

Rhode Island Greenhouse Gas Emissions Inventory

Proposed Methodology Improvements for the 1990 Baseline

Introduction

The *Rhode Island Greenhouse Gas Emissions Inventory* is the primary scientific tool for assessing progress towards the emissions reduction mandates outlined in the [2021 Act on Climate](#) (R.I. General Laws § 42-6.2-2). The Department of Environmental Management (DEM) compiles the inventory annually and strives to utilize the best science and data available. On December 15, 2022, the Executive Climate Change Coordinating Council (EC4) approved the [Rhode Island 2022 Climate Update](#) as the State's official plan to guide climate change mitigation. The *2022 Update* recommended evaluation and discussion of updating the inventory's 1990 baseline, a critical dataset used to benchmark Rhode Island's progress towards the Act on Climate.

History of the 1990 Baseline

The [first inventory](#) for Rhode Island was completed by the Northeast States for Coordinated Air Use Management (NESCAUM) in 2013. Through this contract, the 1990 baseline was established using mainly default data from the Environmental Protection Agency's (EPA) State Inventory Tool (SIT). In 2016, the 1990 baseline was adjusted in the [2016 Rhode Island Greenhouse Gas Emissions Reduction Plan](#). The *2016 Plan* adjusted the baseline's electricity consumption estimate¹ and added a land use, land use change, and forestry (LULUCF) sector².

Proposal to Update the 1990 Baseline

Since the 1990 baseline was first established, scientific understanding of climate change has continuously evolved. The Intergovernmental Panel on Climate Change (IPCC) published its [Fifth Assessment Report](#) (AR5) in 2014, which included new global warming potentials (GWPs) that more accurately portray the impact of methane, nitrous oxide, and other GHG emissions. DEM's accounting methodologies have also improved, and new data sources have emerged in recent years. Preservation of the 1990 baseline memorializes consistency but results in inaccurate comparisons overtime.

Following stakeholder feedback and recommendations approved by the EC4 in the *2022 Update*, DEM proposes to apply the methodology improvements outlined in this document to the 1990 baseline and the entire inventory timeseries. Adoption of the proposed methodology improvements will further align the inventory with national and international reporting guidelines and provide a more direct comparison across 30 years of data. DEM also proposes to apply relevant methodology updates to the 1990 baseline on an as-needed basis in the future, which would align with the approach taken by EPA and other New England states.

Methodology Improvement: Update the Inventory's Global Warming Potentials

The GWP evaluates the climate impact one ton of methane, nitrous oxide, or ozone-depleting substances have compared to one ton of carbon dioxide. Since carbon dioxide, the most prevalent GHG, has an atmospheric lifespan greater than 100 years, GWPs are typically expressed on a 100-year-time horizon. Methane traps more heat than carbon dioxide and has a shorter lifespan of only 12.4 years. To demonstrate methane's greater climate impact, GWPs can also alternatively be expressed on a 20-year-time-horizon. The United Nations Framework Convention on Climate Change (UNFCCC) requires 100-year AR5 GWPs, except for fossil

methane³. The IPCC’s GWP for fossil methane assesses total carbon content, which includes methane’s oxidation to carbon dioxide in the atmosphere⁴. Since most emission factors used in the inventory already account for total carbon content, the inventory’s fossil methane estimates use the same GWP as biospheric methane⁵ to avoid double counting carbon dioxide.

The 1990 baseline and inventories through 2010 presently use 100-year GWPs from the IPCC’s [Second Assessment Report](#) (SAR), while 2011-2019 use 100-year GWPs from the IPCC’s [Fourth Assessment Report](#) (AR4). Examples of 100-year GWPs are listed here:

	IPCC Second Assessment Report (1995)	IPCC Fourth Assessment Report (2007)	IPCC Fifth Assessment Report (2014)
Carbon Dioxide	1	1	1
Methane	21	25	28
Nitrous Oxide	310	298	265

To align with UNFCCC requirements and EPA’s *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, **DEM proposes to update the 1990 baseline and the entire inventory timeseries to 100-year AR5 GWPs.** This proposal is in response to stakeholder feedback from a March 16, 2022 public sharing session and a recommendation approved by the EC4 on page 32 of the *2022 Update*:

“We recommend further evaluation and discussion of updating the 1990 baseline if the best science suggests new and reasonable parameters or methods.”

Updating the 1990 baseline and the entire timeseries to 100-year AR5 GWPs incorporates contemporary climate science, follows best practice, and promotes consistency.

Methodology Improvement: Align the Inventory’s LULUCF Sector with IPCC Guidelines

Land Use, Land Use Change, and Forestry (LULUCF) represents the net carbon flux from natural and working lands (NWLs)⁶ in Rhode Island. The *2016 Plan* estimated LULUCF for the first time and established a net emissions total for the 1990 baseline. The 1990 baseline’s current LULUCF estimate is an interpolated number derived from data provided by the Rhode Island Geographic Information System, Abt Associates, and trends in carbon dynamics found in EPA’s SIT. After the Act on Climate was passed, the 1990 baseline’s net emissions total became increasingly important for assessing progress towards the Act’s “net-zero emissions by 2050”. DEM found the *2016 Plan*’s LULUCF methodology to be irreplicable and [adopted its own methodology with public input](#) last year for estimating carbon sequestered from Rhode Island’s forests.

The *2022 Update* was receptive to DEM’s new methodology and further stated:

“We recommend RIDEM continue to collaborate with its DAFE [Division of Agriculture and Forest Environment] and the U.S. Climate Alliance to continuously improve the LULUCF sector.”

In response to this recommendation, DEM worked with its Division of Agriculture and Forest Environment (DAFE) and the U.S. Climate Alliance at its [Natural & Working Lands 2023 National Learning Lab](#) to improve the LULUCF sector. DEM proposes to align the LULUCF sector with the land-use categories defined by the [2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use](#)^{7,8}. Aligning the LULUCF sector with IPCC guidelines would cover all categories of NWLs, and this will be accomplished by leveraging state-specific data published in EPA’s [Inventory of U.S. Greenhouse Gas Emissions and Sinks by States](#)⁹. Please note, Forest Land Remaining Forest Land (aboveground biomass and forest fires), Croplands, Grasslands, and Settlements Remaining Settlements (urban trees only) will continue to follow

DEM's methodology adopted last year. EPA's state specific data will only be used to include previously omitted components, highlighted in green below.

Current LULUCF Subsectors

- Forest Land
 - Forest Land Remaining Forest Land (Aboveground Biomass, Forest Fires)
- Croplands
 - Agricultural Soil Carbon Flux
- Grasslands
 - Agricultural Soil Carbon Flux
- Wetlands
 - Not Included
- Settlements
 - Settlements Remaining Settlements (Urban Trees, Settlement Soils, Yard Trimmings)

Proposed LULUCF Subsectors (NEW)

- Forest Land
 - Forest Land Remaining Forest Land (Aboveground Biomass, Forest Fires)
 - Land Converted to Forest Land
- Croplands
 - Cropland Remaining Cropland
 - Land Converted to Cropland
- Grasslands
 - Grassland Remaining Grassland
 - Land Converted to Grassland
- Wetlands
 - Coastal Wetlands Remaining Coastal Wetlands
 - Land Converted to Coastal Wetlands
- Settlements
 - Settlements Remaining Settlements (Urban Trees, Settlement Soils, Yard Trimmings)
 - Land Converted to Settlements

This methodology improvement can be applied to the entire inventory timeseries since EPA's state specific data goes back to 1990. Additionally, Forest Land Remaining Forest Land can also be estimated from DAFE's data back to 1990. **DEM proposes to replace the current 1990 baseline's LULUCF sector and apply this proposed methodology improvement to the entire inventory timeseries.** Sensitivity analysis demonstrates that alignment with the IPCC reporting guidelines adjusts the 1990 baseline's LULUCF sector from -0.29 MMTCO₂e to -0.81 MMTCO₂e, an estimate significantly closer to reality. Adoption of this methodology improvement for the 1990 baseline and entire inventory timeseries follows national and international reporting guidelines, creates a net emissions total for each year, and provides a more direct comparison across three decades of data.

Conclusion

The proposed methodology improvements to the inventory's 1990 baseline and entire timeseries incorporates 21st century climate science and more accurately captures the impact of NWLs in Rhode Island. The 1990 baseline is a critical dataset used to benchmark Rhode Island's progress towards the Act on Climate and should be recognized as a dynamic reference point that is subject to updated climate science and new methodologies. DEM proposes the following methodology improvements:

1. Update the 1990 baseline and entire inventory timeseries to 100-year AR5 GWPs.
2. Replace the LULUCF sector in the current 1990 baseline and 2019 inventory and add a LULUCF sector for all other inventory years with the methodology improvement detailed above.
3. Apply relevant methodology changes to the 1990 baseline on an as-needed basis in the future, which would align with the approach taken by EPA and other New England states.

DEM is striving to incorporate the aforementioned recommendations from the EC4's 2022 Update ahead of the 2020 inventory release. Please provide comments via [SmartComment](#) regarding the application of the proposed methodology improvements to the inventory's 1990 baseline. More information on the *Rhode Island Greenhouse Gas Emissions Inventory* can be found at www.dem.ri.gov/ghg-inventory. **Public comments will be accepted through Friday, October 6th at 4:00 pm.**

End Notes

1. See page 52, footnote 17 of the [2016 Plan](#).
2. See page 52 “LULUCF Addition” of the *2016 Plan*.
3. See paragraphs 1 and 2 of 7/CP.27, “Common metrics used to calculate the carbon dioxide equivalent of anthropogenic greenhouse gas emissions by sources and removals by sinks” at the 27th UNFCCC Conference of Parties (COP27), available online at https://unfccc.int/sites/default/files/resource/cp2022_10a01_adv.pdf.
4. Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: Anthropogenic and Natural Radiative Forcing. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
5. Biospheric methane originates from biogenic emission sources (i.e., biofuels, livestock, etc.)
6. Natural and working lands include forests and woodlands, grasslands and shrublands, croplands and rangelands, coastal and freshwater wetlands, and urban greenspaces. (U.S. Climate Alliance)
7. IPCC 2006, [2006 IPCC Guidelines for National Greenhouse Gas Inventories](#), Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan
8. The IPCC defines a sixth land use category “other land”, which is classified as bare soil, rock, and ice. This is assumed to have net carbon flux of 0 MMTCO_{2e} in Rhode Island and is not included for simplicity.
9. See EPA’s [Inventory of U.S. Greenhouse Gas Emissions and Sinks by States](#).