmland, and administer grants, incentive programs, and technical

assistance. CT DoAg can also coordinate funding allocation with federal agencies such as USDA NRCS, which also administers its own federal funding programs. USDA has the authority to provide technical and financial assistance for climate smart agricultural practices and farmers and producers can utilize these state and federal resources and make decisions to adopt technologies and participate in incentive programs. Academic institutions may provide technical assistance, research, and educational outreach to support reducing methane emissions from livestock and manure. Farmers and agricultural producers, as well as local nonprofits and community organizations, may implement their own programs and initiatives to reduce emissions.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 86. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 86. Cumulative Net Adoption Costs for Measure 15

Cost	2025-2050
Reduce methane emissions from livestock and manure	\$

Potential Funding Sources

Table 87 overviews potential funding sources identified for activities under this measure.

Table 87. Potential Funding Sources for Measure 15

Funding Source		Funding Focus Related to Measure
Federal	NRCS Climate-Smart Agriculture Programs	Climate-smart mitigation activities

Implementation Schedule and Milestones

Table 88 provides activity milestones for reducing methane emissions from livestock and manure for 2030, 2040, and 2050.

Table 88. Activity Milestones for Measure 15

Activity	2030	2040	2050
Feed additive adoption ¹⁰¹	15%	45%	100%
Total number of anaerobic digestors installed	5	7	7

¹⁰¹ Includes monensin and 3-NOP.

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Number of technical assistance programs
- ✓ Number of anaerobic digesters installed
- ✓ Number of manure pits deployed
- ✓ Implementation of feed additives
- ✓ Total methane emissions reduced from action implementation
- ✓ Percentage change of livestock operations implementing climate practices

Measure 16: Increase protection and conservation of high-carbon coastal habitats, wetlands, grasslands, and forests.

This measure aims to conserve, restore, and manage high-carbon natural ecosystems that play a critical role in carbon sequestration. It builds on existing state, local, and federal land conservation and restoration initiatives. Beyond GHG reductions, this measure enhances flood protection, improves water quality, supports biodiversity, and increases climate resilience for communities.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 89 provides the emissions reduction potential from land conservation and protection from 2025 through 2050.

Table 89. Measure 16 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.00	0.36	1.01	1.66	2.31	2.96

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP and CT DoAg
- US Fish and Wildlife Service
- Municipalities
- Private landowners

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP is authorized under CGS § 22a to protect and conserve high-carbon coastal habitats, wetlands, grasslands, and forests by regulating land and water resources, administering coastal and wetlands programs, acquiring and managing conservation lands and easements, enforcing environmental standards, and implementing state and federally funded conservation and restoration initiatives to protect natural resources and reduce greenhouse-gas emissions. The specific authority for each current state funding program is included in the funding Table 91 below.

CT DEEP is authorized to conduct planning that guides program and policy implementation across the agency that could support increased protection and conservation of high-carbon habitats including the following plan:

- Connecticut Comprehensive Open Space Acquisition Strategy/”Green Plan” (CGS § 23-8b) guides the efforts by the Department and its land conservation partners to meet a goal of conserving 21% of Connecticut’s land base as open space by year 2023.

Municipal governments have the authority to implement planting, planning, and maintenance programs on municipal lands, streets, and local ordinances. Additionally, they have the authority to acquire land. Private landowners may implement best practices through voluntary or incentive-based programs and/or pursue conservation easements.

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 90Table 34. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 90. Cumulative Net Adoption Costs for Measure 16

Cost	2025-2050
Increase protection and conservation of high-carbon coastal habitats, wetlands, grasslands, and forest	\$\$

Potential Funding Sources

Table 91 summarizes potential funding sources identified for activities under this measure.

Table 91. Potential Funding Sources for Measure 16

Funding Source		Funding Focus Related to Measure
Federal	U.S Fish and Wildlife Service Highlands Conservation Act	Land protection in the Highlands region
	BIL Coastal Zone Management Funding	Build capacity, increase resilience, and restore and protect coastal habitats
	BIL Long Island Sound Study	Habitat restoration; green infrastructure and access along the Long Island Sound coast
	Resilient Forestry Practices Grant	Resilient forestry practices

Funding Source		Funding Focus Related to Measure
	NRCS Environmental Quality Incentives Program	Technical assistance for conservation plan development and covers some costs of conservation plan development
	Urban Forested Natural Areas and Riparian Corridor Restoration Grant	Improves forest health and resilience through reforestation and invasive species removal
	USFWS Wildlife Restoration Program	Funds projects to restore, conserve, manage and enhance wild birds and mammals and their habitats. The program was first authorized by the Wildlife Restoration Act (Pittman-Robertson).
	Land and Water Conservation Fund	Supports increased public access to and protection for federal public lands and waters including national parks, forests, wildlife refuges and recreation areas, and provides matching grants to state governments for the acquisition and development of public parks and other outdoor recreation sites.
	USFS Forest Legacy Program	Protects of privately owned forest lands through conservation easements or land purchases.
State	DEEP Open Space and Watershed Land Acquisition (OSWA) Grant Program (CGS § 7-131d)	Protection of forests, wetlands, grasslands, riparian corridors, and coastal lands through fee acquisition or conservation easements
	DEEP Urban Green and Community Gardens Grant Program (CGS § 7-131d to 7-131k)	Develop or enhance urban green spaces for public enjoyment and/or environmental education in distressed municipalities or environmental justice communities.
	Recreation and Natural Heritage Trust Program (CGS § 23-73 through 23-99)	Acquires lands and waters to be added to the State's system of public Parks, Forests, Wildlife Management, recreational water access, and other natural open spaces.

Implementation Schedule and Milestones

Table 92 provides activity milestones for land conservation and protection for 2030, 2040, and 2050.

Table 92. Activity Milestones for Measure 16

Activity	2030	2040	2050
Area with improved land management practices (acres)	0	12,117	24,235
Cumulative forest area conserved relative to BAU (acres)	6,178	18,533	30,888

Activity	2030	2040	2050
Cumulative wetland area conserved relative to BAU (acres)	198	593	988

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Acres of habitat conserved or restored
- ✓ Number of conservation easements secured
- ✓ Acres of forest cover
- ✓ Acres of wetland
- ✓ Number of outreach programs or educational events conducted

Measure 17: Increase and manage urban tree canopy.

This measure aims to expand and actively manage urban tree canopy to reduce emissions and enhance livability in Connecticut's cities and towns. It builds federal urban forestry funding and technical assistance programs, with a focus on underserved communities with low tree cover. Co-benefits include reduced urban heat island effects, improved air quality, enhanced public health, stormwater management, and stronger community resilience.

Geographic Location

Statewide.

GHG Mitigation Potential

Table 93 provides the emission reduction potential from increasing and managing the urban tree canopy from 2025 through 2050.

Table 93. Measure 17 GHG Mitigation Potential (MMTCO₂e)

Emissions Reductions	2025	2030	2035	2040	2045	2050
MMTCO ₂ e	0.0	0.01	0.01	0.02	0.03	0.03

Key Implementing Agencies

- State agencies or quasi-public agencies, including CT DEEP
- Municipalities
- Non-profit and grassroots organizations
- Local universities and academic institutions
- Private landowners

Authority to Implement and Milestones to Obtain Implementation Authority

CT DEEP is authorized under CGS §22a to protect and conserve high-carbon coastal habitats, wetlands, grasslands, and forests by regulating land and water resources, administering coastal and wetlands

programs, acquiring and managing conservation lands and easements, enforcing environmental standards, and implementing state and federally funded conservation and restoration initiatives to protect natural resources and reduce greenhouse gas emissions.

Municipal governments have the authority to implement planting, planning, and maintenance programs on municipal lands, streets, and local ordinances.

Private landowners may implement best practices to develop and maintain urban forest through voluntary or incentive-based programs and/or pursue conservation easements.

Academic institutions may provide technical assistance, research, and education to support urban forest health. Nonprofit organizations and community groups may implement their own programs and initiatives (e.g., tree planting programs).

Costs

The cumulative net adoption costs for this measure from 2025 through 2050 are provided in Table 94. This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139 in Appendix 7: Measure Cost Methodology for the range values). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

Table 94. Cumulative Net Adoption Costs for Measure 17

Cost	2025-2050
Increase and manage urban tree canopy	\$

Potential Funding Sources

Table 95 summarizes potential funding sources identified for activities under this measure.

Table 95. Potential Funding Sources for Measure 17

Funding Source		Funding Focus Related to Measure
Federal	Urban Forest Resilience Grant	Efforts to restore and improve urban forests lost due to catastrophic losses from Emerald Ash Borer and other pests and diseases
	Urban and Community Forest Planning	Urban forestry planning and data collection
	Urban Forest Equity/Trees for Communities	Stewardship projects such as tree planting, workforce development, or tree stewardship
	Urban Forest Equity through Capacity Building	Support capacity building through urban forestry projects that will increase tree cover

Funding Source	Funding Focus Related to Measure
Urban Forested Natural Areas and Riparian Corridor Restoration Grant	Improves forest health and resilience through reforestation and invasive species removal

Implementation Schedule and Milestones

Table 96 provides the activity milestones for increasing and managing the urban tree canopy for 2030, 2040, and 2050.

Table 96. Activity Milestones for Measure 17

Activity	2030	2040	2050
Percent urban tree canopy area in communities defined in CGS § 22a-20a	29%	32%	35%

Metrics for Tracking Progress

Potential metrics to track progress on measure implementation:

- ✓ Number of trees planted
- ✓ Number of trees stewarded and/or maintained
- ✓ Urban tree canopy cover
- ✓ Urban heat island effect mitigated
- ✓ Number of community engagement events or educational programs conducted/number of volunteers engaged or trained
- ✓ Number of technical assistance programs delivered to urban land managers



APPENDIX 5: CO-BENEFITS ANALYSIS METHODOLOGY

The analysis calculated statewide emissions of conventional air pollutants, including **CAPs**, under the BAU and mitigation pathway. CAPs are the six pollutants for which the federal government has established allowable thresholds of concentration in the air. They are ozone (O₃), particulate matter (PM_{2.5}, PM₁₀), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO₂), and lead (Pb). This analysis focused on changes in emissions as a predictor of changes in concentrations. Accordingly, our analysis excluded O₃ but included the O₃ precursor volatile organic compounds (VOC). Pb and ammonia (NH₃) are included where data is available. The analysis calculated emissions at the sector level, but not all sectors have relevant emissions factors for each pollutant.

CAPs were quantified to illustrate the public health impacts of the scenarios. Public health impacts of CAP pollution include respiratory and cardiovascular diseases, asthma aggravation, and premature death. Their reductions are linked to clear public health benefits and attainment of regulatory air quality standards. CAPs also generally have documented emissions factors to use in their analysis and support public health benefits assessment with standard EPA tools.

Methodology and Approach

Co-Pollutant Quantification Approach

This section summarizes the approach to calculating changes in air pollutant emissions.

The analysis calculated co-pollutant emissions for a BAU scenario and one mitigation pathway. The co-pollutant analysis included the on-road transportation, nonroad transportation (aviation, passenger rail, and ferry), commercial and residential buildings, power, and industrial sectors. The waste sector was not included because no mitigation measures change in-state waste combustion or flaring emissions relative to the BAU scenario.

The scenarios employed associated energy use as the basis for the calculations along with emissions factors from standard, publicly available sources, most commonly EPA's AP-42 handbook¹⁰². Additional sources were used where needed, including EPA's MOtor Vehicle Emission Simulator (MOVES5)¹⁰³ for on-road and nonroad emissions projections and DOE's Greenhouse gases, Regulated Emissions, and Energy use in Technologies (GREET)¹⁰⁴ model for pump-to-wheel emission factors for aviation, passenger rail, and ferries. Emission reductions were then calculated by comparing the emissions under the mitigation pathway to the emissions under the BAU scenario.

¹⁰² AP-42: Compilation of Air Emissions Factors from Stationary Sources. Available at: <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors-stationary-sources>.

¹⁰³ <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>

¹⁰⁴ <https://www.energy.gov/cmei/greet>

The analysis calculated emissions using a consistent framework across all sectors and pollutants. In general, the analysis estimated emissions as follows:

$$\text{Emissions} = \text{Activity (Energy Use)} \times \text{Emission Factor (EF)}$$

The activity value is the energy consumption by sector and fuel, consistent with that used for the quantification of GHG emissions. We applied this equation for each pollutant, fuel type, sector, scenario, incorporating the necessary sector-specific parameters. The on-road and nonroad transportation sectors are the primary exceptions. For these sectors, CAP emissions were calculated with EPA's MOVES model, consistent with the GHG analysis. Another exception is the power sector, for which NO_x and SO₂ emissions were taken directly from IPM outputs, while PM_{2.5}, VOC, and NH₃ emissions were derived from IPM results using regression methods.

Emissions were generally developed at the county scale. For some sectors, statewide or route-level activity data were allocated to counties using sector-specific approaches, such as airport operations for aviation, rail network activity proxies for passenger rail, ferry route geography for ferries, and facility locations for industry.

The following subsections describe the approach used for each sector.

Industry

The analysis estimated statewide fuel consumption for distillate fuel oil, kerosene, hydrocarbon gas liquids, motor gasoline, residual fuel, special naphthas, natural gas and hydrogen for 2025-2050. Statewide energy use was reported in million British thermal units (MMBtu) and derived from the US EPA's GHGRP.

The analysis allocated statewide fuel use to counties using industrial stationary-combustion activity ratios (Figure 19), which represent each reporting county's share of statewide industrial stationary-combustion emissions based on facility-level reported emissions. This data was taken from the GHGRP at the plant-level.

The analysis applied EPA AP-42 emission factors, along with fuel-specific assumptions and proxy assignments where needed, to estimate emissions of NO_x, SO₂, PM_{2.5}, CO, VOC, and lead from industrial fuel use. Several additional steps and assumptions were required to apply the emission factors consistently:

- **Heating value conversions:** Because fuel use data and emission factors are expressed in different units, the analysis used standard heating values listed in Table 97¹⁰⁵ to convert fuel use to the units required by the emission factors.
- **Distillate and residual fuel oil.** Distillate fuel oil emission factors were obtained from AP-42 Chapter 1.3 for industrial boilers. Residual fuel oil was treated separately from distillate oil using AP-42 residual oil combustion guidance¹⁰⁶, reflecting differences in sulfur content and emission characteristics.
- **Natural gas combustion:** Industrial natural gas use includes a mix of boiler combustion, combined heat and power (CHP) gas turbines, and a small non-combustion feedstock component. The analysis calculated a blended emission factor for each pollutant by weighting AP-42 boiler factors (Tables 1.4-1 and 1.4-2) and AP-42 stationary gas turbine factors (Tables 3.1-1 and 3.1-2a) according to the assumed industrial use split: 78% boilers, 17% CHP, and 5% feedstock (no combustion emissions)^{107,108}. Because

¹⁰⁵ API Compendium, Table 4-5, used for all fuels except butane; butane estimated by scaling propane using relative heating values available at <https://ipm.cahnr.uconn.edu/heating-value-fuels/>

¹⁰⁶ No. 6 oil was assumed where AP-42 factors differ by residual oil grade, as it is a common heavy residual fuel used in industrial and heating applications.

¹⁰⁷ https://arpa-e.energy.gov/sites/default/files/migrated/Bill%20Liss_Deployment%20Challenges.pdf

¹⁰⁸ <https://doi.org/10.1016/j.eneco.2020.104984>

AP-42 indicates that particulate matter from natural gas combustion is almost entirely less than 1 μm , all PM was treated as $\text{PM}_{2.5}$.

- **Hydrogen combustion:** Natural gas boiler emission factors were used as proxies for hydrogen because AP-42 does not provide hydrogen-specific emission factors. Hydrogen combustion was assumed to generate only NO_x ; therefore, only a NO_x emission factor was applied for this fuel, using the AP-42 industrial natural gas boiler NO_x factor from Table 1.4-1. SO_2 , $\text{PM}_{2.5}$, CO, VOC, and lead emissions were assumed to be zero because hydrogen contains no sulfur, carbon, or lead.
- **Kerosene.** Kerosene was treated as a No. 1 distillate fuel oil, consistent with AP-42 fuel oil combustion guidance, and therefore used distillate fuel oil emission factors and heating values.
- **Motor gasoline.** Industrial motor gasoline use was assigned emission factors from AP-42 Chapter 3.3 for gasoline-fired industrial engines. VOC emissions were derived from total organic carbon (TOC) emission factors and adjusted to VOC using an assumed VOC/TOC ratio consistent with AP-42 guidance.
- **Propane:** Propane emission factors were taken from AP-42 Table 1.5-1.
- **Hydrocarbon gas liquids:** Hydrocarbon gas liquids were assigned the same combustion emission factors as propane as a proxy, reflecting their similar combustion characteristics as light petroleum gas fuels.
- **Special Naphthas:** In the absence of specific emission factors for special naphthas, butane emission factors from AP-42 Table 1.5-1 were applied as a proxy, given their similar classification as light, highly volatile petroleum-derived fuels.
- **Sulfur content:** Because AP-42 sulfur dioxide emission factors are highly dependent on sulfur content of the fuel, fuel-specific sulfur assumptions were applied^{109,110,111}, as documented in Table 98. sulfur assumptions were only used where needed for SO_2 estimation.
- **Fine particulate matter:** For natural gas combustion, AP-42 indicates that all PM is assumed to be below one micrometer in diameter and the PM emission factors presented may be used to estimate either PM_{10} or $\text{PM}_{2.5}$ emissions. Therefore, we used the published particulate matter factor as $\text{PM}_{2.5}$. For distillate or residual fuel oil, $\text{PM}_{2.5}$ emission factor was derived by combining filterable PM and condensable PM from the relevant AP-42 fuel oil combustion tables. For propane combustion, AP-42 provides a PM_{10} emission factor; because liquefied petroleum gas (LPG) combustion occurs almost entirely in the vapor phase with negligible coarse particulate formation, the analysis treated the PM_{10} emission factor as $\text{PM}_{2.5}$.

Table 99 summarizes the emission factors applied to the primary fuel categories in the analysis. For fuels not shown separately in the table (e.g., kerosene, hydrocarbon gas liquids), emission factors from equivalent fuel categories were applied, as described above.

¹⁰⁹ <https://www.eia.gov/energyexplained/heating-oil/>

¹¹⁰ <https://www.epa.gov/sites/default/files/2017-10/documents/ct-22a-174-19b.pdf>

¹¹¹ <https://19january2021snapshot.epa.gov/sites/static/files/2020-02/documents/sulfur-butane-sprdsht-example-key-doc.pdf>

Figure 19. County Shares of Statewide Industrial Stationary-Combustion Emissions that Exceed 25,000 Metric Tons CO₂e Per Year as Reported in the EPA Greenhouse Gas Reporting Program¹¹²

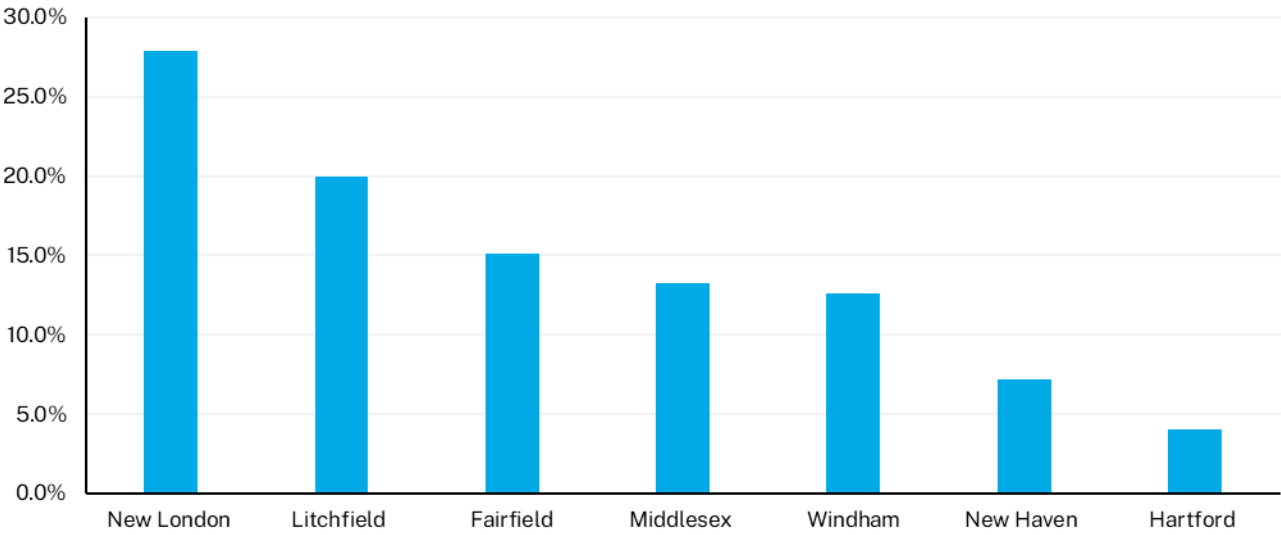


Table 97. Conversion and heat factors

Fuel	Value	Units
Natural gas	1026	BTU/scf
Distillate oil heating value	138	MMBTU/1000 gal
Residual oil heating value	150	MMBTU/1000 gal
Propane heating value	91.5	MMBTU/1000 gal
butane heating value	117.12	MMBTU/1000 gal

Table 98. Fuel Sulfur (S) content assumptions used for SO₂ emissions estimation

Fuel	Sulfur Content (% by weight)
Distillate oil	0.0015
Propane	0.5
Natural gas	0.001705234
Residual oil	0.3
Butane	0.00001

¹¹² This table only includes facilities who GHG emissions from covered sources exceed 25,000 metric tons of CO₂e per year as reported in the EPA Greenhouse Gas Reporting Program ([Greenhouse Gas Reporting Program \(GHGRP\) | US EPA](#)).

Table 99. Industry - emissions factors

Fuel	Source	Units	Pollutant	Value
Natural Gas	AP-42, blended boiler, gas turbine, feedstock	lb/1000000 scf	NOx	202.97
Natural Gas	AP-42, blended boiler, gas turbine, feedstock	lb/1000000 scf	SO ₂	0.74
Natural Gas	AP-42, blended boiler, gas turbine, feedstock	lb/1000000 scf	PM	7.09
Natural Gas	AP-42, blended boiler, gas turbine, feedstock	lb/1000000 scf	CO	79.82
Natural Gas	AP-42, blended boiler, gas turbine, feedstock	lb/1000000 scf	Lead	0
Natural Gas	AP-42, blended boiler, gas turbine, feedstock	lb/1000000 scf	VOC	4.68
Hydrogen ¹¹³	AP-42, natural gas proxy, T.1.4-1, NOx only	lb/1000000 scf	NOx	190.00
Distillate Oil	AP-42, <100 MMBtu, T1.3-1, Boiler Distillate oil fired	lb/1000 gal	NOx	20
Distillate Oil	AP-42, <100 MMBTU, T1.3-1, Boiler Distillate oil fired, sulfur-based	lb/1000 gal	SO ₂	0.213
Distillate Oil	AP-42, T1.3-2, T1.3-6; filterable and condensable PM	lb/1000 gal	PM	1.55
Distillate Oil	AP-42, <100 MMBtu, T1.3-1, Boiler Distillate oil fired	lb/1000 gal	CO	5
Distillate Oil	AP-42, <100 MMBtu, T1.3-10 (converted to lb/1000 gal), Boiler Distillate oil fired	lb/1000 gal	Lead	0.0012420
Distillate Oil	AP-42, T1.3-3, Boiler Distillate oil fired, NMTOC≈VOC	lb/1000 gal	VOC	0.2
Residual Oil	AP-42, <100 MMBtu, T1.3-1, industrial boiler (No. 5/6 oil)	lb/1000 gal	NOx	55
Residual Oil	AP-42, <100 MMBtu, T1.3-1, industrial boiler (No. 5/6 oil), sulfur-based	lb/1000 gal	SO ₂	47.1

¹¹³ This value assumes that NOx controls would be applied to ensure equivalency with natural gas combustion.

Fuel	Source	Units	Pollutant	Value
Residual Oil	AP-42, T1.3-2 (No.6 oil), T1.3-5, filterable and condensable PM	lb/1000 gal	PM	4.79702
Residual Oil	AP-42, <100 MMBtu, T1.3-1, industrial boiler (No. 5/6 oil)	lb/1000 gal	CO	5
Residual Oil	AP-42, T1.3-11	lb/1000 gal	Lead	0.00151
Residual Oil	AP-42, T1.3-3, industrial boilers (No. 6 oil), NMTOC≈VOC	lb/1000 gal	VOC	0.28
Propane	AP-42, T1.5-1	lb/1000 gal	NOx	13
Propane	AP-42 Chapter 1.5, sulfur-based	lb/1000 gal	SO ₂	0.05
Propane	AP-42, T1.5-1	lb/1000 gal	PM	0.7
Propane	AP-42, T1.5-1	lb/1000 gal	CO	7.5
Propane	AP-42, T1.5-1	lb/1000 gal	VOC	0.8
Butane	AP-42, T1.5-1	lb/MMBtu	NOx	0.1281
Butane	AP-42, T1.5-1	lb/MMBtu	PM	0.0068
Butane	AP-42, T1.5-1	lb/MMBtu	SO ₂	0.0000
Butane	AP-42, T1.5-1	lb/MMBtu	CO	0.0717
Butane	AP-42, T1.5-1	lb/MMBtu	VOC	0.0077
Motor Gasoline	AP-42, T3.3-1	lb/MMBtu	NOx	1.6300
Motor Gasoline	AP-42, T3.3-1	lb/MMBtu	PM	0.1000
Motor Gasoline	AP-42, T3.3-1	lb/MMBtu	SO ₂	0.0840
Motor Gasoline	AP-42, T3.3-1	lb/MMBtu	CO	0.9900
Motor Gasoline	AP-42, T3.3-1, T3.3-2, VOC/TOC ratio ≈ 84%	lb/MMBtu	VOC	1.7400

Buildings

For the buildings sector, annual building energy consumption (in MMBtu) was compiled by sector (residential and commercial), subsector (new and existing buildings), fuel type (natural gas, fuel oil, propane), county, and year (2025-2050) under both the BAU and mitigation pathway consistent with the measure modeling

methodology. Energy use from new and existing buildings was summed within each sector–fuel–county–year combination to represent total fuel consumption.

The analysis applied EPA AP-42¹¹⁴ emission factors specific to each fuel type and sector (residential and commercial) for CO, SO₂, PM, NO_x, and VOC. We used the emission factors for residential furnaces to approximate residential natural gas combustion, and the EFs for small or controlled boilers for commercial natural gas combustion. We used the appropriate AP-42 boiler or LPG emission factors for distillate fuel oil and propane combustion. Table 100 shows the complete set of factors applied for each fuel and pollutant. The approach required additional assumptions and conversions to ensure emission factors were applied consistently:

- **Heating value conversions:** To align units between fuel use data and emission factors, the standard heating values of Table 97 were used.
- **Sulfur content:** For sulfur dioxide calculations, the sulfur content assumptions were obtained from Table 98.
- **Fine particulate matter (PM_{2.5}):** The same fuel-specific PM_{2.5} approach described previously for the industrial sector was used.

Table 100. Buildings - emissions factors

Fuel	Source	Units	Pollutant	Value	Sector
Natural Gas	AP-42, Uncontrolled small boiler or controlled (recirculation) large boiler	lb/1000000 scf	NOx	100	Commercial
Natural Gas	AP-42, Table 1.4-2	lb/1000000 scf	SO ₂	0.6	Commercial
Natural Gas	AP-42, Table 1.4-2	lb/1000000 scf	PM	7.6	Commercial
Natural Gas	AP-42, Uncontrolled small boiler or controlled (recirculation) large boiler	lb/1000000 scf	CO	84	Commercial
Natural Gas	AP-42, Table 1.4-2	lb/1000000 scf	Lead	0.0005	Commercial
Natural Gas	AP-42, Table 1.4-2	lb/1000000 scf	VOC	5.5	Commercial
Natural Gas	AP-42, Residential furnace	lb/1000000 scf	NOx	94	Residential
Natural Gas	AP-42, Table 1.4-2	lb/1000000 scf	SO ₂	0.6	Residential
Natural Gas	AP-42, Table 1.4-2	lb/1000000 scf	PM	7.6	Residential
Natural Gas	AP-42, Residential furnace	lb/1000000 scf	CO	40	Residential
Natural Gas	AP-42, Table 1.4-2	lb/1000000 scf	Lead	0.0005	Residential
Natural Gas	AP-42, Table 1.4-2	lb/1000000 scf	VOC	5.5	Residential

¹¹⁴ <https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors-stationary-sources>.

Fuel	Source	Units	Pollutant	Value	Sector
Distillate Oil	AP-42, <100 MMBtu, T1.3-1, Boiler Distillate oil fired	lb/1000 gal	NO _x	20	Both
Distillate Oil	AP-42, <100 MMBTU, T1.3-1, Boiler Distillate oil fired, sulfur-based	lb/1000 gal	SO ₂	0.213	Both
Distillate Oil	AP-42, T1.3-2, T1.3-6; filterable and condensable PM	lb/1000 gal	PM	1.55	Both
Distillate Oil	AP-42, <100 MMBtu, T1.3-1, Boiler Distillate oil fired	lb/1000 gal	CO	5	Both
Distillate Oil	AP-42, <100 MMBtu, T1.3-10 (converted to lb/1000 gal), Boiler Distillate oil fired	lb/1000 gal	Lead	0.0012420	Both
Distillate Oil	AP-42, T1.3-3, Boiler Distillate oil fired, NMTOC≈VOC	lb/1000 gal	VOC	0.2	Both
Propane	AP-42, T1.5-1	lb/1000 gal	NO _x	13	Both
Propane	AP-42 Chapter 1.5, sulfur-based	lb/1000 gal	SO ₂	0.05	Both
Propane	AP-42, T1.5-1	lb/1000 gal	PM	0.7	Both
Propane	AP-42, T1.5-1	lb/1000 gal	CO	7.5	Both
Propane	AP-42, T1.5-1	lb/1000 gal	VOC	0.8	Both

Aviation

For the aviation sector, statewide jet and sustainable aviation (SAF) fuel consumption was modeled for the BAU and mitigation pathway, consistent with the measure modeling approach. Statewide fuel consumption was downscaled to the county-level using airport operations data for commercial aircraft in Connecticut, obtained from the FAA Air Traffic Activity System¹¹⁵ (Table 101). The analysis used takeoffs and landings at each airport to calculate each county's share of total statewide commercial aircraft operations. These county shares were then applied to statewide aviation fuel consumption to estimate county-level fuel consumption for conventional jet fuel and SAF. This process produced county-level fuel energy consumption for 2025-2050 for both fuels.

Next, downstream (pump-to-wake, PTW) emission factors for conventional jet fuel were retrieved from the GREET model¹¹⁶. To ensure consistency between SAF and petroleum jet pathways, the weighted average jet-engine emission factors were used (Table 102).

¹¹⁵ Federal Aviation Administration. Air Traffic Activity System. Airport Operations (2024 Calendar Year).

<https://www.aspm.faa.gov/opsnet/sys/Airport.asp>

¹¹⁶ <https://www.energy.gov/cmei/greet>

For each county, year, and fuel type, the analysis then multiplied energy consumption by the GREET emission factors for CO, NO_x, PM₁₀, PM_{2.5}, SO₂, and VOC.

Table 101. Statewide Aircraft Operations by Facility, 2024

Facility	County	Operations
BDL	Hartford County	83,238
BDR	Fairfield County	75,235
DXR	Fairfield County	51,824
GON	New London County	49,260
HFD	Hartford County	85,624
HVN	New Haven County	35,238
OXC	New Haven County	54,069

Table 102. Aviation - emission factors

Pollutant	Fuel	Units	Value
CO	SAF	g/MJ	0.0586
NO _x	SAF	g/MJ	0.2104
PM ₁₀	SAF	g/MJ	0.0002
PM _{2.5}	SAF	g/MJ	0.0002
VOC	SAF	g/MJ	0.0085
SO ₂	SAF	g/MJ	0.0000
CO	Conventional Jet Fuel	g/MJ	0.0601
NO _x	Conventional Jet Fuel	g/MJ	0.2287
PM ₁₀	Conventional Jet Fuel	g/MJ	0.0027
PM _{2.5}	Conventional Jet Fuel	g/MJ	0.0027
VOC	Conventional Jet Fuel	g/MJ	0.0085
SO ₂	Conventional Jet Fuel	g/MJ	0.0324

Power

The analysis quantified power sector co-pollutant emissions using outputs from the IPM. Connecticut's in-state power sector emissions are driven by natural gas-fired generation. County- and fuel-resolved emissions of NO_x and SO₂ were obtained directly from the IPM results. Emissions were reported every fifth year from 2025 to 2050, and linear interpolation was used to estimate annual values between modeled years.

For PM_{2.5}, VOC and NH₃ emissions, statistical relationships between NO_x, SO₂ were developed, and each other pollutant in the underlying database of EPA's Co-Benefits Risk Assessment (COBRA) model using the 2023 COBRA Tier 1 Energy nationwide dataset. Quantile regressions were estimated across multiple quantiles, and the mean regression coefficients for NO_x, SO₂, and the intercept were selected as the final parameters. Regression terms with high p-values were set to zero to avoid introducing noise into the estimates. The imputation is applied only when either NO_x or SO₂ is nonzero. If both values are zero, the imputed pollutant value is set to zero to avoid generating emissions where none occur. Final equations are provided in Table 103.

Table 103. Regression-Based Coefficients for Estimating PM_{2.5}, VOC, and NH₃ power sector emissions

Fuel	Pollutant	Equation
Gas	NH ₃	$NH_3 = 0.023774 \times NO_x + 0.000000 \times SO_2 + 0.000000$
Gas	PM _{2.5}	$PM_{2.5} = 0.087152 \times NO_x + 0.000000 \times SO_2 + 0.000000$
Gas	VOC	$VOC = 0.043485 \times NO_x + 0.000000 \times SO_2 + 0.000000$

Passenger Rail

For the passenger rail sector, the analysis was based in co-pollutant emissions from diesel fuel use associated with commuter rail operations in Connecticut. Statewide diesel fuel consumption was first compiled for each year of the analysis period under the BAU and mitigation pathway consistent with the measure modeling approach in Appendix 2. Fuel consumption was then allocated to counties using rail network activity proxies based on the number of rail network nodes within each county, derived from US Department of Transportation (USDOT) FRA rail network data¹¹⁷ (Table 104). County-level shares were normalized and applied to distribute statewide fuel consumption across the counties.

Passenger activity was estimated by converting fuel consumption to passenger miles using a constant fuel intensity of 0.019 gallons of diesel per passenger-mile, based on Connecticut-specific study inputs for passenger rail miles and fuel usage. This allowed emissions to be expressed consistently with emission factors defined on a per passenger-mile basis.

Co-pollutant emissions were then calculated using emission factors from the GREET model for commuter rail using diesel fuel. Pump-to-wheel emission factors, representing the combustion phase, were applied for each pollutant, including VOC, CO, NO_x, PM₁₀, PM_{2.5}, and SO₂. Emission factors were expressed in grams per passenger-mile and converted to pounds prior to application. Total emissions were calculated by multiplying county-level passenger miles by the corresponding emission factors for each pollutant. Table 105 shows the set of emission factors applied for the passenger rail sector.

Table 104. Rail network activity by county

County	Number of Rail Network Nodes
Tolland	12

¹¹⁷ USDOT FRA. <https://railroads.dot.gov/rail-network-development/maps-and-data/maps-geographic-information-system/maps-geographic>

County	Number of Rail Network Nodes
Hartford	207
Litchfield	47
Fairfield	87
Middlesex	34
New Haven	181
Windham	74
New London	102

Table 105. Passenger rail – emission factors

Pollutant	Emission Factor (g/passenger-mile)
VOC	0.0738
CO	0.1268
NO _x	1.0679
PM ₁₀	0.0176
PM _{2.5}	0.0171
SO ₂	0.0000

Ferry

For the ferry sector, the analysis estimated co-pollutant emissions from diesel fuel use associated with ferry operations in Connecticut. The model was developed at the ferry route level consistent with the measure modeling approach (see Appendix 2), with total diesel fuel consumption specified for each route under the BAU scenario.

To estimate county-level emissions, ferry routes were crosswalked to counties based on their geographic endpoints. For routes operating within a single county, all fuel consumption was assigned to that county. For routes connecting two counties, fuel consumption was split evenly between the counties (i.e., 50/50 allocation). The route-to-county allocation factors used to distribute ferry activity to counties are presented in Table 106.

In the mitigation pathway, diesel fuel consumption was derived by applying the reduction in ferry diesel fuel consumption. (See Appendix 2.) For each ferry route, BAU diesel consumption was reduced proportionally to the share of ferries assumed to be electrified in each year, with emissions declining to zero once full electrification is achieved.

Co-pollutant emissions were calculated using emission factors from GREET model for marine vessels. More specifically, because GREET does not provide ferry-specific emission factors, the analysis used emission factors for marine diesel engines operating on marine gas oil with 0.1 percent sulfur content (Table 107). This assumption is consistent with regulatory requirements under the North American Emission Control Area, which limits sulfur content to 0.10 percent for marine fuels, and reflects typical fuel use for US passenger ferries operating on short routes near populated shorelines¹¹⁸.

Emission factors were expressed in grams per kilowatt-hour (g/kWh) and converted to pounds prior to application. County-level fuel consumption was first converted to energy units (kWh), and emissions were then calculated by applying pollutant-specific emission factors for VOC, CO, NOx, PM₁₀, PM_{2.5}, and SO₂. Final emissions were reported in pounds by pollutant, county, and year.

Table 106. Ferry route-to-county allocation factors used for county downscaling

Ferry Route	County	Allocation Factor
CTDOT River Ferries (Rocky Hill/Glastonbury & Chester/Hadlyme)	Hartford County	0.50
CTDOT River Ferries (Rocky Hill/Glastonbury & Chester/Hadlyme)	Middlesex County	0.25
CTDOT River Ferries (Rocky Hill/Glastonbury & Chester/Hadlyme)	New London County	0.25
Cross Sound Ferry	New London County	1.00
Bridgeport	Fairfield County	1.00
Block Island Express	New London County	1.00

Table 107. Ferry – emission factors

Pollutant	Emission Factor	Units
VOC	0.50	g/kWh
CO	1.10	g/kWh
NOx	13.20	g/kWh
PM ₁₀	0.1867	g/kWh
PM _{2.5}	0.1718	g/kWh
SO ₂	0.4008	g/kWh

On-Road Transportation

The analysis calculated on-road transportation sector co-pollutant emissions using EPA's MOtor Vehicle Emission Simulator (MOVES5)¹¹⁹ with local vehicle miles traveled (VMT) estimates. The analysis covered the

¹¹⁸ <https://dieselnet.com/standards/us/marine.php>

¹¹⁹ <https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves>

following fuel types: compressed natural gas (CNG), diesel, electricity, ethanol (E-85), gasoline, and hydrogen; and these vehicle categories: LDV, motorcycles (MCY), and MHDVs. For each pollutant (CO, NO_x, SO₂, PM₁₀, PM_{2.5}, VOC, and NH₃), the following steps were applied:

- The emission factors were calculated by dividing total 2025 to 2050 MOVES5 emissions by total 2025 to 2050 VMT, disaggregated by county, pollutant, vehicle type, and fuel type, resulting in mass per mile (e.g., metric tons CO per diesel truck mile).
- MOVES5 provided data for 5-year increments. To generate annual values, linear interpolation was used to estimate VMT and emissions between years.
- The derived emission factor ratios are then multiplied by VMT. Specifically, the factor for each pollutant and vehicle/fuel category was multiplied by the corresponding VMT in the scenarios. The result is a quantified co-pollutant emission by county, pollutant, vehicle type, and fuel type for all scenarios.

Health Impacts Assessment

The health impacts assessment estimated the potential avoided adverse health outcomes that could result from implementing the mitigation pathway. We calculated potential health benefits and their monetized value using the most recent version of the EPA's COBRA health impacts screening model, coupled with the modeled emissions by sector, fuel, and scenario as detailed in previous sections. We considered the mitigation pathway relative to the BAU.

Methodology

The analysis used COBRA Version 5.2¹²⁰ to quantify and monetize changes in the incidence of adverse health impacts resulting from changes in human exposure to PM_{2.5} and ozone (O₃) under the mitigation pathway. COBRA is a screening-level air quality health benefits model that provides estimates of the impact of changes in air pollution emissions on ambient PM_{2.5} and O₃ concentrations, the resulting impacts on associated health effects, and the monetary value of those avoidable health impacts.¹²¹

COBRA uses a source-receptor (S-R) matrix to translate changes in air pollutant emissions (primary PM_{2.5}, NO_x, SO₂, and VOC) into corresponding changes in ambient PM_{2.5} and O₃ concentrations. The S-R matrix consists of fixed transfer coefficients that relate annual average PM_{2.5} concentrations at a single receptor in each county to the contribution of PM_{2.5} precursors from each emissions source. For ozone, the matrix has separate transfer coefficients for NO_x and VOC to calculate the ozone season maximum daily 8-hour average (MDA8) ozone concentrations. The S-R matrix is based on the Comprehensive Air Quality Model with Extensions (CAMx) and specifically uses the source apportionment feature to track the contribution of air pollutant emissions at sources to concentrations at receptors. CAMx is a photochemical grid model that comprises an open-source system for tropospheric air pollution over various spatial scales.

The COBRA model contains detailed county- and source-type-specific emissions estimates for 2028, presented in discrete categories, known as tiers, along with other emissions source parameters. These estimates account for federal and state regulations as of May 2018.¹²² In addition to the health outputs, the analysis also reports the population-weighted change in annual average PM_{2.5} concentrations under the pathway, calculated using

¹²⁰ "CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)," US EPA.

¹²¹ COBRA relies on a suite of health impact functions and valuation functions that closely approximate what EPA used in developing the Final 2006 National Ambient Air Quality Standards (NAAQS) for PM.

¹²² Projected EGU emissions comply with the Cross-State Air Pollution Rule Update (CSAPR Update) finalized December 27, 2016, the Mercury and Air Toxics Rule (MATS), and the Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources.

COBRA's estimates of county-level PM_{2.5} changes and each county's total population. This metric is useful as an approximation of the overall effect each scenario will have on regional air quality. A significant change in this version of COBRA is the inclusion of ozone health effects. The health outcomes reported here reflect the combined effects of PM_{2.5} and O₃.

Modeling Inputs and Approach

To translate the calculated emissions into the COBRA model, the analysis adjusted emissions to fit the source categories in COBRA for the BAU and mitigation pathway. We modeled two analysis years (2030 and 2050). The sector emissions that were updated in COBRA for the BAU and mitigation pathway are discussed above.

However, the sectors defined in COBRA do not cleanly align with those modeled here. In COBRA, emissions are defined according to specific tiers. We identified the tiers that likely most accurately reflect sector emissions in the default COBRA emissions data. Table 108 through Table 111 lists the selected tiers into which the analysis mapped the calculated sector emissions.

We did not adjust emissions for the remaining categories in the default COBRA emissions dataset, except for the power and industry sectors. We zeroed out the remaining COBRA default tiers for power and industry sectors because the analysis assumes the state's emissions represent the full sector. Because COBRA calculates health benefits based on changes in emissions, this approach determines benefits solely for the modeled sectors. Although there may be some uncertainty in mapping sectors to COBRA tiers, the approach captures all changes in CAP emissions from the scenarios.

Table 108. Buildings Sector Tier Mapping

Tier 1 Name	Tier 2 Name	Tier 3 Name	Emissions Sector Apportioning
Fuel Combustion: Other	Commercial/Institutional Oil	Other	Commercial Fuel Oil
Fuel Combustion: Other	Commercial/Institutional Gas	Other	Commercial Natural Gas
Fuel Combustion: Other	Misc. Fuel Combustion (Except Residential)	Other	Commercial-Propane
Fuel Combustion: Other	Residential Other	Distillate Oil	Residential-Fuel Oil
Fuel Combustion: Other	Residential Other	Natural Gas	Residential Natural Gas
Fuel Combustion: Other	Residential Other	Other	Residential-Propane

Table 109. Transportation Sector Tier Mapping

Tier 1 Name	Tier 2 Name	Tier 3 Name	Emissions Sector Apportioning
Highway Vehicles	CNG	Heavy-Duty	CNG, Medium-and Heavy-Duty
Highway Vehicles	Diesel Fuel	Heavy-Duty	Diesel Fuel, Medium-and Heavy-Duty

Tier 1 Name	Tier 2 Name	Tier 3 Name	Emissions Sector Apportioning
Highway Vehicles	Diesel Fuel	Light-Duty	Diesel Fuel, Light-Duty + Diesel Fuel, Motorcycle
Highway Vehicles	Ethanol (E-85)	Light-Duty	Ethanol (E-85), Motorcycle + Ethanol (E-85), Light-Duty
Highway Vehicles	Gasoline	Heavy-Duty	Gasoline, Medium-and Heavy-Duty + Ethanol (E-85), Medium-and Heavy-Duty
Highway Vehicles	Gasoline	Light-Duty	Gasoline, Motorcycle + Gasoline, Light-Duty + CNG, Light-Duty + CNG, Motorcycle
Off-Highway	Aircraft	Other	All aviation emissions
Off-Highway	Marine Vessels	Diesel	All ferry emissions
Off-Highway	Railroads	Other	All passenger rail emissions

Table 110. Power Sector Tier Mapping

Tier1 Name	Tier2 Name	Tier3 Name	Emissions Sector Apportioning
Fuel Combustion: Electric Utility	Gas	Natural	Gas

Table 111. Industrial Sector Tier Mapping

Tier 1 Name	Tier 2 Name	Tier 3 Name	Emissions Sector Apportioning
Fuel Combustion: Industrial	Oil	Residual	Residual Fuel
Fuel Combustion: Industrial	Oil	Distillate	Distillate Fuel + Kerosene
Fuel Combustion: Industrial	Gas	Natural	Natural Gas
Fuel Combustion: Industrial	Internal Combustion	Other	Motor Gasoline
Fuel Combustion: Industrial	Gas	Other	Hydrocarbon Gas Liquids + Special Naphthas
Fuel Combustion: Industrial	Other	Other	Hydrogen

For each sector's BAU and mitigation pathway emissions by county and fuel, as described above, we distributed emissions to the Tier 3-level for each analysis year, proportional to the magnitude of the default 2028 COBRA emissions subset corresponding to the sector's tiers in Connecticut. The analysis also apportioned emissions by stack height based on the corresponding distribution in the 2028 default COBRA

emissions. This approach aligns emissions inputs with their sources for COBRA modeling while retaining the total specificity calculated by the analysis.

Health Incidence and Impact Functions

COBRA relies on baseline incidence rates for each health endpoint and health impact functions to estimate the absolute change in annual incidence of an adverse health effect. The analysis obtained age-, health endpoint-, and county-specific incidence rates in the United States, projected for each analysis year, from the US EPA Environmental Benefits Mapping and Analysis Program (BenMAP)¹²³ model database. COBRA includes several pre-loaded health impact functions that estimate changes in adverse health effects from changes in air pollutant concentrations, based on epidemiological studies. Each function was developed based on data from cohort studies performed in various locations throughout the US and uses different formulas and coefficients. The applicable ages for each health impact function reflect the age groups examined in the cohort studies. COBRA employs these health impact functions to assess the impact of PM_{2.5} and O₃ reductions on mortality incidence (for both infants and adults), nonfatal heart attacks, hospital admissions, and emergency room visits for respiratory and cardiovascular events, acute bronchitis, asthma symptoms, minor restricted activity days, and work and school loss days. For certain health endpoints, such as adult mortality and nonfatal heart attacks, COBRA employs multiple functions to obtain lower-bound and upper-bound estimates of potential health impacts. This is consistent with the methods the EPA employed when analyzing proposed National Ambient Air Quality Standards.¹²⁴

Discount Rate

In COBRA, a discount rate is applied to convert future economic values to present terms, as health effects and their associated economic values do not occur solely in the year of analysis. Therefore, COBRA accounts for a general preference for presenting future benefits by discounting benefits received later. COBRA Version 5.2 defaults to using a 2% discount rate to calculate monetized health benefits.

Population

The affected population is the number of people exposed to reduced PM_{2.5} and O₃ levels resulting from the mitigation pathway. We obtained county- and age-specific population estimates for the analysis years from the BenMAP model database. These are based on the 2010 US Census, using annual population growth rates developed by Woods and Poole (2015).¹²⁵ This approach aligns with BenMAP's spatial and age-group resolution within Connecticut for input into COBRA.

Valuation

The final step in the health benefits analysis is to estimate the economic value of avoided health impacts. COBRA includes several pre-loaded valuation functions for health endpoints associated with O₃ and PM_{2.5} concentrations. Depending on the health endpoint being considered, valuation methods may involve estimates of willingness to pay to avoid certain illnesses, the medical costs of treating illnesses, the value of lost wages, and the EPA-estimated Value of a Statistical Life (VSL; applicable only to mortality endpoints). Default valuation data for all health points in COBRA are reported in 2023\$, and we used the Bureau of Labor

¹²³ Environmental Benefits and Mapping Program-Community Edition (BenMAP-CE). BenMAP is US EPA's detailed model for estimating the health impacts from air pollution. Unlike COBRA, it relies on detailed input on changes in air pollutant concentrations, then applies concentration-response (C-R) health impact functions. See <https://www.epa.gov/benmap> for more information.

¹²⁴ US EPA. (2006). Final Regulatory Impact Analysis: PM_{2.5} NAAQS. Research Triangle Park, NC: Office of Air and Radiation, Office of Air Quality Planning and Standards; US EPA. (2009). Proposed NO₂ NAAQS Regulatory Impact Analysis (RIA). Research Triangle Park, NC: Office of Air and Radiation, Office of Air Quality Planning and Standards

¹²⁵ Woods & Poole Economics Inc. 2015. Complete Demographic Database. Washington, DC. <http://www.woodsandpoole.com/index.php>.

Statistics (BLS) consumer price index to convert to 2025\$.¹²⁶ For non-mortality health endpoints, we did not adjust valuation data to reflect changes in willingness to pay, medical costs, or lost wages during the analysis years. However, because the VSL is typically the dominant contributor to monetized benefits, we followed EPA's guidance for economic analysis¹²⁷ and used the standard VSL of \$4.8 million in (1990\$).¹²⁸ We applied projected income growth rates from the Organization for Economic Cooperation and Development and consumer price index data from the BLS to update this base VSL value to each analysis year, expressed in 2025\$.¹²⁹

We also applied a 20-year cessation lag to mortality benefits, consistent with EPA practice and Science Advisory Board (SAB) recommendations that long-term PM_{2.5} mortality risks decline gradually rather than immediately (US EPA, 2004).¹³⁰ The SAB has advised allocating approximately 30% of benefits in year 1, 50% across years 2-5, and 20% across years 6-20. Although COBRA does not apply cessation lags by default, we include the lag in this analysis for consistency with EPA's NAAQS Regulatory Impact Analyses, where the 20-year lag has been used for more than a decade.

We did not include consumer costs outside of the health sector, such as changes in fuel costs or tax revenue effects, in this valuation. This analysis focuses exclusively on monetized health benefits resulting from reduced sector emissions.

Benefits Assessment

Emissions Levels Under Each Scenario

The analysis estimated cumulative co-pollutant emissions for 2025–2050 under the BAU and mitigation pathway across all sectors described above. For each sector, annual emissions were first calculated using the methods described in the previous sections. Annual emissions were then summed across all years to produce cumulative emissions by county, pollutant, and scenario. These cumulative county-level results were then aggregated to the state level.

The following tables (Table 112-Table 119) present cumulative emissions totals for 2025–2050 in pounds (lbs.) by sector and scenario, along with cumulative statewide totals across all sectors. Across sectors, cumulative emissions generally decrease from the BAU to the mitigation pathway as cleaner technologies and fuels are adopted over time. Buildings, on-road transportation, industry, passenger rail, ferry, and power sectors show lower cumulative emissions under the mitigation pathway across the pollutants evaluated. Aviation follows the same pattern for CO, NO_x, PM₁₀, PM_{2.5}, and SO₂, while VOC remains nearly unchanged due to GREET tailpipe assumptions for SAF.

¹²⁶ Bureau of Labor Statistics, 2025 (Series ID: CUUR0000SA0, CUUS0000SA0): <https://data.bls.gov/pdq/SurveyOutputServlet>

¹²⁷ US EPA. 2010. Guidelines for Preparing Economic Analyses. EPA 240-R-10-001.

¹²⁸ Our approach is consistent with EPA regulatory impact analyses which use this value for VSL and adjust it for inflation and changes in income over time.

¹²⁹ OECD (2020), "Long-term baseline projections, No. 103", OECD Economic Outlook: Statistics and Projections (database): https://www.oecd-ilibrary.org/economics/data/oecd-economic-outlook-statistics-and-projections/long-term-baselineprojections-no-103_68465614-en.

¹³⁰ There is scientific consensus that reductions in PM_{2.5}-related mortality risks do not occur immediately after exposure reductions. Much of the PM-related mortality is linked to long-term disease progression (e.g., chronic respiratory and cardiovascular conditions), meaning that benefits accrue gradually rather than instantaneously. US Environmental Protection Agency, 2004. Advisory Council on Clean Air Compliance Analysis Response to Agency Request on Cessation Lag. EPA-COUNCIL-LTR-05-001.

Table 112. Cumulative emissions (lbs.) (2025-2050) by scenario – Industry

Pollutant	BAU	Mitigation
CO	96,410,504	44,107,638
Lead	989	400
NO _x	204,361,998	113,795,133
PM _{2.5}	9,870,460	4,503,914
SO ₂	4,810,442	2,355,783
VOC	91,227,540	45,329,959

Table 113. Cumulative emissions (lbs.) (2025-2050) by scenario – Buildings

Pollutant	BAU	Mitigation
CO	252,119,457	183,227,149
NO _x	520,471,119	377,795,058
SO ₂	4,082,373	2,959,128
VOC	19,959,482	14,582,661
PM _{2.5}	39,965,292	29,067,552

Table 114. Cumulative emissions (lbs.) (2025-2050) by scenario – Power¹³¹

Pollutant	BAU	Mitigation
NO _x	38,218,554	25,238,319
SO ₂	-	-
VOC	1,661,928	1,097,485
PM _{2.5}	3,330,809	2,199,560
NH ₃	908,594	600,007

¹³¹ Note: power sector emissions do not include CO.

Table 115. Cumulative emissions (lbs.) (2025-2050) by scenario – Aviation

Pollutant	BAU	Mitigation
CO	42,844,728	42,232,592
NOx	163,110,137	155,456,431
SO ₂	23,110,018	9,612,886
VOC	6,025,927	6,036,516
PM ₁₀	1,918,282	887,544
PM _{2.5}	1,918,282	887,544

Table 116. Cumulative emissions (lbs.) (2025-2050) by scenario – Passenger Rail

Pollutant	BAU	Mitigation
NOx	3,407,546	1,731,760
VOC	235,523	119,696
CO	404,452	205,548
PM ₁₀	56,147	28,535
PM _{2.5}	54,462	27,678
SO ₂	-	-

Table 117. Cumulative emissions (lbs.) (2025-2050) by scenario – Ferry

Pollutant	BAU	Mitigation
NOx	42,561,263	16,369,717
VOC	1,612,169	620,065
CO	3,546,772	1,364,143
PM ₁₀	602,127	231,587
PM _{2.5}	553,957	213,060
SO ₂	1,292,274	497,028

Table 118. Cumulative emissions (lbs.) (2025-2050) by scenario – On-Road Transportation

Pollutant	BAU	Mitigation
NO _x	375,891,406	295,837,980
VOC	241,211,961	175,863,577
CO	3,256,784,365	2,322,119,792
PM ₁₀	8,359,666	6,598,862
PM _{2.5}	7,512,585	5,939,598
SO ₂	3,836,716	2,576,110
NH ₃	65,208,798	43,422,973

Table 119. Cumulative emissions (lbs.) (2025-2050) by scenario – Total (Across all Sectors)¹³²

Pollutant	BAU	Mitigation
CO	3,652,110,277	2,593,256,861
NO _x	1,348,022,022	986,224,397
PM _{2.5}	63,205,847	42,838,907
SO ₂	37,131,822	18,000,936
VOC	361,934,530	243,649,959

Emissions Reductions

Cumulative co-pollutant emission reductions were estimated for 2025–2050 under the mitigation pathway by comparing modeled emissions to the BAU scenario. For each pollutant and sector, reductions represent the difference between cumulative emissions under the BAU scenario and cumulative emissions under the mitigation pathway. Positive values indicate net reductions, while negative values, shown in parentheses, indicate net increases relative to the BAU scenario. The tables below summarize the cumulative reductions by sector, as well as total reductions across all sectors.

Industry

In the industry sector, cumulative emissions reductions from 2025 to 2050 reflect lower combustion-related emissions under the mitigation pathway relative to BAU. These reductions are driven by changes in industrial fuel use over time, including a shift away from more emissions-intensive fuels and reduced reliance on combustion-based energy. As shown below, the largest cumulative reductions occur for NO_x, CO, and VOC.

¹³² Note: power sector emissions do not include CO.

Table 120. Total industry emissions reductions (lbs.), Cumulative (2025-2050)

Pollutant	Reductions
CO	52,302,866
Lead	589
NOx	90,566,864
PM _{2.5}	5,366,546
SO ₂	2,454,659
VOC	45,897,581

Buildings

The buildings sector yields substantial cumulative emissions reductions from 2025 to 2050 as electrification and energy efficiency measures reduce fossil fuel combustion in residential and commercial buildings. The largest reductions are observed for NOx and CO, with additional benefits for PM_{2.5}, VOC, and SO₂. These results indicate that building decarbonization strategies can provide meaningful air quality benefits alongside greenhouse gas reductions.

Table 121. Total commercial and residential buildings emissions reductions (lbs.), Cumulative (2025-2050)

Pollutant	Reductions
CO	68,892,308
NOx	142,676,060
SO ₂	1,123,245
VOC	5,376,822
PM _{2.5}	10,897,740

Power

Cumulative emissions reductions in the power sector are driven by declining reliance on in-state fossil generation over the study period. Because Connecticut's power sector emissions are primarily associated with natural gas-fired generation, reductions are concentrated in NOx, with additional decreases in PM_{2.5}, VOC, and NH₃ as overall generation from combustion sources declines. SO₂ reductions are not reported because baseline emissions are already negligible in the absence of coal-fired generation.

Table 122. Total power emissions reductions (lbs.), Cumulative (2025-2050)¹³³

Pollutant	Reductions
NO _x	12,980,235
SO ₂	-
VOC	564,444
PM _{2.5}	1,131,249
NH ₃	308,587

Aviation

The aviation results show that the mitigation pathway reduces cumulative emissions for most reported pollutants over 2025–2050, with the largest reduction occurring for SO₂ and additional reductions in NO_x, PM_{2.5}, and CO. The especially large reduction in SO₂ reflects the near-zero sulfur content assumed for SAF relative to conventional jet fuel, which substantially reduces sulfur dioxide formation during combustion. VOC emissions show a slight net increase under the mitigation pathway, reflecting higher VOC tailpipe emission factors for SAF than for conventional jet fuel.

Table 123. Total aviation emissions reductions (lbs.), Cumulative (2025-2050)

Pollutant	Reductions
CO	612,136
NO _x	7,653,705
SO ₂	13,497,131
VOC	(10,590)
PM ₁₀	1,030,738
PM _{2.5}	1,030,738

Note: Values in parentheses indicate net increases in emissions

Passenger Rail

Reductions in the passenger rail sector are observed across all reported pollutants, with the largest absolute reductions occurring for NO_x, followed by CO and VOCs. Smaller but still notable reductions are achieved for particulate matter as well. These reductions are consistent with a transition away from diesel-powered rail operations toward lower-emitting technologies, which substantially reduce combustion-related emissions. SO₂ emissions are reported as zero, reflecting the use of GREET pump-to-wheel emission factors based on ultra-low sulfur diesel fuel. Under these assumptions, downstream SO₂ emissions from combustion are negligible.

¹³³ Note: power sector emissions do not include CO.

Table 124. Total passenger rail emissions reductions (lbs.), Cumulative (2025-2050)

Pollutant	Reductions
NO _x	1,675,786
VOC	115,827
CO	198,904
PM ₁₀	27,612
PM _{2.5}	26,784
SO ₂	-

Ferry

The ferry sector exhibits substantial cumulative emission reductions under the mitigation pathway over the 2025–2050 period, driven by the phased electrification of diesel-powered ferry operations. The largest reductions occur for NO_x, reflecting the elimination of combustion-related emissions from marine diesel engines as routes transition to full electrification by 2040. Meaningful reductions are also observed for CO, VOC, SO₂, PM₁₀, and PM_{2.5} as diesel fuel use declines over time.

Table 125. Total ferry emissions reductions (lbs.), Cumulative (2025-2050)

Pollutant	Reductions
NO _x	26,191,547
VOC	992,104
CO	2,182,629
PM ₁₀	370,540
PM _{2.5}	340,897
SO ₂	795,245

On-Road Transportation

The mitigation pathway results in substantial cumulative reductions in on-road transportation co-pollutant emissions. Large reductions are observed for CO, NO_x, and VOC emissions, reflecting decreased combustion from gasoline and diesel vehicles under the modeled vehicle activity and fuel transitions. Reductions are also observed for PM₁₀, PM_{2.5}, SO₂, and NH₃, reflecting lower fuel combustion and associated exhaust emissions across the fleet.

Table 126. Total transportation sector emissions reductions (lbs.), Cumulative (2025-2050)

Pollutant	Reductions
NO _x	80,053,427
VOC	65,348,383
CO	934,664,573
PM ₁₀	1,760,804
PM _{2.5}	1,572,987
SO ₂	1,260,606
NH ₃	21,785,825

Total

When aggregated across all analyzed sectors, cumulative emissions decline for all major co-pollutants under the mitigation pathway over the 2025–2050 period. Large statewide reductions are observed for CO, NO_x, and VOCs, along with meaningful decreases in particulate matter, SO₂, and NH₃. Results here only include pollutants that are available for most or all sectors.

Table 127. Total emissions reductions (lbs.) (across sectors), Cumulative (2025-2050)¹³⁴

Pollutant	Reductions
CO	1,058,853,416
NO _x	361,797,624
PM _{2.5}	20,366,939
SO ₂	19,130,886
VOC	118,284,571

Quantified Health Benefits

As part of the co-benefits analysis, we assessed the avoided adverse health outcomes expected to result statewide under the mitigation pathway. The estimated impacts reflect changes across all sectors collectively rather than sector-specific modeling. The avoided impacts represent reductions in health incidence and associated avoided costs relative to the baseline case. The following tables present year-specific and cumulative health benefits and associated monetary values resulting from the quantified co-pollutant mitigation pathway in Connecticut between 2030 and 2050. These estimates are derived from the COBRA model and reflect changes in incidence (i.e., avoided cases) for each health impact category. The

¹³⁴ Note: power sector emissions do not include CO.

monetary benefits represent the economic value of these avoided outcomes, including reduced mortality, fewer hospital visits, and improved productivity through fewer missed school and workdays.

A low and high estimate for each health outcome is shown for each scenario and year. These values approximate a range reflecting uncertainty arising primarily from variability in key epidemiological and economic assumptions used in the analysis. They should not be interpreted as the full range of possible outcomes.

Analysis Year-Specific Impacts

Table 128 and Table 129 present total annual estimates of avoided adverse health outcomes and the corresponding economic value of these health risk reductions at a 2% discount rate for the mitigation pathway. These economic values reflect a combination of willingness to pay and cost of illness valuation methods, depending on the health endpoint,¹³⁵ and therefore represent monetized US public health benefits. Although COBRA can estimate benefits beyond the immediate location of emissions changes due to dispersion, this report presents public health benefits for Connecticut only.

At a 2% discount rate, total monetized public health benefits in Connecticut range from approximately \$110-\$160 million in 2030 to \$665-962 million in 2050 (2025\$) under the mitigation pathway. Mortality is the primary driver of monetized benefits from reduced emissions, with an estimated reduction in premature deaths of 38-56 under the mitigation pathway in 2050. Mortality attributed to PM_{2.5} and O₃ is summed to obtain a total estimate.

In Connecticut, population-weighted annual PM_{2.5} concentrations decline under the mitigation pathway. The annual concentration reductions under the mitigation pathway range from 0.0168 to 0.107 µg/m³ in 2030 and 2050, respectively.

Table 128. Connecticut State-Level Health Impact Summary for 2030 Under the Mitigation Pathway (2% Discount Rate).

Health Endpoint	2030	
	Change in the Number of Cases	Monetary Health Benefits (2025\$) ^{a,b}
PM, Mortality, low estimate	3.32	\$48,600,000
PM, Mortality, high estimate	6.71	\$98,300,000
O3, Mortality	3.58	\$52,400,000
Mortality, low estimate ^c	6.91	\$101,000,000
Mortality, high estimate ^d	10.30	\$151,000,000
PM, Infant Mortality	0.02	\$239,000
PM, Asthma Symptoms, Albuterol use	1,310.00	\$980

¹³⁵ For some health endpoints, the economic value estimates are based on non-market valuation studies that estimate people's willingness to pay for reductions in these health risks. For other endpoints, non-market valuation studies are not readily available, and valuation is approximated using cost-of-illness methods that estimate medical costs and illness-related productivity losses.

Health Endpoint	2030	
	Change in the Number of Cases	Monetary Health Benefits (2025\$) ^{a,b}
O3, Asthma Symptoms, Chest tightness	875.00	\$385,000
O3, Asthma Symptoms, Cough	1,030.00	\$454,000
O3, Asthma Symptoms, Shortness of breath	442.00	\$194,000
O3, Asthma Symptoms, Wheeze	827.00	\$364,000
Asthma Symptoms	4,490.00	\$1,400,000
PM, Asthma Incidence	6.82	\$602,000
O3, Asthma Incidence	20.10	\$1,780,000
Asthma Incidence	26.90	\$2,380,000
PM, Rhinitis Incidence	44.70	\$58,100
O3, Rhinitis Incidence	134.00	\$174,000
Rhinitis Incidence	179.00	\$232,000
PM, Respiratory Emergency Room Visits	2.25	\$4,270
O3, Respiratory Emergency Room Visits	9.02	\$17,100
Respiratory Emergency Room Visits	11.30	\$21,400
PM, Hospital Admits, All Respiratory	0.30	\$10,500
O3, Hospital Admits, All Respiratory	0.41	\$8,560
Hospital Admits, All Respiratory	0.71	\$19,100
PM, Nonfatal Heart Attacks	2.26	\$222,000
PM, Minor Restricted Activity Days	2,230.00	\$320,000
PM, Work Loss Days	378.00	\$138,000
PM, Incidence Lung Cancer	0.24	\$12,900
PM, Hospital Admits, Vascular Disease	0.47	\$15,700
PM, Hospital Admits, Alzheimer's Disease	2.28	\$59,400
PM, Hospital Admits, Parkinson's Disease	0.29	\$8,080

Health Endpoint	2030	
	Change in the Number of Cases	Monetary Health Benefits (2025\$) ^{a,b}
PM, Stroke Incidence	0.22	\$15,900
PM, Non-Hospital Cardiac Arrest	0.05	\$3,390
PM, ER Cardiac Visits	0.94	\$2,370
O3, Asthma ER Visits	0.07	\$65
O3, All-Cause School Days Lost	1,990.00	\$3,890,000
Total, low estimate		\$110,000,000
Total, high estimate		\$160,000,000
Population-Weighted Average Delta PM _{2.5} ($\mu\text{g}/\text{m}^3$)		0.02

^a The discount rate expresses future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis.

^b Adult mortality valuation is based on a Value of a Statistical Life (VSL; grown from EPA 1990 VSL using standard income growth data) and is lagged 20 years (per EPA guidance), not the default valuation in COBRA.

^c PM_{2.5} values within the low estimate are based on Wu et al. (2020)¹³⁶

^d PM_{2.5} values within the high estimate are based on Pope et al. (2019)¹³⁷

¹³⁶ Wu, X., D. Braun, J. Schwartz, M.A. Kioumourtoglou, and F. Dominici. 2020. Evaluating the impact of long-term exposure to fine particulate matter on mortality among the elderly. *Science Advances* 6: eaba5692.

¹³⁷ Pope, C.A., J.S. Lefler, M. Ezzati, J.D. Higbee, J.D. Marshall, S. Kim, M. Bechele, K.D. Gilliat, S.E. Vernon, A.L. Robinson, and R.T. Burnett. 2019. Mortality Risk and Fine Particulate Air Pollution in a Large, Representative Cohort of US Adults. *Environmental Health Perspectives* 127(7): 077077.

Table 129. Connecticut State-Level Health Impact Summary for 2050 Under the Mitigation Pathway (2% Discount Rate).

Health Endpoint	2050	
	Change in the Number of Cases	Monetary Health Benefits (2025\$) ^{a,b}
PM, Mortality, low estimate	18.80	\$308,000,000
PM, Mortality, high estimate	36.90	\$606,000,000
O3, Mortality	18.60	\$306,000,000
Mortality, low estimate ^c	37.50	\$615,000,000
Mortality, high estimate ^d	55.60	\$913,000,000
PM, Infant Mortality	0.09	\$1,500,000
PM, Asthma Symptoms, Albuterol use	8,860.00	\$6,620
O3, Asthma Symptoms, Chest tightness	4,770.00	\$2,100,000
O3, Asthma Symptoms, Cough	5,640.00	\$2,480,000
O3, Asthma Symptoms, Shortness of breath	2,410.00	\$1,060,000
O3, Asthma Symptoms, Wheeze	4,520.00	\$1,990,000
Asthma Symptoms	26,200.00	\$7,650,000
PM, Asthma Incidence	46.00	\$4,060,000
O3, Asthma Incidence	110.00	\$9,670,000
Asthma Incidence	156.00	\$13,700,000
PM, Rhinitis Incidence	302.00	\$393,000
O3, Rhinitis Incidence	731.00	\$951,000
Rhinitis Incidence	1,030.00	\$1,340,000
PM, Respiratory ER Visits	15.10	\$28,600
O3, Respiratory ER Visits	48.90	\$92,600
Respiratory ER Visits	64.00	\$121,000
PM, Hospital Admits, All Respiratory	2.00	\$69,200

Health Endpoint	2050	
	Change in the Number of Cases	Monetary Health Benefits (2025\$) ^{a,b}
O3, Hospital Admits, All Respiratory	2.13	\$44,600
Hospital Admits, All Respiratory	4.13	\$114,000
PM, Nonfatal Heart Attacks	14.50	\$1,420,000
PM, Minor Restricted Activity Days	15,100.00	\$2,160,000
PM, Work Loss Days	2,560.00	\$931,000
PM, Incidence Lung Cancer	1.59	\$83,700
PM, Hospital Admits, Vascular Disease	3.00	\$101,000
PM, Hospital Admits, Alzheimer's Disease	14.50	\$378,000
PM, Hospital Admits, Parkinson's Disease	1.86	\$51,600
PM, Stroke Incidence	1.38	\$102,000
PM, Non-Hospital Cardiac Arrest	0.31	\$22,200
PM, ER Cardiac Visits	6.17	\$15,500
O3, Asthma ER Visits	0.37	\$353
O3, All-Cause School Days Lost	10,900.00	\$21,200,000
Total, low estimate		\$665,000,000
Total, high estimate		\$962,000,000
Population-Weighted Average Delta PM _{2.5} (μg/m ³)		0.11

^a The discount rate expresses future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis.

^b Adult mortality valuation is based on a Value of a Statistical Life (VSL; grown from EPA 1990 VSL using standard income growth data) and is lagged 20 years (per EPA guidance), not the default valuation in COBRA.

^c PM_{2.5} values within the low estimate are based on Wu et al. (2020).¹³⁸

^d PM_{2.5} values within the high estimate are based on Pope et al. (2019).¹³⁹

¹³⁸ Wu, X., D. Braun, J. Schwartz, M.A. Kioumourtoglou, and F. Dominici. 2020. Evaluating the impact of long-term exposure to fine particulate matter on mortality among the elderly. *Science Advances* 6: eaba5692

¹³⁹ Pope, C.A., J.S. Lefler, M. Ezzati, J.D. Higbee, J.D. Marshall, S. Kim, M. Bechele, K.D. Gilliat, S.E. Vernon, A.L. Robinson, and R.T. Burnett. 2019. Mortality Risk and Fine Particulate Air Pollution in a Large, Representative Cohort of US Adults. *Environmental Health Perspectives* 127(7): 077077.

Cumulative Impacts

We also post-processed health benefits results from COBRA to illustrate the cumulative impacts of the proposed scenarios over the entire modeled period from 2030 to 2050. We calculated cumulative impacts using piecewise linear interpolation of the discounted monetized health benefits between the modeled years (2030 and 2050). Table 130 presents cumulative estimates of the total number of avoided adverse health effects and the associated economic value of these health risk reductions at the 2% discount rate under the mitigation pathway for Connecticut. As in the analysis year-specific impacts results, these economic values represent monetized public health benefits for Connecticut. At a 2% discount, cumulative monetized public health benefits from 2030 to 2050 in Connecticut range from approximately \$8.13 billion to \$11.8 billion under the mitigation pathway. Mortality is the primary driver of the benefits associated with emissions reductions, with an estimated reduction in premature deaths of 466 to 692 under the mitigation pathway.

Table 130. Connecticut State-Level Cumulative Health Impact Summary for 2030-2050 Under the Mitigation Pathway (2% Discount Rate), 2025\$.

Health Endpoint	Change in the Number of Cases	Monetary Health Benefits ^{a,b}
PM, Mortality, low estimate	232.00	\$3,740,000,000
PM, Mortality, high estimate	458.00	\$7,390,000,000
O3, Mortality	233.00	\$3,760,000,000
Mortality, low estimate ^c	466.00	\$7,520,000,000
Mortality, high estimate ^d	692.00	\$11,200,000,000
PM, Infant Mortality	1.13	\$18,300,000
PM, Asthma Symptoms, Albuterol use	107,000.00	\$79,800
O3, Asthma Symptoms, Chest tightness	59,300.00	\$26,100,000
O3, Asthma Symptoms, Cough	70,100.00	\$30,900,000
O3, Asthma Symptoms, Shortness of breath	30,000.00	\$13,200,000
O3, Asthma Symptoms, Wheeze	56,100.00	\$24,700,000
Asthma Symptoms	322,000.00	\$95,000,000
PM, Asthma Incidence	555.00	\$49,000,000
O3, Asthma Incidence	1,360.00	\$120,000,000
Asthma Incidence	1,920.00	\$169,000,000
PM, Rhinitis Incidence	3,640.00	\$4,730,000
O3, Rhinitis Incidence	9,080.00	\$11,800,000

Health Endpoint	Change in the Number of Cases	Monetary Health Benefits ^{a,b}
Rhinitis Incidence	12,700.00	\$16,500,000
PM, Respiratory ER Visits	182.00	\$345,000
O3, Respiratory ER Visits	608.00	\$1,150,000
Respiratory ER Visits	790.00	\$1,500,000
PM, Hospital Admits, All Respiratory	24.20	\$837,000
O3, Hospital Admits, All Respiratory	26.70	\$559,000
Hospital Admits, All Respiratory	50.90	\$1,400,000
PM, Nonfatal Heart Attacks	176.00	\$17,200,000
PM, Minor Restricted Activity Days	182,000.00	\$26,100,000
PM, Work Loss Days	30,800.00	\$11,200,000
PM, Incidence Lung Cancer	19.20	\$1,010,000
PM, Hospital Admits, Vascular Disease	36.50	\$1,220,000
PM, Hospital Admits, Alzheimer's Disease	176.00	\$4,600,000
PM, Hospital Admits, Parkinson's Disease	22.50	\$627,000
PM, Stroke Incidence	16.80	\$1,240,000
PM, Non-Hospital Cardiac Arrest	3.74	\$269,000
PM, ER Cardiac Visits	74.70	\$188,000
O3, Asthma ER Visits	4.54	\$4,390
O3, All-Cause School Days Lost	135,000.00	\$264,000,000
Total, low estimate		\$8,130,000,000
Total, high estimate		\$11,800,000,000

^a The discount rate expresses future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis.

^b Adult mortality valuation is based on a Value of a Statistical Life (VSL; grown from EPA 1990 VSL using standard income growth data) and is lagged 20 years (per EPA guidance), not the default valuation in COBRA.

^c PM2.5 values within the low estimate are based on Wu et al. (2020).¹⁴⁰

^d PM2.5 values within the high estimate are based on Pope et al. (2019).¹⁴¹

¹⁴⁰ Wu, X., D. Braun, J. Schwartz, M.A. Kioumourtoglou, and F. Dominici. 2020. Evaluating the impact of long-term exposure to fine particulate matter on mortality among the elderly. *Science Advances* 6: eaba5692

¹⁴¹ Pope, C.A., J.S. Lefler, M. Ezzati, J.D. Higbee, J.D. Marshall, S. Kim, M. Bechele, K.D. Gilliat, S.E. Vernon, A.L. Robinson, and R.T. Burnett. 2019. Mortality Risk and Fine Particulate Air Pollution in a Large, Representative Cohort of US Adults. *Environmental Health Perspectives* 127(7): 077077.



APPENDIX 6: WORKFORCE PLANNING ANALYSIS METHODOLOGY

Purpose and Scope of the Workforce Planning Analysis

This appendix documents the analytical approach, data sources, and assumptions used to assess workforce supply and demand associated with implementation of Connecticut's CCAP. The workforce planning analysis was designed to identify occupations critical to implementation of the plan's GHG emissions reduction measures, evaluate near-term labor market conditions, and assess opportunities to align existing workforce capacity with projected implementation needs.

The analysis supports CCAP implementation planning by answering three core questions:

- Which occupations are most relevant to implementation of CCAP measures?
- Where are workforce shortages or surpluses most likely to affect implementation readiness?
- Which existing occupations and training pathways offer opportunities for workforce transitions into implementation-critical roles?

The analysis focuses on near-term and medium-term workforce conditions relevant to CCAP implementation and is not intended to serve as a long-range labor market forecast.

Identification of Implementation-Relevant Occupations

The workforce planning analysis examined labor demand associated with 17 CCAP GHG emissions reduction measures and grouped them into seven categories for analysis: transportation, buildings, electric power, industry, waste and wastewater, agriculture, and natural and working lands. Each measure was reviewed to identify the occupations involved in technology deployment, construction, operation, maintenance, program administration, and supporting services required for implementation. Occupations were mapped using Standard Occupational Classification (SOC) codes to ensure consistency across data sources.

The analysis identified 151 occupations relevant to CCAP implementation. These occupations account for approximately 339,000 workers, representing about 18 percent of total statewide employment in 2025. The majority of identified occupations fall within the following major occupational groups: architecture and engineering; construction and extraction; installation, maintenance, and repair; production; transportation; and material moving. This distribution reflects the infrastructure-intensive and operational nature of CCAP implementation.

Labor Market Data Sources

The workforce planning analysis relied primarily on Lightcast labor market data, which integrates multiple data sources including the U.S. Bureau of Labor Statistics, employer job postings, and modeled projections. Key data inputs included:

- Current employment by occupation
- Projected employment growth

- Occupational separations (replacement needs due to retirements and turnover)
- Projected annual hires

Employment and projections reflect statewide conditions and do not capture sub-state geographic variation.

Workforce Gap Estimation Methodology

Workforce demand for each occupation was defined as the sum of:

- Projected employment growth, and
- Occupational separations, representing workers leaving the occupation due to retirement, career changes, or other factors

This approach captures both expansion demand and replacement demand. Workforce supply was represented by projected annual hires into each occupation, based on historical and modeled labor market behavior.

The workforce gap for each occupation was calculated as: $\text{Gap} = \text{Supply (hires)} - \text{Demand (growth + separations)}$. A negative gap indicates a projected workforce shortage, while a positive gap indicates a projected workforce surplus. Gap estimates reflect near-term labor market conditions and are intended to highlight potential implementation risks and opportunities rather than precise future shortages.

Shortage Occupations

The analysis identifies targeted workforce shortages in several implementation-critical occupations, particularly:

- Electricians
- Telecommunications line installers and repairers
- Mechanical and civil engineers
- Construction and engineering managers
- Utility and infrastructure-support roles

In some cases, shortages are modest in percentage terms but significant in absolute terms due to the scale at which these occupations are required across multiple CCAP measures. In other cases, shortages are large in percentage terms within smaller, specialized occupations that are essential for grid, communications, or natural and working lands activities.

In addition to direct shortage roles, the analysis identifies adjacent occupations that may provide strong transition pathways. HVAC mechanics, plumbers and pipefitters, automotive service technicians, diesel mechanics, and helper-level construction trades can serve as feeder occupations for targeted upskilling and retraining.

Several occupations appear repeatedly across multiple CCAP measures and sectors, increasing the likelihood of competition for labor across projects and timelines. Coordinating implementation schedules, smoothing demand peaks, and aligning workforce investments with deployment timelines can help mitigate these risks.

Balanced and Surplus Occupations

Many CCAP-adjacent occupations exhibit balanced or surplus labor market conditions, including:

- HVAC mechanics and installers
- Plumbers and pipefitters

- Maintenance and repair workers
- Automotive and diesel mechanics
- Construction laborers and helper-level trades

These occupations represent important feeder and transition pathways into more constrained, implementation-critical roles through targeted upskilling, reskilling, and credentialing.

Table 131. Top 20 occupations with the largest net workforce shortages in Connecticut, 2024

SOC	Occupation	Sector
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	Waste and Wastewater
11-9041	Architectural and Engineering Managers	Transportation
17-2141	Mechanical Engineers	Industry
11-3071	Transportation, Storage, and Distribution Managers	Transportation
11-3051	Industrial Production Managers	Industry
53-7051	Industrial Truck and Tractor Operators	Waste and Wastewater
17-2051	Civil Engineers	Transportation
51-1011	First-Line Supervisors of Production and Operating Workers	Industry
47-2061	Construction Laborers	Transportation, Buildings
11-9021	Construction Managers	Transportation, Buildings
25-2032	Career/Technical Education Teachers, Secondary School	Transportation, Buildings
49-9052	Telecommunications Line Installers and Repairers	Electric Power
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	Transportation
17-2161	Nuclear Engineers	Electric Power
49-9099	Installation, Maintenance, and Repair Workers, All Other	Electric Power
19-4071	Forest and Conservation Technicians	Natural and Working Lands
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	Transportation, Electric Power
49-9098	Helpers--Installation, Maintenance, and Repair Workers	Electric Power
47-2111	Electricians	Transportation, Buildings, Electric Power, Industry
53-7081	Refuse and Recyclable Material Collectors	Waste and Wastewater

Table 132. Top 20 occupations with the largest workforce shortages as a percentage of employment, 2024

SOC	Occupation	Sector
53-7071	Gas Compressor and Gas Pumping Station Operators	Electric Power, Waste and Wastewater
51-8091	Chemical Plant and System Operators	Electric Power, Waste and Wastewater
47-4021	Elevator and Escalator Installers and Repairers	Transportation
19-4043	Geological Technicians, Except Hydrologic Technicians	Electric Power
53-4013	Rail Yard Engineers, Dinkey Operators, and Hostlers	Transportation
45-4021	Fallers	Natural and Working Lands
49-2093	Electrical and Electronics Installers and Repairers, Transportation Equipment	Transportation, Electric Power
47-3016	Helpers--Roofers	Transportation, Buildings, Electric Power
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	Electric Power
47-2231	Solar Photovoltaic Installers	Electric Power
19-4044	Hydrologic Technicians	Electric Power
19-4071	Forest and Conservation Technicians	Natural and Working Lands
17-2041	Chemical Engineers	Industry
49-9052	Telecommunications Line Installers and Repairers	Electric Power
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	Transportation, Electric Power
47-2161	Plasterers and Stucco Masons	Transportation, Buildings
19-4012	Agricultural Technicians	Agriculture
19-4042	Environmental Science and Protection Technicians, Including Health	Natural and Working Lands
11-3071	Transportation, Storage, and Distribution Managers	Transportation
53-7199	Material Moving Workers, All Other	Waste and Wastewater

Table 133. Top 20 occupations with the largest net workforce surpluses in Connecticut, 2024

SOC	Occupation	Sector
11-1021	General and Operations Managers	Industry
53-3033	Light Truck Drivers	Waste and Wastewater
47-2031	Carpenters	Transportation, Buildings
53-3032	Heavy and Tractor-Trailer Truck Drivers	Waste and Wastewater
17-2199	Engineers, All Other	Industry
37-3011	Landscaping and Groundskeeping Workers	Natural and Working Lands
51-4041	Machinists	Industry
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	Transportation
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Transportation, Buildings, Industry
53-3052	Bus Drivers, Transit and Intercity	Transportation
51-4121	Welders, Cutters, Solderers, and Brazers	Buildings
47-2141	Painters, Construction and Maintenance	Transportation, Buildings
49-9071	Maintenance and Repair Workers, General	Electric Power
13-1041	Compliance Officers	Transportation, Buildings
49-3023	Automotive Service Technicians and Mechanics	Transportation
49-9031	Home Appliance Repairers	Buildings
49-9051	Electrical Power-Line Installers and Repairers	Electric Power
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	Transportation, Buildings
47-2152	Plumbers, Pipefitters, and Steamfitters	Transportation, Buildings
47-2082	Tapers	Transportation, Buildings

Table 134. Top 20 occupations with the largest workforce surpluses as a percentage of employment, 2024

SOC	Occupation	Sector
47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters	Transportation, Buildings
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	Transportation
45-4023	Log Graders and Scalers	Natural and Working Lands
47-2082	Tapers	Transportation, Buildings
47-2043	Floor Sanders and Finishers	Transportation, Buildings
45-4011	Forest and Conservation Workers	Natural and Working Lands
17-2171	Petroleum Engineers	Electric Power
47-3014	Helpers--Painters, Paperhangers, Plasterers, and Stucco Masons	Transportation, Buildings
17-2021	Agricultural Engineers	Transportation
53-7121	Tank Car, Truck, and Ship Loaders	Waste
49-9031	Home Appliance Repairers	Buildings
47-3019	Helpers, Construction Trades, All Other	Transportation, Buildings
47-2131	Insulation Workers, Floor, Ceiling, and Wall	Transportation, Buildings
17-2151	Mining and Geological Engineers, Including Mining Safety Engineers	Electric Power
49-3053	Outdoor Power Equipment and Other Small Engine Mechanics	Transportation
19-1032	Foresters	Natural and Working Lands
51-8021	Stationary Engineers and Boiler Operators	Industry
51-8092	Gas Plant Operators	Electric Power
19-4031	Chemical Technicians	Industry
17-3025	Environmental Engineering Technologists and Technicians	Natural and Working Lands

Table 135 summarizes the occupations with the largest estimated workforce shortages in 2024. Shortages appear across multiple CCAP-relevant sectors, with the largest absolute gaps in high-employment occupations (e.g., material movers and construction laborers) and the largest proportional gaps in smaller, specialized occupations (e.g., petroleum pump system operators; forest and conservation technicians; telecommunications line installers). Cross-cutting roles — such as engineers, construction managers, and electricians — also show shortages, indicating potential competition for talent across sectors and project types as implementation ramps up.

Table 135. Occupations with the Largest Estimated Shortage of Workers

SOC	Description	Sector	2024 Jobs	2024 Gap	Gap as % of Workers 2024
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	Waste	26,997	(562)	2.1%
11-9041	Architectural and Engineering Managers	Transportation	5,004	(325)	6.5%
17-2141	Mechanical Engineers	Industry	5,344	(302)	5.7%
11-3071	Transportation, Storage, and Distribution Managers	Transportation	2,584	(253)	9.8%
11-3051	Industrial Production Managers	Industry	3,208	(251)	7.8%
53-7051	Industrial Truck and Tractor Operators	Waste	3,107	(246)	7.9%
17-2051	Civil Engineers	Transportation	4,448	(232)	5.2%
51-1011	First-Line Supervisors of Production and Operating Workers	Industry	9,170	(220)	2.4%
47-2061	Construction Laborers	Transportation, Buildings	13,517	(181)	1.3%
11-9021	Construction Managers	Transportation	5,776	(126)	2.2%
25-2032	Career/Technical Education Teachers, Secondary School	Transportation, Buildings	1,694	(120)	7.1%
49-9052	Telecommunications Line Installers and Repairers	Electric Power	868	(113)	13.1%
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	Transportation	6,317	(84)	1.3%
17-2161	Nuclear Engineers	Electric Power	999	(82)	8.3%
49-9099	Installation, Maintenance, and Repair Workers, All Other	Electric Power	2,398	(72)	3.0%

SOC	Description	Sector	2024 Jobs	2024 Gap	Gap as % of Workers 2024
19-4071	Forest and Conservation Technicians	Natural and Working Lands	407	(69)	16.9%
49-2094	Electrical and Electronics Repairers, Commercial and Industrial Equipment	Transportation, Electric Power	591	(69)	11.6%
49-9098	Helpers--Installation, Maintenance, and Repair Workers	Electric Power	1,159	(65)	5.6%
47-2111	Electricians	Transportation, Buildings, Electric Power, Industry	8,756	(64)	0.7%
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	Electric Power	315	(64)	20.3%

Table 136 summarizes occupations with the largest estimated workforce surpluses in 2024. The largest absolute surpluses appear in broad, high-employment occupations (e.g., general and operations managers; light and heavy truck drivers; carpenters), while several smaller occupations show high surplus rates relative to their size, such as home appliance repairers, Electrical Power-Line Installers and Repairers; Welders, Cutters, Solderers, and Brazers; and Bus Drivers, Transit and Intercity. Many surplus occupations overlap with CCAP-adjacent skill needs in construction, building maintenance, transportation operations, and industrial production, suggesting opportunities to transition and upskill workers into implementation-critical shortage roles where appropriate. Surplus construction trades can be targeted for skill transition into other critical roles such as electricians, heat-pump/HVAC specialties, energy efficiency/weatherization, and solar installation.

Table 136. Occupations with the Largest Estimated Surplus of Workers

SOC	Description	Sector	2024 Jobs	2024 gap	Gap as % of Workers 2024
11-1021	General and Operations Managers	Industry	47,605	670	1.4%
53-3033	Light Truck Drivers	Waste	11,369	533	4.7%
47-2031	Carpenters	Transportation, Buildings	9,705	331	3.4%
53-3032	Heavy and Tractor-Trailer Truck Drivers	Waste	17,641	277	1.6%
17-2199	Engineers, All Other	Industry	1,858	198	10.6%

SOC	Description	Sector	2024 Jobs	2024 gap	Gap as % of Workers 2024
37-3011	Landscaping and Groundskeeping Workers	Natural and Working Lands	17,050	196	1.2%
51-4041	Machinists	Industry	6,178	189	3.1%
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	Transportation	2,627	187	7.1%
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Transportation, Buildings, Industry	5,173	178	3.4%
53-3052	Bus Drivers, Transit and Intercity	Transportation	2,269	177	7.8%
51-4121	Welders, Cutters, Solderers, and Brazers	Buildings	2,516	172	6.8%
47-2141	Painters, Construction and Maintenance	Transportation, Buildings	4,100	157	3.8%
49-9071	Maintenance and Repair Workers, General	Electric Power	13,982	154	1.1%
13-1041	Compliance Officers	Transportation, Buildings	3,536	151	4.3%
49-3023	Automotive Service Technicians and Mechanics	Transportation	7,687	116	1.5%
49-9031	Home Appliance Repairers	Buildings	495	90	18.1%
49-9051	Electrical Power-Line Installers and Repairers	Electric Power	893	78	8.8%
47-2152	Plumbers, Pipefitters, and Steamfitters	Transportation, Buildings	5,122	74	1.4%

Table 137 focuses on a subset of priority occupations that appear repeatedly across CCAP measures and are therefore most consequential for implementation. The table shows that several implementation-critical occupations are projected to be in shortage in 2024, especially telecommunications line installers and repairers, mechanical and civil engineers, and solar photovoltaic installers, while electricians and construction laborers show smaller shortages in percentage terms but remain important because they are needed at scale across multiple sectors. In contrast, some adjacent occupations (e.g., HVAC mechanics/installers, plumbers/pipefitters/steamfitters, and electrical power-line installers and repairers) show surplus conditions, indicating near-term opportunities to align and transition existing workers into the most constrained roles.

Table 137. Gap for Priority Occupations

SOC	Description	Sector	2024 Jobs	2024 gap	Gap as Percent of Employment 2024
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	Waste	26,997	(562)	-2.1%
17-2141	Mechanical Engineers	Industry	5,344	(302)	-5.7%
17-2051	Civil Engineers	Transportation	4,448	(232)	-5.2%
47-2061	Construction Laborers	Transportation, Buildings	13,517	(181)	-1.3%
49-9052	Telecommunications Line Installers and Repairers	Electric Power	868	(113)	-13.1%
47-2111	Electricians	Transportation, Buildings, Electric Power, Industry	8,756	(64)	-0.7%
47-2231	Solar Photovoltaic Installers	Electric Power	179	(34)	-18.8%
47-2152	Plumbers, Pipefitters, and Steamfitters	Transportation, Buildings	5,122	74	1.4%
49-9051	Electrical Power-Line Installers and Repairers	Electric Power	893	78	8.8%
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Transportation, Buildings, Industry	5,173	178	3.4%

Existing Training and Workforce Assets

The analysis also included a review of existing training and workforce development assets relevant to CCAP implementation. These assets were categorized into major program types, including:

- Foundational access and career navigation services
- Earn-and-learn pathways (apprenticeships, pre-apprenticeships, on-the-job training)
- Sector-based and short-term occupational training
- Incumbent worker upskilling programs
- Re-entry and targeted population pathways

This information was used to assess alignment between current workforce delivery capacity and CCAP workforce needs, rather than to evaluate program effectiveness.

Connecticut has a strong workforce development ecosystem that can be mobilized to support implementation. Core statewide assets include the Connecticut Office of Workforce Strategy, the Connecticut Department of Labor, five Workforce Development Boards, American Job Centers, adult education providers, community colleges, technical high schools, and community-based organizations.

Existing workforce and training programs relevant to CCAP implementation include registered apprenticeship programs; WIOA-funded services; American Job Centers; Adult Education; Jobs First Employment Services; CareerConneCT; the Manufacturing Pipeline Initiative; the Manufacturing Innovation Fund; sector-based training; Youth Career Pathways and industry-recognized credential efforts; and Energize Connecticut Green STEP.

These programs provide a strong foundation for upskilling, retraining, youth pipeline development, and re-entry. However, climate-specific training remains less developed in several implementation-relevant areas, including EV maintenance, energy auditing, rooftop solar, heat pump specialization, and some emerging electrification-related competencies.

Table 138. Connecticut training assets relevant to CCAP implementation

Program Type	Examples	Primary Value for CCAP
Foundational access and navigation	WIOA services, American Job Centers, Adult Education	Provides entry points, career navigation, basic skills, and training access.
Earn-and-learn pathways	Registered apprenticeships, pre-apprenticeships, OJT	Supports workers entering electrical, HVAC, plumbing, and related trades.
Sector-based and short-term training	CareerConneCT, Manufacturing Pipeline Initiative, Green STEP	Delivers employer-aligned training for targeted occupations and emerging skills.
Incumbent worker upskilling	Incumbent Worker Training, Manufacturing Innovation Fund, contractor training	Helps current workers adapt to new technologies and implementation needs.
Re-entry and targeted population pathways	DOC re-entry programs, community-based providers, JFES	Expands participation among workers facing barriers to employment.

Analytical Limitations

The workforce planning analysis is subject to several limitations:

- Occupational projections reflect historical trends and may not fully capture rapid demand increases driven by large-scale infrastructure investment.
- Occupational categories do not distinguish between specialized skill sets within an occupation (e.g., general HVAC versus heat-pump specialization).
- Regional variation within the state is not captured.

- Training capacity constraints, licensing requirements, and support service availability are not fully reflected in labor market projection data.

As a result, workforce gaps should be interpreted as indicators of relative risk and opportunity, rather than precise measures of future shortages.

Despite these limitations, the workforce planning analysis provides a consistent, data-driven framework for:

- Identifying implementation-critical occupations
- Anticipating workforce alignment challenges
- Prioritizing upskilling and transition strategies
- Informing coordination between CCAP implementation and workforce investments

The results are intended to support ongoing workforce planning, program design, and coordination as CCAP implementation advances, and can be updated over time as labor market conditions evolve.



APPENDIX 7: MEASURE COST METHODOLOGY

Cost Results by Sector

This analysis evaluates the overall scale of costs across all measures and summarizes results using a qualitative dollar-sign scale corresponding to established ranges of cumulative net adoption costs from 2025 through 2050 (see Table 139). This approach reflects the total magnitude of costs captured in the modeling and supports consistent comparison across measures where implementation details, timing, and funding structures vary. All costs are non-discounted and incremental to the BAU scenario.

The cost estimates are intended to illustrate the order-of-magnitude economic implications associated with implementing the CCAP mitigation pathway and are designed primarily from a *societal cost perspective*. These estimates represent the total incremental costs and savings associated with measure adoption relative to the BAU scenario, regardless of who bears those costs or realizes the savings.

Costs therefore include a combination of *capital expenditures (CAPEX)* and *operational expenditures (OPEX)* incurred by a range of actors, including residents, businesses, utilities, and other private or public entities. For example, transportation electrification cost estimates reflect the incremental purchase cost of EVs relative to conventional vehicles, as well as associated changes in fuel and maintenance costs, and do not represent the cost of state incentives or subsidy programs alone.

As a result, the cost figures presented here should not be interpreted as direct state expenditures, program budgets, or funding needs. In many cases, state action is expected to play an enabling role— such as through incentives, regulations, technical assistance, or planning— while the majority of costs accrue to private actors or are offset by long-term operational savings. This approach provides a consistent analytical framework for comparing measures and understanding relative cost drivers across sectors, but it is not intended to represent a state budget or funding request.

This cost estimate is only for the purpose of gauging the relative costs of the CCAP measures to meet the requirements for the EPA CPRG Planning Grant Program. It should not be interpreted to be used for any other type of decision-making by the CT DEEP or any other state agency for climate, clean energy, or any other related activities. As such it has not been reviewed or vetted for those purposes. As is the case with all information contained in this CCAP, the cost information provided here is not a binding implementation plan and does not establish new mandates. Rather, the cost estimates for the economy-wide mitigation pathway are intended to inform future policy, programs, funding, and implementation decisions.

Table 139. Dollar-sign symbols relative to cumulative net adoption costs in millions of USD.

Symbology (Number of \$)	Minimum	Maximum
\$	\$(999.00)	\$50.00
\$\$	\$51.00	\$1,000.00
\$\$\$	\$1,001.00	\$30,000.00
\$\$\$\$	\$30,001.00	\$89,000.00

Table 140 summarizes the cumulative costs from 2025-2050 for all emission reductions measures, presented following the dollar-sign scale.

Table 140. Cumulative costs by measure from 2020 through 2050 (with \$ scale).

Measure	2025 - 2050
Measure 1. Reduce VMT	\$\$\$
Measure 2(a). On-road vehicle electrification	\$\$\$\$
Measure 2(b). On-road Renewable Diesel	\$\$\$
Measure 3(a). Nonroad Renewable Diesel	\$\$
Measure 3(b). Port Decarbonization	\$\$
Measure 3(c). Sustainable Aviation	\$\$\$
Measure 3(d). Passenger Rail Electrification	\$\$\$
Measure 3(d). Freight Rail Renewable Diesel	\$\$
Measure 4. Increase energy efficiency in existing residential and commercial buildings	\$
Measure 5. Increase electrification in existing residential and commercial buildings.	\$\$\$
Measure 6. Maximize energy efficiency in new residential and commercial buildings.	\$
Measure 7. Maximize electrification in new residential and commercial buildings.	\$
Measure 8. Expand grid-scale clean energy resources	\$\$\$
Measure 9. Deploy distributed clean energy resources	\$\$
Measure 10. Decarbonize industrial processes through energy efficiency, electrification, and low-carbon fuels.	\$\$
Measure 11. Expand Carbon Capture, Utilization, and Storage(CCUS) at industrial facilities	\$\$
Measure 12. Reduce emissions from the disposal of organic solid waste.	\$\$
Measure 13. Reduce emissions from the disposal of non-organic solid waste.	\$
Measure 14. Increase soil carbon sequestration and reduce emissions from agricultural soils.	\$
Measure 15. Reduce methane emissions from livestock and manure.	\$\$
Measure 16. Increase protection and conservation of high-carbon coastal habitats, wetlands, grasslands, and forests.	\$
Measure 17. Increase and manage urban tree canopy.	\$

Transportation

Measure 1: Reduce vehicle miles traveled (VMT).

A custom cost-effectiveness calculator was developed to estimate the dollar value per vehicle mile traveled (VMT) reduced. This metric was derived based on a representative set of transit and active transportation projects implemented across the United States. The calculator summarized both capital and operating costs, relating them to the associated VMT reductions to create a standardized measure of cost per VMT avoided.

The analysis of representative projects indicated that average capital costs for transit and active transportation investments are \$0.14 per VMT reduced over the project lifetime. This estimate includes infrastructure investments such as expanded bus service, bike lanes, pedestrian pathways, and e-bike programs.

Operating expenses were comprised of the following components:

- Operations and maintenance costs for transit investments were estimated at \$1.00 per VMT reduced. This included recurring expenditures such as enhanced service operations and equipment upkeep to sustain VMT reductions.
- Energy cost savings were calculated by estimating the annual reduction in energy use for each fuel type (e.g., gasoline, diesel), multiplied by the projected unit cost, based on the U.S. Energy Information Agency’s (EIA) Annual Energy Outlook 2025. Electricity costs were estimated based on residential sector prices for light-duty vehicles (LDVs).
- Vehicle maintenance costs were estimated by multiplying vehicle miles traveled for each vehicle and fuel type by the corresponding maintenance cost per mile. These rates were obtained from Argonne National Laboratory’s AFLEET tool.

The data sources used for estimating costs for this measure are outlined in Table 141.

Table 141. Measure 1 cost analysis data sources

Activity or Data Point	Source
Capital cost of public transportation projects	ICF, DEEP contractor, customized calculator to estimate cost-effectiveness of VMT reduction projects
Operational cost of public transportation projects	ICF, DEEP contractor, customized calculator to estimate cost-effectiveness of VMT reduction projects
Projected fuel and electricity prices	EIA’s Annual Energy Outlook 2025, Table 3
Vehicle maintenance cost	AFLEET

Measure 2: Expand vehicle electrification, electric vehicle (EV) infrastructure, and zero- and low-carbon fuels in the on-road transportation sector.

On-Road Vehicle Electrification

For this sub-measure, both capital and operational costs associated with the electrification of light-duty vehicles (LDVs) and medium- and heavy-duty vehicles (MHDVs) were calculated. Capital costs include the upfront investment required for the purchase of new electric vehicles and the acquisition and installation of electric vehicle supply equipment (EVSE). Operational costs include ongoing changes in fuel usage and

vehicle maintenance expenses resulting from electrification. All costs represent the net change in total cost between this measure and the BAU scenario. The cost modeling was based on several key assumptions, which are detailed below.

- Vehicle capital costs were estimated by multiplying the annual sales of new vehicles by the average cost per vehicle and engine type. These average costs were sourced from Argonne National Laboratory’s AFLEET tool, calibrated for the current year, and projected for future years considering the change in technology costs over time.
- EVSE capital costs were determined by multiplying the number of chargers required by their respective unit costs, as provided by AFLEET and calibrated for the current year.
- Energy costs were estimated by calculating the fuel consumption multiplied by the projected unit cost of each fuel type, based on the U.S. EIA Annual Energy Outlook 2025. Electricity costs were computed using consumption and sector-specific prices: residential rates for LDVs and commercial rates for MHDVs.
- Vehicle maintenance costs were estimated by multiplying vehicle miles traveled for each vehicle and fuel type by the corresponding maintenance cost per mile. These rates were obtained from Argonne National Laboratory’s AFLEET tool.
- A standard rebate of \$500 was applied to each light-duty battery electric vehicle (BEV) purchase, and a \$1,000 rebate was applied to each plug-in hybrid electric vehicle (PHEV) purchase, following the Connecticut Hydrogen and Electric Automobile Purchase Rebate (CHEAPR) program guidelines.

Table 142 lists the data sources that were used to estimate costs for this sub-measure.

Table 142. Measure 2a cost analysis data sources

Activity or Data Point	Source
Vehicle Cost, EV Charger Cost	ICF, DEEP contractor, projections for vehicle sales costs by type and fuel, as well as EVSE purchase and installation costs, based on AFLEET
Vehicle Maintenance Cost	AFLEET
Projected fuel and electricity prices	EIA’s Annual Energy Outlook 2025, Table 3
Connecticut Standard EV Rebates	Connecticut Hydrogen and Electric Automobile Purchase Rebate (CHEAPR)

Low-Carbon Fuel Vehicles

The incremental cost of renewable diesel was calculated by determining the unit price difference between renewable diesel and conventional diesel, then multiplying that difference by the projected volume of diesel fuel replaced. This method quantifies the cost premium associated with adopting low-carbon alternative fuel instead of conventional diesel.

To reflect the higher cost of renewable diesel prior to the implementation of regulatory incentives or market-based programs, a price of \$4.8 per gallon for renewable diesel was assumed based on existing pricing

reports. This represents the estimated cost of renewable diesel in the absence of subsidies and credits to capture the full economic burden of alternative fuel adoption in a pre-regulatory context.

Data sources for estimating renewable diesel costs are outlined in Table 143 below.

Table 143. Measure 2b cost analysis data sources

Activity or Data Point	Source
Projected conventional diesel price	EIA's Annual Energy Outlook 2025, Table 3
Renewable diesel price	Clean Cities and Communities Alternative Fuel Price Report, January 2025

Measure 3: Decarbonize the nonroad transportation sector, including ports, airports, and rail.

Nonroad

Consistent with the renewable diesel cost calculations for on-road low-carbon fuel vehicles, incremental costs for nonroad equipment were determined by calculating the unit price difference between renewable diesel and conventional diesel and multiplying that difference by the projected volume of conventional diesel fuel replaced in nonroad applications.

To reflect the higher cost of renewable diesel for nonroad equipment prior to the implementation of regulatory incentives or market-based programs, a price of \$4.8 per gallon was assumed based on existing pricing reports. This value represents the estimated cost of renewable diesel in the absence of subsidies and credits.

Data sources for estimating renewable diesel costs for nonroad equipment are outlined in Table 144 below.

Table 144. Measure 3a cost analysis data sources

Activity or Data Point	Source
Projected conventional diesel price	EIA's Annual Energy Outlook 2025, Table 3
Renewable diesel price	Clean Cities and Communities Alternative Fuel Price Report, January 2025

Marine

Fuel savings from ferry electrification were calculated by estimating the decrease in diesel fuel consumption and comparing it with the cost of electricity needed for electric ferries. The analysis assumes electricity and diesel price forecasts from EIA's Annual Energy Outlook 2025. Capital costs are based on an annual investment of \$15 million from 2029 to 2038 for vessel electrification and terminal upgrades, using unit costs from similar projects. It is assumed that all vessels and terminals will be upgraded within this timeframe and that price forecasts remain consistent throughout the period.

Data sources used in the cost analysis are outlined in Table 145.

Table 145. Measure 3b cost analysis data sources

Activity or Data Point	Source
Projected conventional diesel and electricity prices	EIA's Annual Energy Outlook 2025, Table 3

Aviation

The incremental cost of sustainable aviation fuel (SAF) implementation was estimated by multiplying the projected SAF consumption by the cost difference between SAF and conventional jet fuel. To reflect the high cost of SAF prior to the influence of federal incentives and market scaling, the analysis used a production cost of \$7.00 per gallon. This metric represents the estimated cost of producing SAF using current technologies and feedstocks, such as HEFA or alcohol-to-jet pathways. SAF production costs are significantly higher than conventional jet fuel due to limited commercial-scale production, feedstock availability, and complex refining processes. For conventional jet fuel, the modeling relied on price forecasts from the EIA's Annual Energy Outlook 2025.

To account for policy-driven cost reductions, the analysis accounted for \$1.62 per gallon SAF tax credit established in the mitigation pathway to facilitate SAF adoption. The tax credit is designed to incentivize SAF production and adoption by offsetting part of the cost differential with conventional fuels.

Data sources used in the cost analysis are outlined in Table 146 below.

Table 146. Measure 3c cost analysis data sources

Activity or Data Point	Source
Projected jet fuel price	EIA's Annual Energy Outlook 2025, Table 3

Rail

Passenger Rail Electrification: Operating costs for passenger rail electrification were estimated by multiplying projected fuel consumption by the unit cost of each fuel type, using the U.S. EIA Annual Energy Outlook 2025. Electricity costs reflect rail-specific consumption and transportation sector rates. Operating costs represent the net change in cost between this measure and the BAU scenario. Capital costs assume an annual investment of \$156 million from 2030 to 2044 to replace diesel trains and electrify the Hartford Line, Danbury Branch Line, and Waterbury Branch Line, using an assumed \$16 million per mile for electrification based on comparable projects.

Renewable Diesel for Freight Rail: For freight rail, incremental costs of renewable diesel were calculated by multiplying the difference between renewable diesel and conventional diesel unit prices by the projected volume of conventional diesel replaced in. A price of \$4.80 per gallon was assumed for renewable diesel, excluding subsidies and credits.

Data sources used in the cost analysis are outlined in Table 147 below.

Table 147. Measure 3d cost analysis data sources

Activity or Data Point	Source
Projected conventional diesel and electricity prices	EIA's Annual Energy Outlook 2025, Table 3
Renewable diesel price	Clean Cities and Communities Alternative Fuel Price Report, January 2025

Residential & Commercial Buildings Sector

Measure 4: Increase energy efficiency in existing residential and commercial buildings.

Costs evaluated for this measure included upfront capital investments required to install new equipment and long-term impacts on customer utility bills resulting from changes in electricity and fuel consumption. The analysis did not include annual maintenance costs, program administration expenses, or the effects of rebates and incentives.

Annual capital expenditures were calculated by multiplying the number of new equipment units installed each year by the incremental replacement cost. In the residential sector, costs were calculated on a per-home basis. In the commercial sector, costs were modeled based on building attributes such as HVAC system tonnage, floor area, and building type, as represented in ComStock.

All capital costs were assumed to occur at the time of equipment replacement, consistent with adoption trajectories and equipment lifetime assumptions. Once a system was upgraded to an electric or more efficient alternative, subsequent replacements were assumed to be like-for-like exchanges, such as replacing a heat pump with another heat pump. In those cases, no additional incremental cost was applied.

Equipment cost estimates were developed using multiple data sources, including national studies, state-specific assessments, and utility potential studies. Sources were evaluated based on technology coverage, efficiency assumptions, publication date, and regional applicability. EIA's Updated Building Sector Appliance and Equipment Costs and Efficiencies Report was used most frequently because of its breadth of equipment types and inclusion of efficiency tiers. Cost trajectories for heat pumps were drawn from NREL's Electrification Futures Study Moderate Technology Advancement case. Costs for all other systems were assumed to remain constant over time.

For residential HVAC systems, equipment costs from NESCAUM's Heat Pumps in the Northeast and Mid-Atlantic were adjusted using RSMeans City Cost Indexes to account for regional variation in labor and material costs. Incremental heat pump costs were calculated relative to the avoided cost of both space heating and cooling equipment in homes with existing air conditioning systems. For homes without existing air conditioning, incremental costs were calculated relative to heating equipment only.

Data sources used in the cost analysis are outlined in Table 148 below.

Table 148. Measure 4 cost analysis data sources

Metric	Data Sources
Residential Space Heating/Cooling	NESCAUM Heat Pumps in the Northeast and Mid-Atlantic – Costs and Market Trends EIA's 2023 Technology Forecast Updates Rocky Mountain Institute (RMI) Green Upgrade Calculator NREL Residential Measures Database
Residential Water Heating	RMI Green Upgrade Calculator NREL Residential Measures Database
Residential Cooking Equipment	RMI Green Upgrade Calculator
Residential Lighting	EIA's 2023 Technology Forecast Updates
Residential Appliances	NREL Residential Measures Database
Residential Building Envelopes	RSMeans 2025 Residential Costs Data
Commercial Space Heating/Cooling	EIA's 2023 Technology Forecast Updates
Commercial Water Heating	EIA's 2023 Technology Forecast Updates
Commercial Cooking Equipment	RSMeans 2025 Commercial Renovation Costs Data
Commercial Interior Lighting	NEEA 2022 LLLC Incremental Cost Study
Commercial Wall and Roof Insulation	RSMeans 2025 Commercial Renovation Costs Data
Commercial Window Replacements	CalNEXT Commercial Windows Market Study

Energy costs and savings associated with electrification were estimated using projections of energy uses and changes from the GHG reduction analysis and state-level current retail fuel prices from EIA, escalated based on growth rates in EIA's Annual Energy Outlook 2025, Table 3.5. Data sources for fuel expenditure are outlined in Table 149.

Table 149. Fuel expenditure data sources

Metric	Data Sources
Average 2024 retail price of electricity	EIA-861
Average 2024 retail price of natural gas	EIA Natural Gas Prices
Average 2024 retail price of fuel oil and propane in the South Atlantic region	EIA's Annual Energy Outlook 2025, Table 3.5
Projected growth rates for electricity and fuel prices in the South Atlantic region	EIA's Annual Energy Outlook 2025, Table 3.5

Measure 5: Increase electrification in existing residential and commercial buildings.

The methodology approach used the approach and sources from measure 4, given the overlap between efficiency and electrification technologies. Data sources used in the cost analysis are outlined in Table 148 above.

Measure 6: Maximize energy efficiency in new residential and commercial buildings.

For new buildings, costs were divided into upfront costs and operating costs, with operating costs reflecting changes in energy use. Upfront costs were further divided into code improvement costs and additional stretch or green building code costs.

Upfront costs for implementing energy efficiency through code improvements were extrapolated based on costs and savings estimated in the most recently available PNNL cost-effectiveness studies. For residential buildings, the analysis used the 2021 International Energy Conservation Code. For commercial buildings, the analysis used ASHRAE Standard 90.1-2019. These cost estimates were multiplied by the number of residential homes, including single-family and multifamily homes, or by commercial square footage in each city or county to estimate total costs.

To reflect the additional costs of a stretch or green building code, new residential buildings meeting this additional standard were modeled to achieve Passive House energy use intensity requirements. Costs for Passive House implementation were sourced from Passive House Institute U.S. cost data research, with state new construction cost estimates sourced from Home-Cost.

New commercial buildings were modeled to meet energy use intensity standards corresponding to a Portfolio Manager ENERGY STAR score of 90. Cost estimates were derived from studies by Built Environment Plus and BR+A, along with construction cost estimates from RSMeans.

Energy cost savings from new building measures were calculated based on changes in fuel and electricity consumption relative to baseline code-compliant construction. Fuel prices were sourced from EIA and escalated using growth rates from EIA's Annual Energy Outlook 2025, Table 3, consistent with the approach for existing buildings.

Upfront code improvement costs for new buildings are commonly financed as an increase in mortgage or loan amounts. In the near term, annual energy cost changes will typically exceed the increase in amortized upgrade costs, resulting in positive monthly cash flow for owners when more stringent energy codes are applied.

Data sources used in the cost analysis are outlined in Table 150 below.

Table 150. Measure 6 cost analysis data sources

Activity or Data Point	Source
Residential Building Costs for various Code Versions	Cost-Effectiveness of the 2021 IECC for Residential Buildings in Connecticut
Commercial Building Costs for various Code Versions	Cost-Effectiveness of ANSI/ASHRAE/IES Standard 90.1-2019 for Connecticut
Household Construction Costs	Home Cost-Home Construction Cost Per SF by State

Activity or Data Point	Source
Passive House Costs	Summary of Cost Data Research on Multi-Family buildings built to the Phius Standard
Net-Zero Cost	Built Environment Plus Net-Zero Costs
RS Means Construction Costs	Construction Cost Estimates for an Office, 2-4 Story in National, US
Localizing Costs compared to national Averages	RSMeans City Cost Index

Measure 7: Maximize electrification in new residential and commercial buildings.

The methodology approach used the approach and sources from measure 6, given the overlap between efficiency and electrification technologies and costs in new buildings. Data sources used in the cost analysis are outlined in Table 150 above.

Electric Power Sector

Measure 8: Expand grid-scale clean energy resources.

Total system costs were outputs of the IPM scenario modeling and include capital expenditures, operations and maintenance costs, and fuel costs. Assumptions for capital costs for generating technologies came from the NREL Annual Technology Baseline 2024 for clean energy; EIA's 2023 Annual Energy Outlook for conventional fossil technologies; and EPA for carbon capture retrofits. Costs for the capacity expansion pathway only represent the costs associated with generation assets and do not include any costs from grid infrastructure upgrades on the transmission or distribution systems. Data sources used in the cost analysis are outlined in Table 151 below.

Table 151. Measure 8 cost analysis data sources

Activity or Data Point	Source
Clean energy technology costs	2024 NREL Annual Technology Baseline
Conventional technologies costs	EIA 2023 Annual Energy Outlook
Carbon capture and sequestration (CCS) retrofits costs	EPA v6.22 IPM
Federal tax incentives (e.g., Section 45 tax credits)	One Big Beautiful Bill Act

Measure 9: Deploy distributed clean energy resources.

No incremental distributed resources were modeled in the mitigation pathway above the BAU.

Industrial Sector

Measure 10: Decarbonize industrial processes through energy efficiency, electrification, and low carbon fuels.

Capital costs for industrial decarbonization were estimated using a portfolio-level cost intensity approach based on representative project data. A range of industrial decarbonization projects spanning energy efficiency, process electrification, and low-carbon fuel switching were evaluated to derive capital cost values expressed in dollars per metric ton of carbon dioxide equivalent reduced.

These values were informed by project-level cost analyses reflecting observed capital investment requirements across real-world applications and supplemented with published literature to support consistency with broader industry cost ranges. Existing studies indicate that industrial decarbonization costs vary widely by technology, with marginal abatement costs ranging from negative values for efficiency improvements to more than \$500 per metric ton of carbon dioxide equivalent for more capital-intensive measures, such as fuel switching and process electrification.

The representative capital cost intensity was calculated by dividing total capital investment across the portfolio of measures by total GHG emissions reductions. This value was then applied to the GHG emissions abated under the modeled mitigation pathway to estimate total capital investment requirements.

Operational cost impacts were estimated based on changes in fuel and electricity consumption associated with each mitigation pathway. Modeled energy demand by fuel type was multiplied by projected unit prices from EIA's Annual Energy Outlook 2025 to estimate total fuel expenditures under both the mitigation and BAU scenarios. The difference in fuel costs between scenarios represents the net operational cost impact, capturing both increases from electrification and low-carbon fuels and savings from reduced fossil fuel use and improved efficiency.

Together, these capital and operational components were used to estimate the total incremental cost of industrial decarbonization relative to the BAU scenario. Capital costs were applied to total GHG emissions reductions, while operating costs reflect ongoing changes in energy expenditures over time.

data sources used in the cost analysis are outlined in Table 152 below.

Table 152. Measure 10 cost analysis data sources

Activity or Data Point	Source
Capital cost intensity estimate (\$/metric ton CO ₂ e)	ICF internal analysis; Columbia University Center on Global Energy Policy; ACEEE
Industry-average fuel use data	EIA's MECS 2018

Measure 11: Expand Carbon Capture, Utilization, and Storage(CCUS) at industrial facilities.

Capital costs for CCUS deployment were estimated using the same portfolio-level cost intensity approach applied in Measure 10. A representative cost intensity, expressed in dollars per metric ton of carbon dioxide equivalent, was derived from internal analysis and published literature. This value was applied to carbon emissions captured under the modeled mitigation pathway to estimate total capital investment. Available studies indicate that carbon capture costs vary substantially across industrial applications depending on

factors such as carbon dioxide concentration, facility configuration, and retrofit requirements. Higher costs are generally associated with lower-concentration emissions streams and more complex retrofit conditions. The selected cost intensity reflects this variability across industrial subsectors and was multiplied by modeled carbon dioxide capture volumes to estimate total capital costs. This analysis includes capital expenditures only. Data sources used in the cost analysis are outlined in Table 153 below.

Table 153. Cost analysis data sources

Activity or Data Point	Source
Capital cost intensity estimate (\$/metric ton CO ₂ e)	ICF internal analysis; DOE/NETL (2022)

Waste Sector

Measure 12: Reduce emissions from the disposal of organic solid waste.

For organic waste diversion, the analysis used the ReFED Solutions Database to obtain Connecticut-specific data on annual diversion potential, in tons, and annual greenhouse gas reduction potential, in metric tons of carbon dioxide equivalent. An average cost per ton of organic waste diverted through community composting was calculated using the diversion share and cost-per-ton greenhouse gas data. The resulting cost was \$20.48 per ton of waste diverted. This implementation cost was applied to the quantity of waste diverted to calculate total cost. Data sources used in the cost analysis are outlined in Table 154 below.

Table 154. Measure 12 cost analysis data sources

Activity or Data Point	Source
Cost per ton of organic waste diverted	ReFED Solutions Database

Measure 13: Reduce emissions from the disposal of non-organic solid waste.

For the baseline recycling cost reference, the analysis used a unit cost of \$129 per ton of recycling based on the NYC Independent Budget Office. This value was adjusted to 2025 dollars using historical GDP implicit price deflator data from the Federal Reserve Bank of St. Louis. The GDP implicit price deflator approach is consistent with the inflation adjustment method used in other sectors to convert historical prices to 2025 dollars. Data sources used in the cost analysis are outlined in Table 155 below.

Table 155. Measure 13 cost analysis data sources

Activity or Data Point	Source
Cost per ton of recycling	NYC Independent Budget Office

Agriculture Sector

Measure 14: Increase soil carbon sequestration and reduce emissions from agricultural soils.

Cover Crops

The capital cost estimate assumed no additional capital costs for cover crop adoption in Connecticut. This assumption is consistent with the USDA Marginal Abatement Cost Curve Report, which assumes that farmers already have access to necessary equipment, such as seed drills. Therefore, no new investment in planting or cultivating machinery was included in the analysis.

O&M costs included seed expenses, which vary by cover crop species, as well as labor, fuel, and activities related to planting and terminating cover crops. These costs were modeled as annual per-acre expenses and scaled according to projected adoption rates. The methodology used 2025 Environmental Quality Incentives Program payments for the Cover Crop–Basic practice as a proxy for 75 percent of total costs to farmers. These payments were then scaled to represent 100 percent of estimated costs.

The analysis assumed that EQIP payments capture all relevant operational costs and that there are no independent capital costs not already captured within the EQIP payment category for other operations and maintenance changes. EQIP payment rates do not account for co-benefits of cover crop adoption over time, such as improved soil health, reduced erosion, and enhanced water retention, which can lead to cost savings. To incorporate these benefits, the analysis subtracted inflation-adjusted average benefit values from Table 10 of the USDA Marginal Abatement Cost Curve Report. Values from the first, third, and fifth years of cover cropping were used. Values for the second and fourth years were interpolated, and the fifth-year benefit was applied to all modeled years from 2030 through 2050. This adjustment reflects the long-term economic benefits of cover crop adoption.

Several simplifying assumptions were used in the cost analysis. The analysis assumed uniform adoption costs across crop types, with no differentiation between field crops and vegetables. Farm size was also assumed to have no effect on per-acre costs. In addition, the analysis assumed no independent capital costs beyond those already captured in EQIP payments. These assumptions may limit the precision of the estimates, particularly in diverse agricultural contexts. Data sources used in the cost analysis are outlined in Table 156 below.

Table 156. Measure 14 cover crop cost analysis data sources

Activity or Data Point	Source
Capital Costs	USDA MACC Report (2023)

Nitrification Inhibitors (NI)

The capital cost estimate treated nitrification inhibitor product costs as per-acre costs added to fertilizer application, rather than as upfront capital investments. Fertilizer application equipment was assumed to be available to farmers at no additional cost. Consistent with the USDA Marginal Abatement Cost Curve Report, the analysis assumed that no new capital investments are required for nitrification inhibitor adoption.

O&M costs for nitrification inhibitors are minimal because inhibitors are integrated into existing fertilizer application practices. Any additional labor or equipment calibration costs were included in per-acre cost estimates starting in 2026 and continuing annually through 2030. The methodology used Connecticut EQIP

payments for the Nutrient Management practice as a proxy for 75 percent of total cost to farmers. These payments were then scaled to represent 100 percent of estimated costs.

Cost benefits were included to reflect potential yield benefits from nitrification inhibitor adoption, which could result in cost savings. The analysis assumed that a 10 percent reduction in fertilizer applications leads to a proportional 10 percent reduction in fertilizer costs, consistent with USDA Marginal Abatement Cost Curve Report assumptions. When acreage changes were modeled, each percent increase in planted crop acres, based on crop- and region-specific data, was assumed to result in a corresponding percent decrease in fertilizer costs based on Table 14 of the USDA report.

Cost distribution was modeled as recurring annual per-acre costs that increase over time with adoption rates. These costs were scaled by crop-specific adoption trajectories and fertilized acreage. Costs were aggregated annually. The analysis assumed that fertilizer application equipment is already available and that operational changes are captured within EQIP payment estimates. However, excluding some yield benefits from EQIP calculations may overestimate costs if yields increase in practice. Data sources used in the cost analysis are outlined in Table 157 below.

Table 157. Measure 14 nitrification inhibitors cost analysis data sources

Activity or Data Point	Source
Capital Costs	USDA MACC Report (2023)

Measure 15: Reduce methane emissions from livestock and manure.

Feed Additives

The analysis assumed zero capital costs for feed additive adoption because additives can be incorporated into existing livestock feeding systems without major infrastructure changes. This assumption aligns with the USDA Marginal Abatement Cost Curve Report, which indicates that no additional capital investments are necessary to implement feed additives in dairy and beef cattle operations.

O&M costs included annual per-head feed additive costs, which vary by product and dosage, as well as labor and management expenses associated with integrating additives into feeding routines. These costs were modeled as annual per-head expenses and scaled according to adoption rates and livestock populations. Monensin adoption was modeled from 2026 through 2035, and 3-nitrooxypropanol adoption was modeled from 2036 through 2050, with cost distributions increasing over time to reflect phased adoption.

Feed additives were expected to improve livestock feed efficiency, which translates into direct reductions in feed costs. This assumption was based on Table 6 of the USDA Marginal Abatement Cost Curve Report, which links percentage increases in feed efficiency to proportional decreases in feed expenses. Feed cost data for dairy and beef cattle were sourced from Table 8 of the same report, allowing the analysis to quantify economic benefits associated with improved feed conversion.

Cost distribution was modeled as recurring annual per-animal costs that increase over time with adoption rates. Costs were aggregated annually. The analysis assumed that no capital costs are required to implement feed additives and that existing feeding infrastructure is sufficient. Although the model accounted for feed efficiency improvements, it may not capture other potential benefits or regional variation in implementation costs, which could affect overall cost-effectiveness. Data sources used in the cost analysis are outlined in Table 158 below.

Table 158. Measure 15 feed additive cost analysis data sources

Activity or Data Point	Source
Capital Costs	USDA MACC Report (2023)
O&M Costs: Monensin feed additive costs	USDA MACC Report
O&M Costs: Nitrooxypropanol (3-NOP) feed additive costs	Luke and Tonsor (2024)

Anaerobic Digesters

No swine farms in Connecticut currently operate anaerobic digesters; therefore, anaerobic digesters were modeled only for dairy cattle. Capital costs for anaerobic digesters included the purchase and installation of digester systems, gas handling infrastructure, and energy generation equipment. Capital expenditure estimates were based on Table 7B of the USDA Marginal Abatement Cost Curve Report for dairy cattle. Capital costs were amortized over a 10-year financing term, and the analysis assumed no digester retirements because system lifetimes were assumed to exceed 25 years across the 2026–2050 time series.

Four existing digesters were identified: Fort Hill Farms, Freund Farm, Hytone Farm, and Oakridge Dairy. These digesters were assumed to represent the current 2 to 3 percent of manure excreted by dairy cattle that is managed in anaerobic digesters. This assumption was based on communication with the Connecticut Department of Energy and Environmental Protection and EPA national greenhouse gas inventory model outputs.

A maximum of 38 percent of all dairy cattle manure excreted was assumed to be manageable in anaerobic digesters. To maximize mitigation potential, anaerobic digesters would need to be established in the near term. Two farm sizes were considered relevant based on USDA NASS QuickStats inventory data for cows: mid-sized farms with 350 head and large farms with 1,981 head. The analysis assumed that two large digesters and five mid-sized digesters would be established, with one digester added annually, for a total of seven new digesters between 2026 and 2032. This adoption trajectory reaches the maximum assumption of 38 percent of dairy cattle manure managed in anaerobic digester systems.

For each assumed new anaerobic digester, additional capital expenditure was included to support development. For dairy cattle, the analysis used the average cost of plug-flow digesters across all farm sizes, referencing the single plug-flow anaerobic digester in Connecticut as of 2025. O&M costs included annual labor, maintenance, monitoring, digestate handling, and system upkeep. These costs were modeled as annual per-head or per-system costs, scaled with adoption rates and livestock populations, and informed by consultation with the Connecticut Department of Energy and Environmental Protection. Operational cost data were sourced from Table 7B of the USDA Marginal Abatement Cost Curve Report for dairy cattle. Costs were cumulative and reflected the total number of digesters operating each year from 2026 through 2050.

The financial benefit of captured biogas from anaerobic digesters was expressed in U.S. dollars based on inflation-adjusted revenue from biogas combustion used to generate excess electricity sold back to the grid. Electricity generation estimates, in kilowatt-hours by farm size, were sourced from Table 12B of the USDA Marginal Abatement Cost Curve Report for dairy cattle. Annual revenue from electricity sold back to the grid was calculated by applying Connecticut-specific retail electricity prices to these generation estimates.

Cost distribution was modeled as recurring annual per-head costs that increase with the proportion of livestock manure managed by anaerobic digesters. Costs were aggregated annually. Capital costs were

amortized over a 10-year financing term, and the analysis assumed no digester retirements. Other potential benefits and regional cost differences were not captured, which may affect the overall cost-effectiveness of anaerobic digester implementation. Data sources used in the cost analysis are outlined in Table 159 below.

Table 159. Measure 15 anaerobic digester cost analysis data sources

Activity or Data Point	Source
Capital Costs	USDA MACC Report (2023)
O&M Costs	EPA AgSTAR , USDA MACC Report (2023)

Natural & Working Lands Sector

Measure 16: Increase protection and conservation of high-carbon coastal habitats, wetlands, grasslands, and forests.

Forest management activities include conservation thinning and thinning for wildlife and forest health. Costs reflect materials, equipment, labor, and mobilization based on NRCS Forest Stand Improvement practice standards. Wetland activities include habitat establishment, ongoing management and monitoring, and wetland rehabilitation design and construction. Costs were informed by NRCS payment schedules and Chesapeake Assessment Scenario Tool cost profiles. A comprehensive conservation planning cost was applied to support long-term management across multiple land uses. Conservation planning was assumed to occur throughout the full time series beginning in 2025. Forest and wetland management implementation was assumed to begin in 2030 and continue annually thereafter at constant acreage levels. Data sources used in the cost analysis are outlined in Table 160 below.

Table 160. Measure 16 cost analysis data sources

Activity or Data Point	Source
Forest management, wetland management, & conservation costs	USDA NRCS
Wetland rehabilitation costs	CBP CAST

Measure 17: Increase and manage urban tree canopy.

Capital planting costs were based on NRCS Urban Tree Planting practice standards and were applied in the year of planting. Annual O&M costs reflect ongoing tree care and increase cumulatively as planted acreage grows. Urban tree planting was assumed to occur annually from 2026 through 2049 at a constant acreage level. Data sources used in the cost analysis are outlined in Table 161 below.

Table 161. Measure 17 cost analysis data sources

Activity or Data Point	Source
Tree Planting costs	USDA NRCS