

NERC Rethink Resource Use 2025

A Material Shift: Implementing
Consumption-Based Emissions Strategies

Nathan Robbins, Climate Change Specialist
Megan Mansfield-Pryor, Waste Management Climate Policy Advisor



GOVERNOR'S OFFICE OF
Policy Innovation
and the Future



MAINE DEPARTMENT OF
Environmental Protection

Tuesday, October 7th, 2025

80% of Maine's carbon dioxide emissions from fossil fuels come from transportation and buildings.



49%

Transportation



19%

Residential



12%

Commercial



10%

Industrial



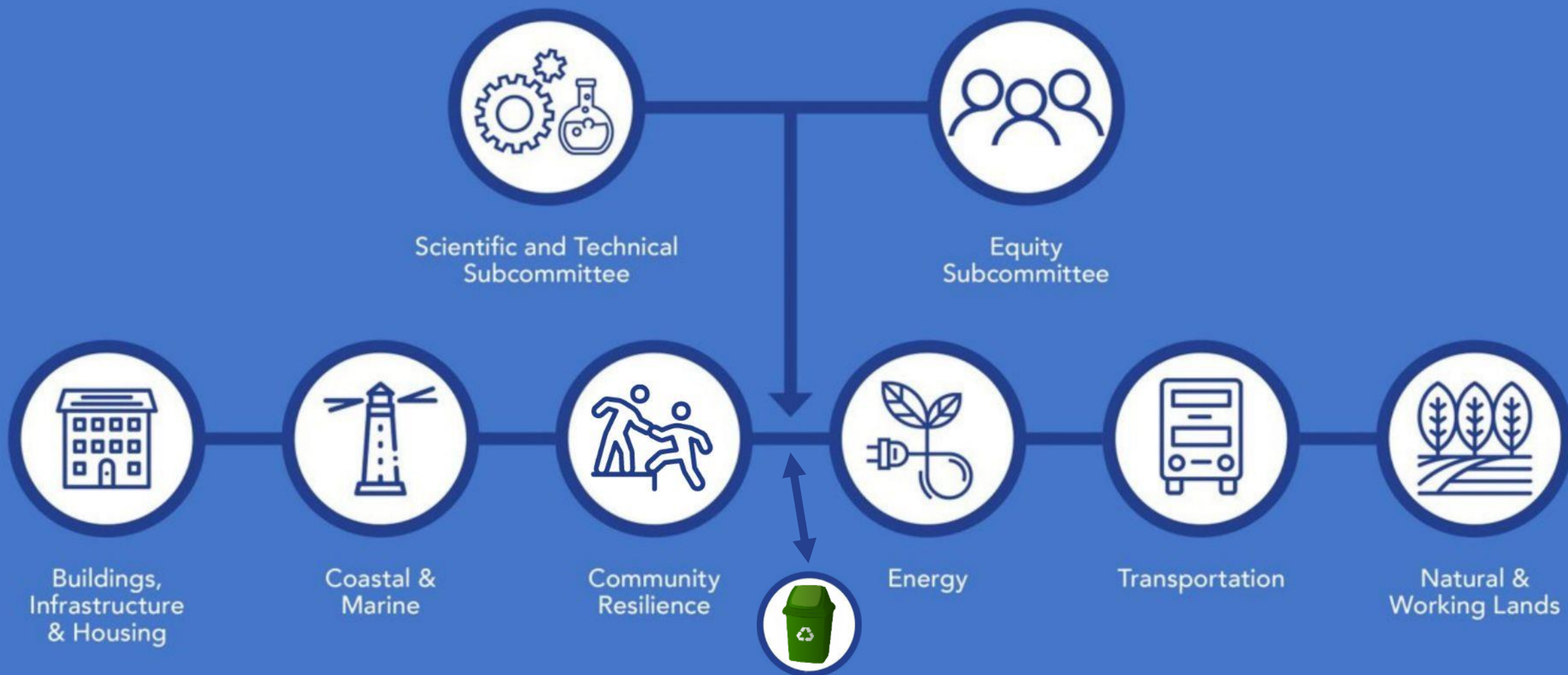
9%

Electric Power

Source: Maine Department of Environmental Protection 10th Biennial Greenhouse Gas Emissions Report



Maine Climate Council



Maine Won't Wait Strategies:

A —

Embrace the future of transportation in Maine



B —

Modernize Maine's buildings: energy-efficient, smart, and cost-effective homes and businesses



C —

Transition to clean energy



D —

Create jobs and grow Maine's economy through climate action



E —

Protect the environment and natural and working lands and waters in Maine



F —

Build healthy and resilient communities



G —

Engage with Maine people on climate action



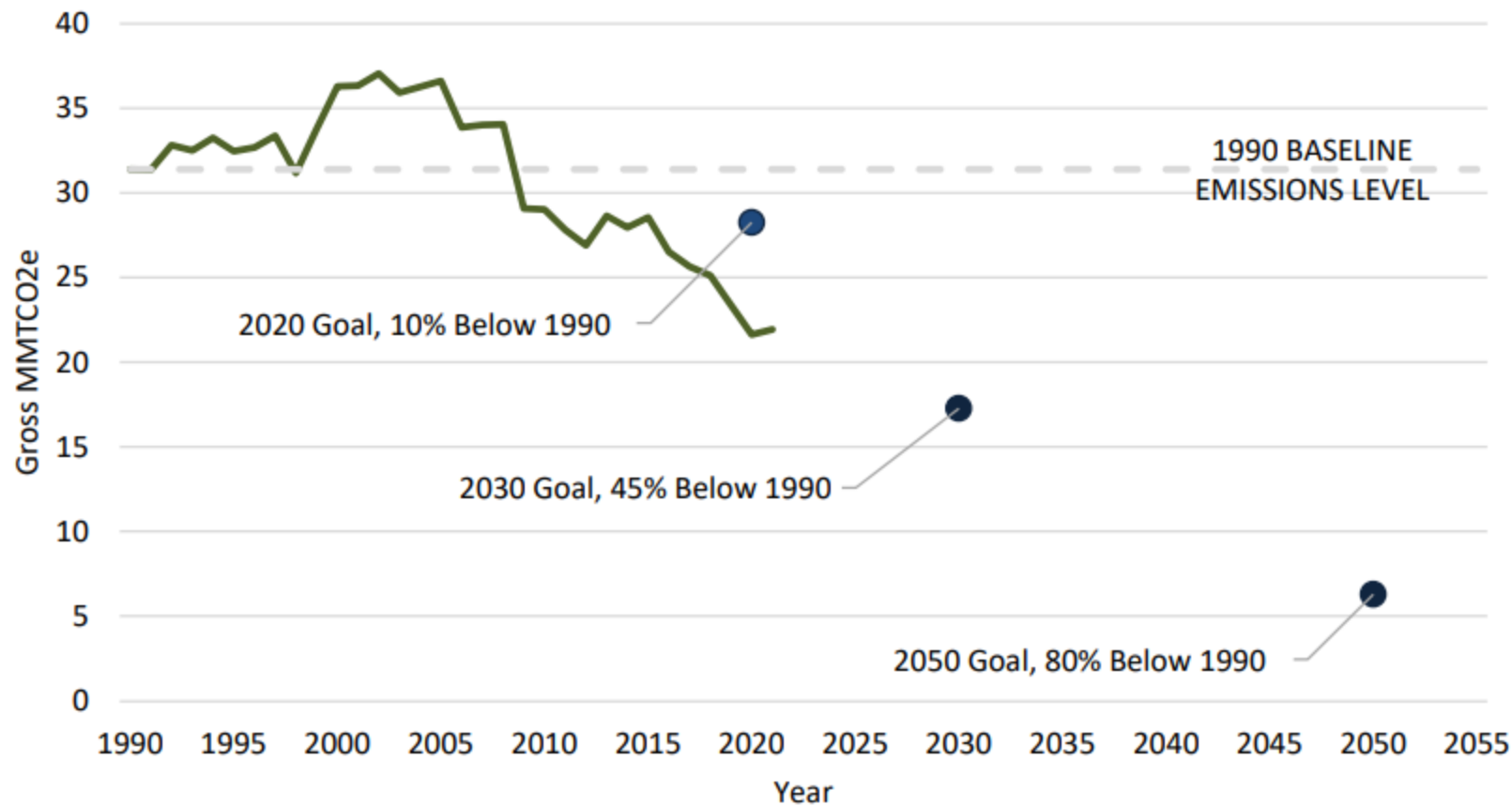


Figure 18. Maine’s gross greenhouse gas emissions, including biogenic, 1990-2021 with 2020, 2030, and 2050 reduction goals.

L.D. 1429 An Act To Achieve Carbon Neutrality in Maine by the Year 2045 (2021)

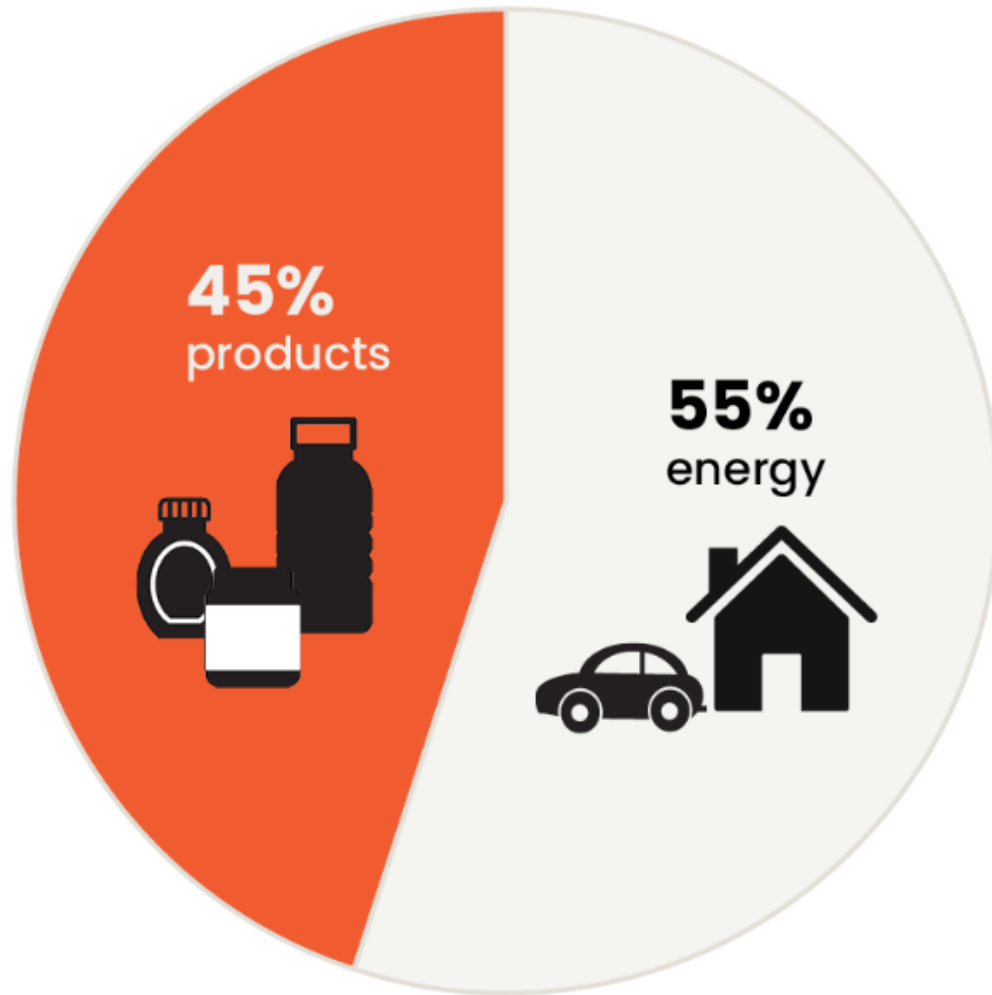
LD 1679 An Act To Promote Clean Energy Jobs and To Establish the Maine Climate Council (2019)

LD 845 An Act To Provide Leadership in Addressing the Threat of Climate Change (2003)

Tenth Biennial Report on Progress Toward Greenhouse Gas Reduction Goals, June 2024

Maine Department of Environmental Protection

Global Emissions Sources



- “Renewable energy addresses only 55% of UN climate goals. The remaining 45% hinges on transforming how we **produce, consume, and dispose of consumable goods**, emphasizing the crucial role of reuse solutions.”
- For example, global warming potential from buildings would be **reduced by 88%** if they were designed for reuse rather than recycling

Source: Upstream “Reuse is a Climate Solution”

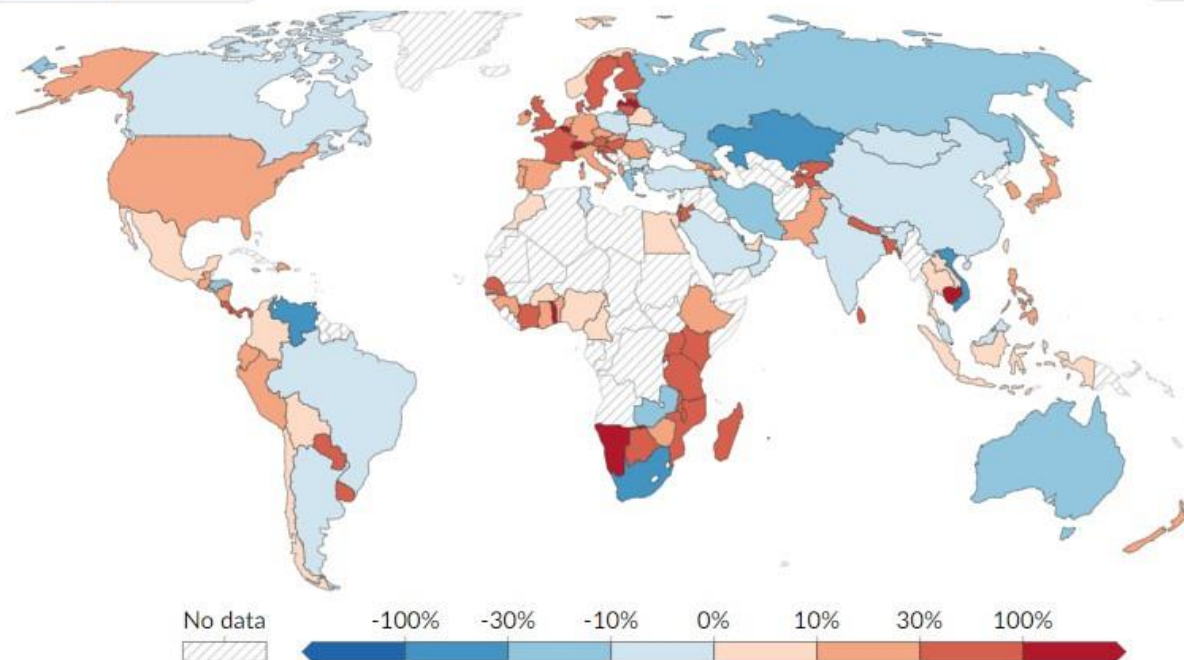
Share of CO₂ emissions embedded in trade, 2021

Exported or imported emissions as a percentage of domestic production emissions. Positive values (red) represent net importers of CO₂. Negative values (blue) represent net exporters of CO₂.

Our World
in Data

Table Map Chart

World



1990

2021

Data source: Global Carbon Budget (2023) – [Learn more about this data](#)
OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

Download

Share

Enter full-screen

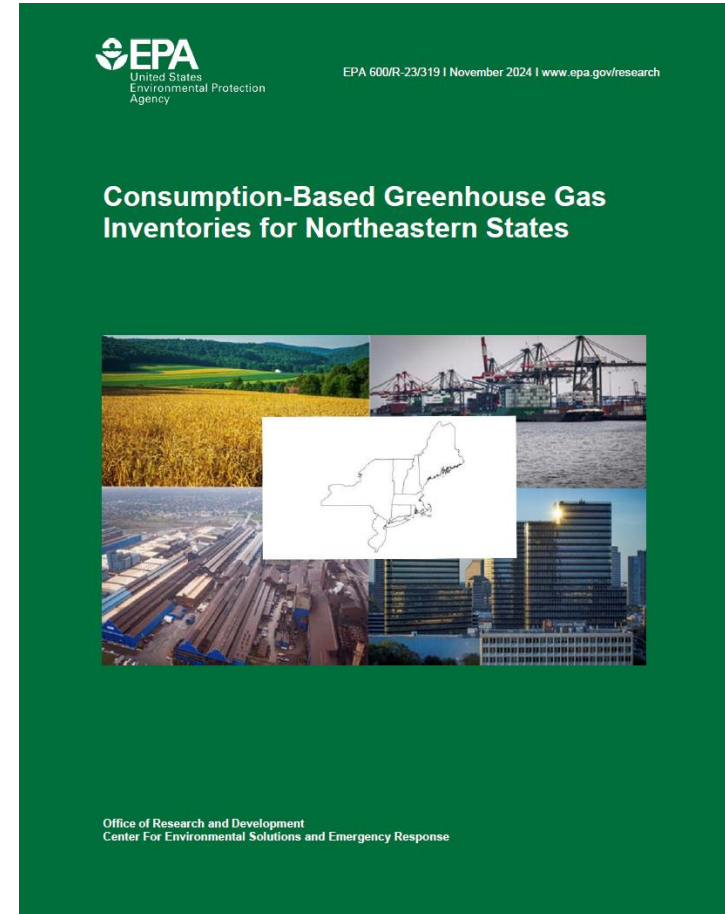
Related: [CO₂ data: sources, methods and FAQs](#)

- What actions can help?
- What individuals can do?

<https://ourworldindata.org/consumption-based-co2>

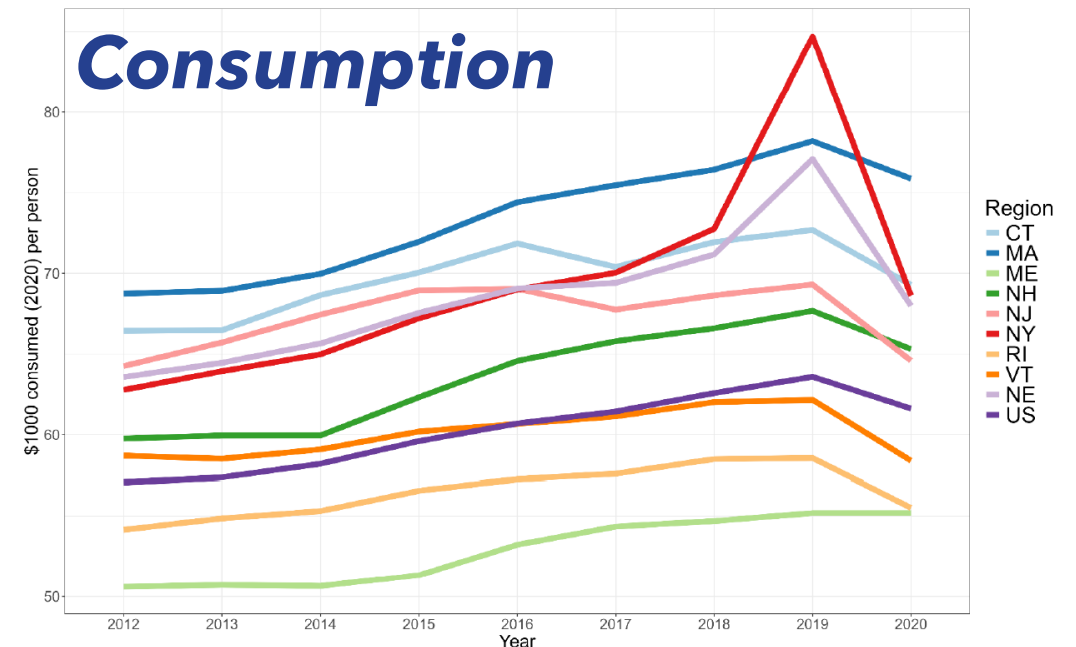
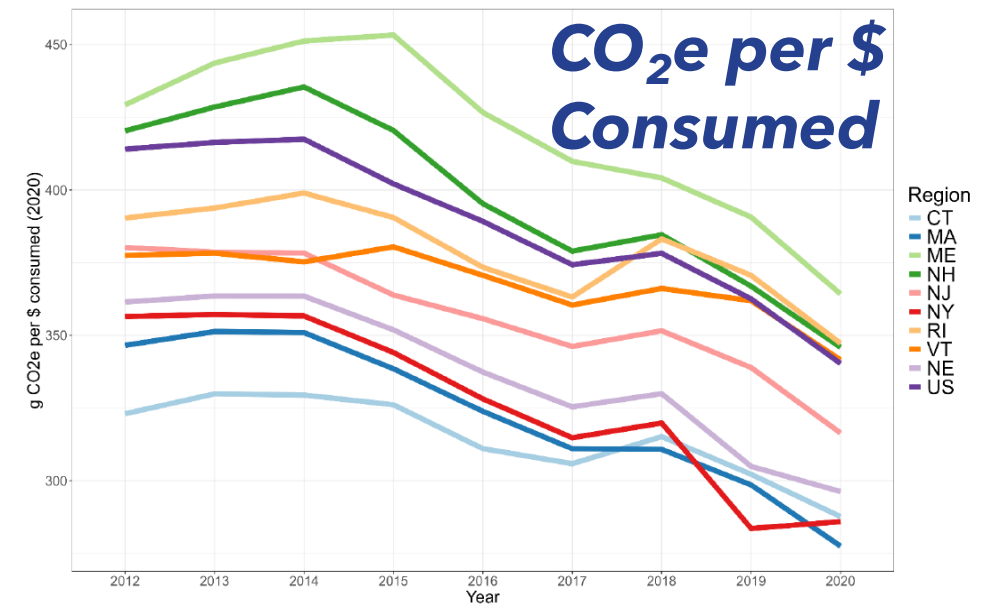
Regional Consumption-Based Emissions Inventory Project

- ✓ Pilot **complimentary** GHG accounting methodology
- ✓ Look at associated **consumption-based emissions** for participating states (+)
- ✓ Identify consumption-based **hotspots**
- ✓ Determining **possible mitigation actions**
- ✓ Improve understanding of the impact's **region-wide**
- ✓ Develop a regional **understanding of methodology**
- ✓ Create a **streamlined procedure** (+)
- ✓ Improve **messaging** around consumption

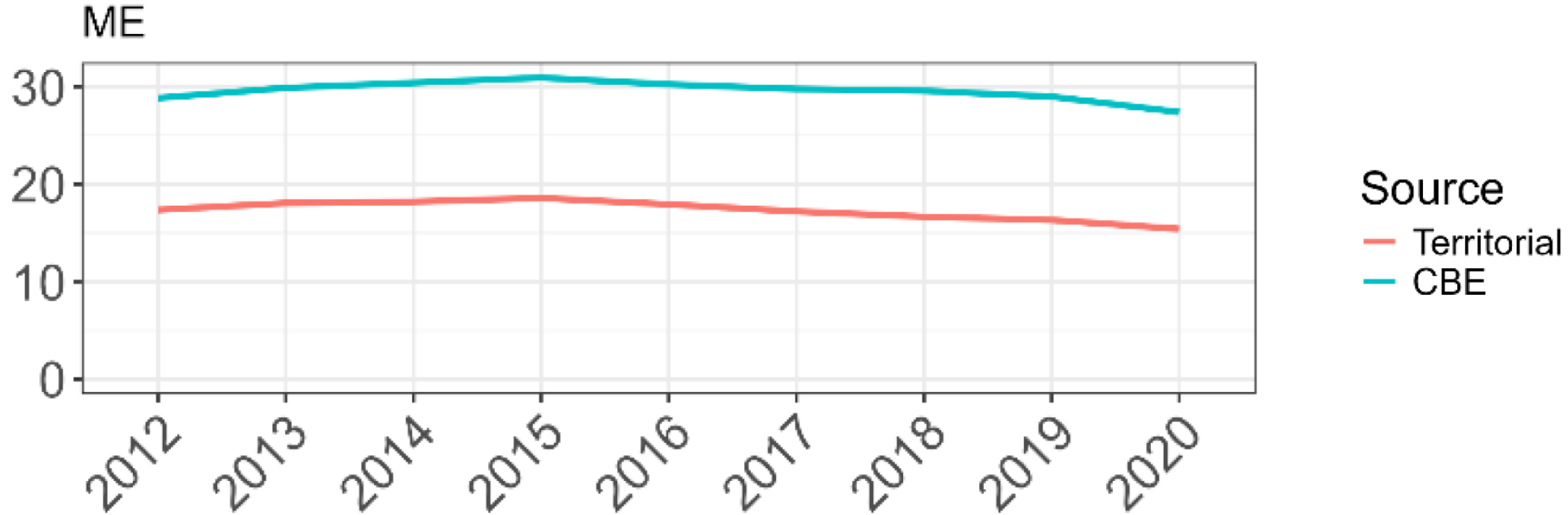


November 2024

1. Consumption-based GHG emissions from the Northeastern states are **40-60% greater than territorial emissions**;
2. The **largest category** contributing to the states' consumption-based emissions is **Manufactured goods**, and the emissions from this category are largely from commodities made outside the state
3. The emissions embodied within imports are **primarily from the rest of the U.S., followed by those occurring in the rest of the world**;
4. Increases in the consumption of goods and services from 2012-2019 have **negated the reduction** in overall emissions per a dollar.

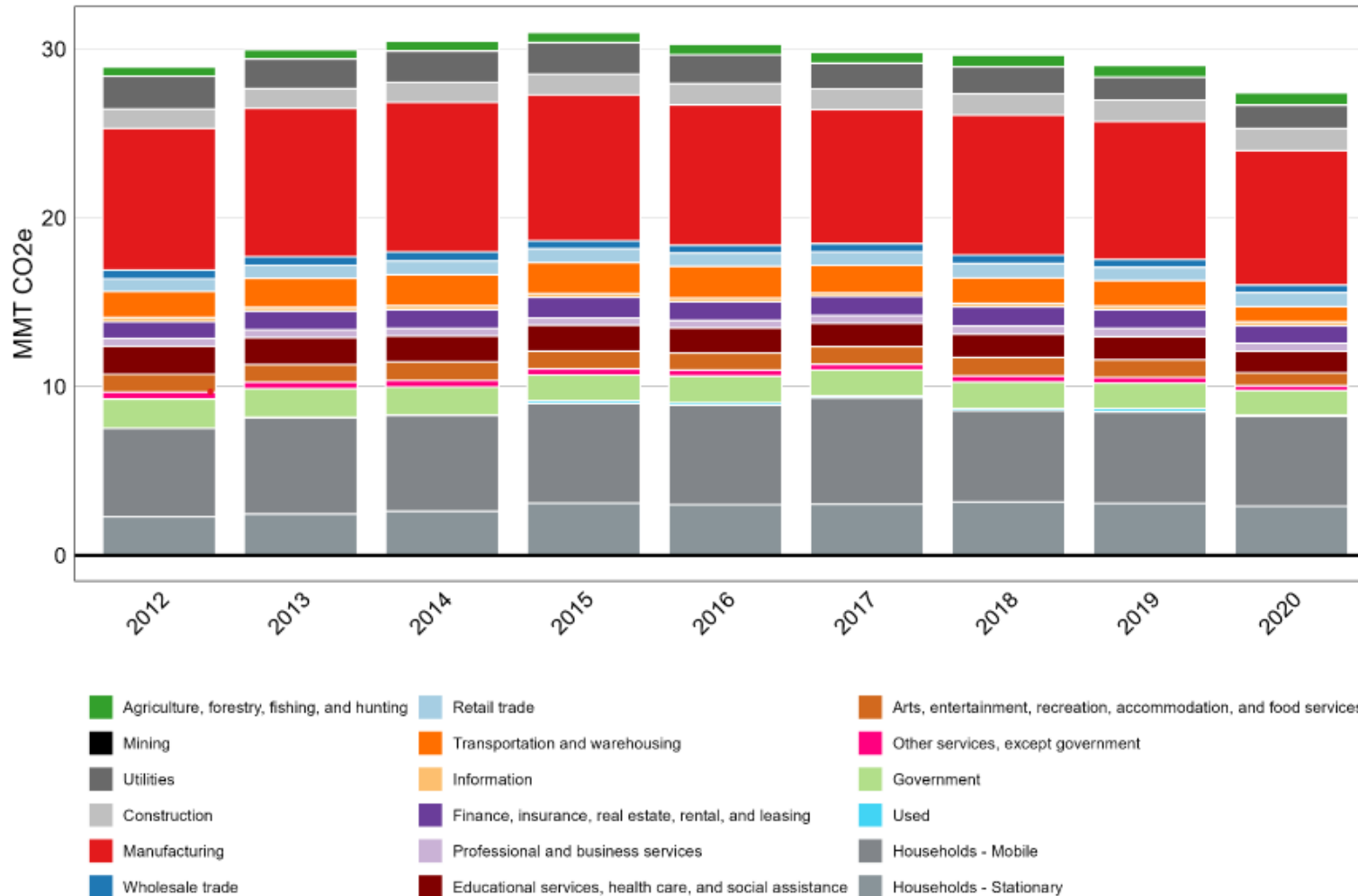


Sector-Based vs. Consumption-Based Inventory



Courtesy of EPA: Consumption-Based Greenhouse Gas Inventories for Northeastern States

What Drives Maine's Consumption-Based Emissions?



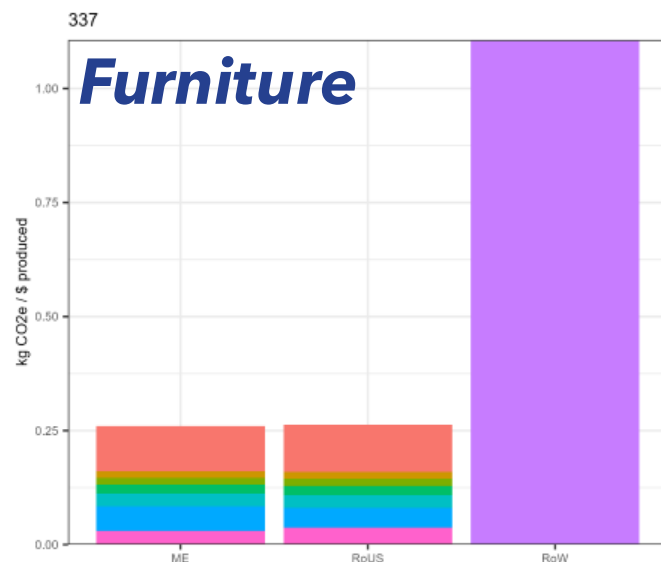
The **top three** drivers of CBEs in Maine are:

- **Manufactured** goods
- Personal **transportation**
- **Residential** heating and cooking

2020 dips are likely related to the COVID-19 pandemic and not reflective of a trend

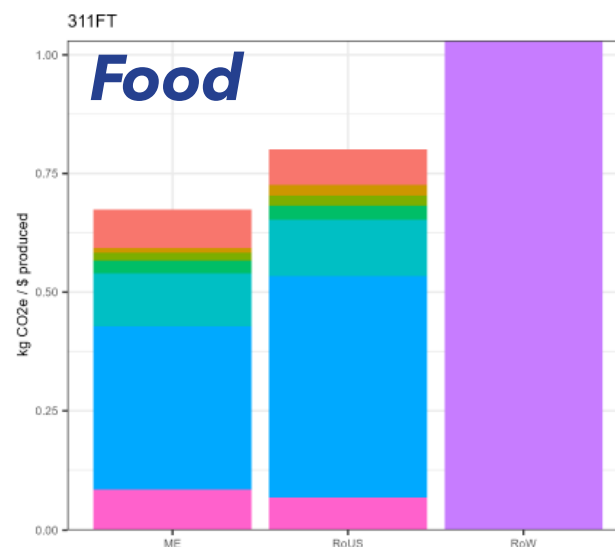
Source: Consumption-Based Greenhouse Gas Inventories for Northeastern States

CBEs Per Dollar for High-Impact Goods

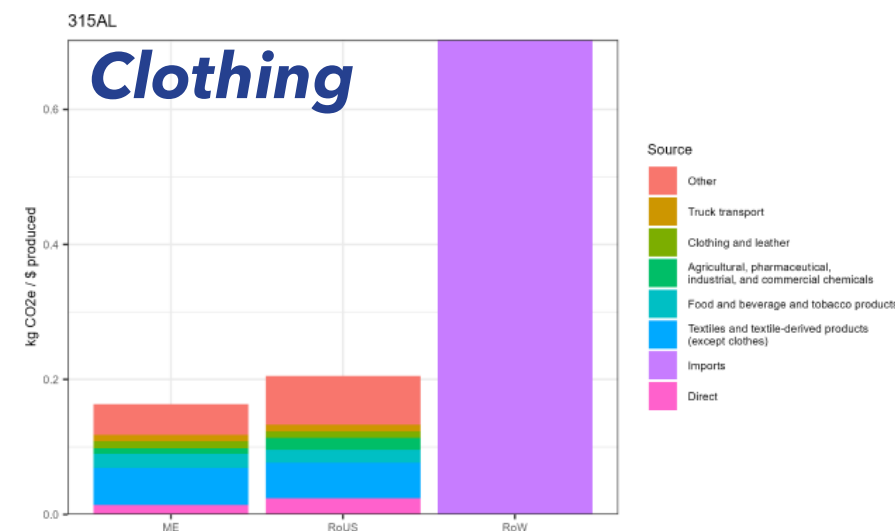


CBEs from imported furniture - 4 times greater

- Far Left = Maine
- Middle = Rest of U.S.
- Far Right = Rest of World



CBEs from imported food are greater



CBEs from imported clothing - 5 times greater

The CBEs per dollar for food do not include transport within Maine or end-of-life emissions, which would increase the emissions intensity.

Source: Consumption-Based Greenhouse Gas Inventories for Northeastern States

Reduce **waste**
and **emissions**
from **products** that
Maine people
buy and use



Actions:

- Support **reuse, refill, and repair**
- **Lead by Example** at state facilities through food waste prevention, reuse and repair
- Develop a **consumption-based emissions inventory** for Maine's greenhouse gas reporting
- Coordinate and fund **regional waste management** planning
- **Increase access to waste reduction and diversion programs** through educational materials and tools



Promote the manufacture and use of climate-friendly building products



Actions:

- **Divert demolition debris from landfills** by encouraging municipalities to give two weeks' notice for **salvage** opportunities
- Promote low-carbon building materials through **education** and **technical support**
 - Is there another use of materials before disposing? (explore applicability of any tax credit program)
 - Are there climate-friendly building materials for new projects?
 - Electric and water efficiency opportunities in lighting, faucets, settings?
 - Materials reduction through bulk purchasing?

State-Level Actions to Reduce Embodied Carbon



 **The Maine Deconstruction Network: Proposed Framework**

The Maine Deconstruction Network is forming in 2025. Your participation is welcome!

The Network is an informal network of individuals interested in the economic opportunities and environmental benefits of building deconstruction who want to raise awareness and help Maine transition from a linear building economy to a circular one.

The network will meet on a recurring basis depending on member availability either quarterly or monthly and will work together to engage different entities in deconstruction, identify any potential opportunities to pilot deconstruction projects, consider how we can support local governments, communities, and small businesses in efforts to move towards deconstruction over demolition.

- Reusing just **50,000 tons of wood** flooring reduces GHGs by 141,284 (MTCO₂E) - equivalent to annual emissions from **29,997 gas-powered passenger vehicles** (cars, trucks, vans, SUVs)
- Reuse **preserves the value** of irreplaceable materials like heritage timber from old growth lumber

Leading by Example:

- Formed the Maine Deconstruction Network in 2025; convening monthly meetings to learn and brainstorm ideas to move deconstruction forward in Maine
- Maine is part of the Federal State Buy Clean Partnership, working with the U.S. Climate Alliance to actively explore collective opportunities to procure building and construction materials with **lower embodied carbon**.

Waste Reduction Model - EPA Resource

- Provides high-level comparisons of potential greenhouse gas emissions reductions, energy savings, and economic impacts for considering different materials management practices.
- Assesses GHG benefits from a systems perspective—cutting across the traditional sectors used in inventories—to show how manufacturing, transportation, and end-of-life disposal practices relate to materials management.

Waste Reduction Model



- Is comparative rather comprehensive, and cannot be used for developing GHG inventories, which need to establish a baseline and measure reductions over time on an annual basis for an entity.
- Detailed guidance expands the usefulness for modeling product lifetime extension (repair), reuse, food donation, and other scenarios that require additional calculations to model.

Quick How-To for WARM

- You'll need material tons to enter for comparing two possible management pathways
- Identify your baseline and comparison scenario (recycling vs. landfill, compost vs. anaerobic digestion, etc.)
- Enter tons of material into the correct row to compare the two scenarios

Material Type	Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested	Tons Generated	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested
Paper	Corrugated Containers		150.00		NA	NA	150.00		150.00			NA	NA
	Magazines/Third-class Mail				NA	NA	0.00					NA	NA
	Newspaper				NA	NA	0.00					NA	NA
	Office Paper				NA	NA	0.00					NA	NA
	Phonebooks				NA	NA	0.00					NA	NA
	Textbooks				NA	NA	0.00					NA	NA

Total Change in GHG Emissions (MTCO₂E): **(529.83)**

- Flip through the spreadsheet tabs to view results
- What's the important metric? WARM provides:
 - GHG Emissions
 - Energy Savings
 - Labor hours
 - Wages
 - Taxes
- Use the data that is most relevant.

This is equivalent to...	
Removing annual emissions from	112 Passenger Vehicles
Conserving	59,619 Gallons of Gasoline
Total Change in Energy Use (million BTU):	
(2,305.73)	

This is equivalent to...	
Conserving	25 Households' Annual Energy Consumption
Conserving	397 Barrels of Oil
Total Change in Taxes (\$):	
\$3,932.30	



Quick How-To for WARM Continued

- Data can be customized to improve accuracy by identifying geographic region, travel distance to facilities, and other locale or project-specific circumstances

3. In order to account for the avoided electricity-related emissions in the landfilling and combustion pathways, EPA assigns the appropriate regional "marginal" electricity grid mix emission factor based on your location. Select state for which you are conducting this analysis.

Please select state or select national average:

Maine

Region Location:

New England

9b. If you have chosen to provide information, please fill in the table below. Distances should be from the curb to the landfill, combustor, or material recovery facility (MRF).
*Please note that if you chose to provide information, you must provide distances for both the baseline and the alternative scenarios.

Management Option	Default Distance (Miles)	Distance (Miles)
Landfill	20	200.00
Combustion	20	200.00
Recycling	20	200.00
Composting	20	200.00
Anaerobic Digestion	20	200.00

10. If you wish to personalize your results report, input your name & organization, and also specify the project period corresponding to the data you entered above.

Name

Organization

Project Period

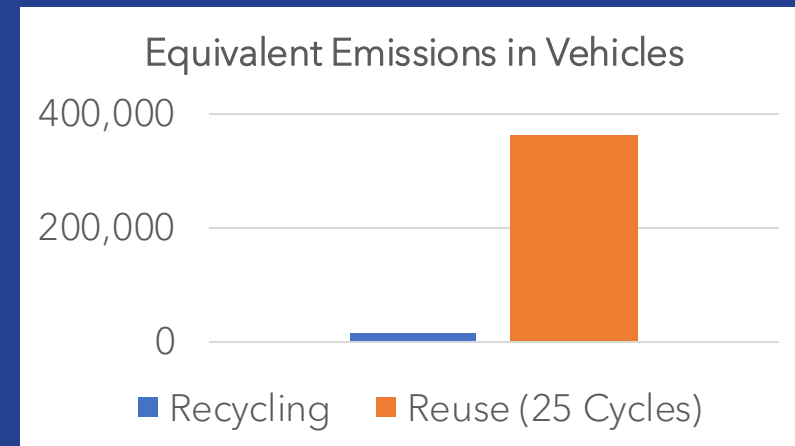
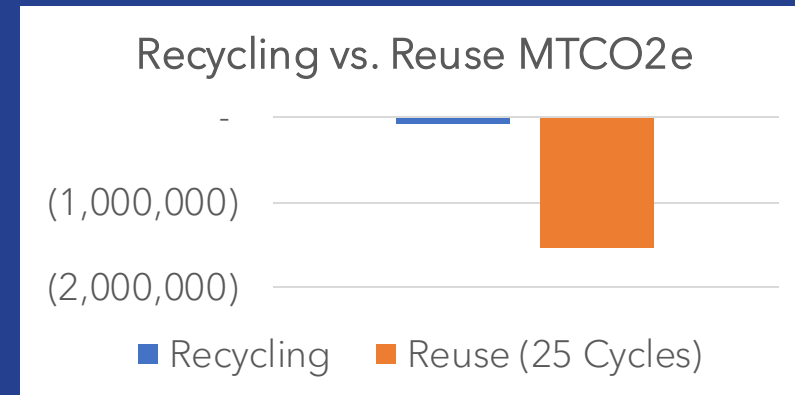
From

to



WARM Tool Lifecycle Snapshot – Reuse vs. Recycling

- Maine has funding earmarks to support infrastructure and program development for reusable packaging (amount TBD) and refillable beverage containers (\$500K/year)
- Maine recycled 43,341 tons of metal, glass, and plastic beverage containers in 2022
 - Lifecycle GHG savings = 67,766 MTCO₂e, like taking 14,388 vehicles off the road for an entire year
- What if we reused these containers (25 use cycles)?
 - Lifecycle GHG savings = 1,526,665 MTCO₂e, like taking 363,349 vehicles off the road off the road for a year



Reuse = Maximum Emissions Impact

- Comparing management scenarios reveals the **upstream** impact of materials
- Reuse 10K tons steel: emissions reductions = removing **up to 317,067** gas-powered passenger vehicles (cars, trucks, SUVs, vans) from the road for an entire year.
- Recycling 10K tons steel: emissions reductions = removing **3,933** vehicles' annual emissions.

Pathway	PET (#1)	PP (#5)	PLA	Glass	Steel
Source Reduction	(4,656)	(3,280)	(1,720)	(1,170)	(6,471)
Reuse (25 Cycles)	(111,754)	(78,729)	n/a	(28,080)	(155,298)
Reuse (50 Cycles)	(228,164)	(160,738)	n/a	(57,331)	(317,067)
Composted	n/a	n/a	3,211	n/a	n/a
Recycled	(2,242)	1,728	n/a	(629)	(3,933)
Combusted	3,168	3,775	2,612	1	(3,432)

Modeled in the EPA WARM tool; based on a 20 Mile Travel Distance and 10,000 Tons of each material, with Maine-specific landfill factors.



Repair Cafes – Community Resilience & Climate Solution

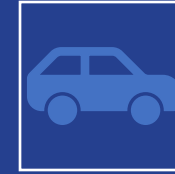
- “Intensive use of longer-lived repairable products” identified by the IPCC as a necessary climate action
- Survey data suggests that “nearly every half of all products are discarded after they malfunction or become defective,” regardless of repairability



Community Repair Cafés are volunteer run events; people of all ages with different backgrounds, skill sets, and income levels **come together to collectively repair** items like bicycles, electronics, small appliances, and clothing



Repair café **success rates** are high, averaging 67% for most items, with an even higher **89% success rate** for clothing and textiles

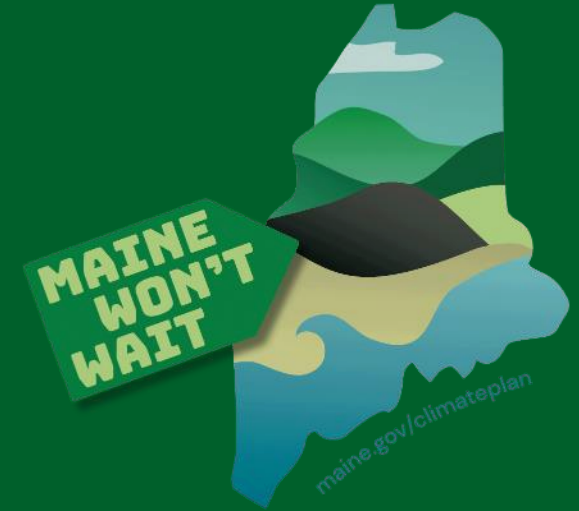


A November community repair café in Midcoast Maine recovered 36 items for an **estimated GHG savings of 1,184.4 MTCO₂e** - equivalent to taking **282 gasoline powered vehicles** off the road for a year.



Photo courtesy of Hallie Kirsch and Maine GearShare

Suggested Climate Actions



- Businesses can adopt policies to reduce waste from facilities and product supply chains
- Municipalities can adopt policies to renovate and deconstruct buildings and repurpose building materials
- Restaurants, breweries, grocers, and other businesses can opt for reusable/refillable programs to replace single-use food service ware and packaging

Tools for Measuring CBEI

- [CBEI Guidebook - Creating a CBEI for your city](#), Urban Sustainability Directors Network
- [US Environmentally-Extended Input-Output \(USEEIO\) Models*](#), EPA
- [Estimating consumption-based greenhouse gas emissions at the city scale](#), C40 Knowledge Hub
- [Forum Products and Toolkits](#), West Coast Climate & Materials Management Forum
- [Waste Impact Calculator Web App](#), Oregon DEQ
- [Smart Tools for a Cooler Planet](#), Cool Climate Network

*This resource will be moving to an academic institution for preservation and continued improvement, but currently this is the available version.

To engage with the Maine Climate Council,

Follow us on Instagram @maineclimatecouncil

Sign up for our newsletter



Read the plan!





Explore Maine.gov/climateplan



Explore an interactive map showing how climate change is impacting our state's landscape, economies and recreation.

Learn about *Maine Won't Wait*, our state's climate action plan to reduce greenhouse gas emissions and secure a strong future for our people and economy.

Mainers from every corner of the state are taking action and confronting climate change.

GUIDES TO CLIMATE ACTION & INCENTIVES

WHAT CAN YOU DO?

FOR **YOUR HOME**

WHAT CAN YOU DO?

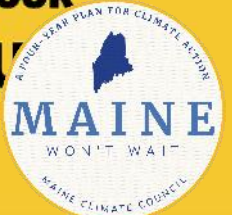
FOR **YOUR
VEHICLE**

WHAT CAN YOU DO?

FOR **YOUR BUSINESS**

WHAT CAN YOU DO?

FOR **YOUR COMMUNITY**



Climate&Me

**A new initiative to
engage young Mainers
in climate action**

**Check out the website for
resources on how to get
involved**



Follow us on Instagram to learn
about upcoming events
[@MaineClimateCouncil](#)

Connect with initiative lead
Abigail Hayne
abigail.hayne@maine.gov



**Information and inspiration for young Mainers about
climate change, the State's climate action plan, and how
youth can get involved and make a difference.**

