CPRG Tools and Technical Resources – Greenhouse Gas Inventory and Projections

This webpage provides a list of tools and resources that support Climate Pollution Reduction Grants (CPRG) Planning Grantees meet the Greenhouse Gas (GHG) inventory and emission projections requirements for the Priority Climate Action Plan (PCAP) and Comprehensive Climate Action Plan (CCAP). These requirements are laid out in the Program Guidance for States, Municipalities, and Air Pollution Control Agencies and Federally Recognized Tribes, Tribal Consortia, and U.S. Territories. EPA and other federal organizations publish and maintain a variety of resources that grantees may leverage to meet these requirements, including Greenhouse Gas Data, GHG Inventory Development Tools and Methods, and GHG Projections Tools and Methods. These resources are further described below.

The PCAP requires a simplified GHG inventory using existing data. The CCAP requires a comprehensive inventory, including all GHG emissions and sinks (e.g., through the uptake of carbon and storage in forests, vegetation, and soils) by emission source and sink category following commonly accepted protocols for the following sectors, if applicable: electric power, transportation, industrial, commercial and residential buildings, agriculture/natural and working lands, and waste and materials management. The CCAP also requires grantees to complete near-term (e.g., 2030-2035) and long-term (e.g., 2050) projections of GHG emissions.

Note: EPA does not require the usage of a specific dataset, tool, or baseline year for this analysis. Instead, inventory data, tools, and years should be chosen based on availability of underlying data and in terms of GHG emission targets.

Visit the Electric Power, Transportation, Industrial, Commercial and Residential Buildings, Agriculture/Natural and Working Lands, Waste and Materials Management sector webpages for more information on sector specific overview information, data, methods, tools, and resources.

Where to get started?

EPA offered three trainings for all CPRG grantees the summer of 2023 to demonstrate where to get started on creating a GHG Inventory and Emission Projections based on EPA data, tools, and resources:

- Webinar on GHG Inventory and Emission Projections 101 (for States)
- Webinar on GHG Inventory and Emission Projections 101 (for MSAs)
- Webinar on GHG Inventory and Emission Projections 101 (for Tribes and Territories)

In addition, the GHG Quick Start User's Guide (pdf) (827.84 KB) was designed to help municipalities, Tribes, and territories plan and complete their first greenhouse gas (GHG) inventory for inclusion in their Priority Climate Action Plans (PCAPs).

Note: There are several other GHG Inventory training recordings and supplemental resources for CPRG Planning grantees located on the CPRG Technical Assistance Forum (TAF) Resource Library SharePoint site. If you are planning grantee, planning grantee partner, or TAF participant and would like access to the site, please contact cprg.epa@endyna.com.

Greenhouse Gas (GHG) Data

CPRG grantees may use existing self-published inventories and/or existing federal or third-party datasets in compiling their PCAP GHG Inventories; CCAP inventories may also incorporate such data.

- EPA develops an annual report called the Inventory of U.S. GHG Emissions and Sinks by State. This report includes state-level inventories by gas, Intergovernmental Panel on Climate Change (IPCC) sector (Energy, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use, and Waste), and economic sector over time. The latest data covers 1990-2021 and can be used to meet the PCAP/CCAP GHG inventory requirements. A crosswalk of EPA's State Inventory Tool (SIT) and incorporation of GHG Inventory by State data can be found here.
  - Grantees can learn more EPA's emissions estimates and can explore inventories by state on the GHG inventory factsheet.
  - EPA's Methodology Report: Inventory of U.S. GHG Emissions and Sinks 1990-2021 by State describes the methods used to compile emissions disaggregated by U.S. state and contains useful approaches, assumptions, and data sources. The methodology report data appendices include underlying state-level data or activity factors for many categories.
- The U.S. GHG Reporting Program (GHGRP) requires reporting of GHG data and other relevant information from large GHG emission sources, fuel and industrial gas suppliers, and CO2 injection sites in the United States. Approximately 8,000 facilities are required to report their emissions annually, and the reported data are made available to the public in October of each year. GHGRP facility-level data is searchable and exportable at the state and county level using the Facility Level Information on GHG Tool (FLIGHT). FLIGHT is an interactive website with mapping features to identify GHGRP facilities by location, name, industry type, and other criteria. FLIGHT can also generate and download customized graphics (pie charts, trend lines, etc.) and facility lists. The latest data covers 2022 with reporting starting in 2010 or 2011 depending on the industry and can be used to develop source category estimates included within GHG inventory to help meet the PCAP/CCAP requirement(s).
  - The FLIGHT Help Content page provides a range of resources and tutorials for using this tool.
- EPA's National Emissions Inventory (NEI) is a county-, facility-, process-level emissions inventory of Criteria Air Pollutants (CAPs) and Hazardous Air Pollutants (HAPs). In addition to including CAPs and HAPs, the NEI also maintains GHG emissions data at the county- and facility-level for many sources, including mobile sources and large stationary sources. Mobile source emissions, both on- and off-highway, are generated using EPA's MOVES model and other methods for locomotives, commercial marine vessels, and aircraft. These mobile source inventories are informed by local data that are provided by state, local, and Tribal agencies and developed by EPA. Large stationary source, facility-level GHG emissions come from the U.S. EPA's Greenhouse Gas Reporting Program or direct state, locality, or tribal GHG submissions to the NEI. EPA notes that the NEI estimates emissions for entities that do not submit their own inventories and can provide these inventories to state, local, and tribal governments. The latest data can be used to help meet the PCAP/CCAP requirement(s).
  - *Note: the bottom-up approach applied in the NEI differs from the approach and methods used in the national GHG inventory and the related state level estimates in the Inventory of U.S. GHG Emissions and Sinks by State.*
  - Webinar on Co-Pollutant Inventory and Future Projections Benefits Analysis
  - The Guidance for Accessing NEI Transportation Data explains how to incorporate transportation NEI data into EPA's Local GHG Inventory Tool and Tribal GHG Inventory Tool.
  - Visit the Co-Pollutant Benefits Analysis webpage for more information
- DOE's State and Local Planning for Energy (SLOPE) Data Viewer contains city-, county-, and state-level data on energy consumption and generation, renewables, efficiency, transportation, commercial buildings, and more.
  - Webinar on SLOPE Data Viewer
  - The Guidance for County and Regional Inventories on Energy Sector Data Source explains how to incorporate SLOPE data into EPA's Local GHG Inventory Tool.

GHG Inventory Development Tools and Methods

The PCAP and CCAP require that state, local, and tribal governments provide a list of emission sources and sinks, and the associated emissions quantified using standard methods. Grantees may use existing methods and tools as a guide to complete this requirement.

Inventory Development Tools

The tools described below can be used to develop comprehensive GHG Inventories as required by the CCAP.

- EPA's State Inventory and Projection Tool is a customizable Excel-based tool designed to help states develop GHG emissions inventories. The tool has two components: the state inventory tool which calculates emissions and sinks by economic sector and gas (1990-2020) and the projection tool (2021-2050). A crosswalk of EPA's State Inventory Tool and incorporation of GHG Inventory by State data (described above) can be found here.
  - The GHG Inventory and Emission Projections 101 (for States) webinar provides information on GHG Inventory/Projection Basics; Best practices and frequent questions; Difference between GHG and conventional inventories; How to select a baseline; Existing Data and Tools; National GHG Inventory Disaggregated data; State Inventory Tool and Non-CO2 marginal abatement curves; and an Overview of GHG Reporting Program (GHGRP) and National Emissions Inventory (NEI).
  - EPA developed the User's Guide for Estimating Emissions and Sinks from Land Use, Land-Use Change, and Forestry to accompany the tool.
- EPA's Local GHG Inventory Tool is a customizable Excel-based tool that helps municipalities across the United States to evaluate their GHG emissions. The tool can compile a GHG inventory for an entire community or for local government operations.
  - The GHG Inventory and Emission Projections 101 (for MSAs) webinar provides an overview of CPRG Requirements on GHG Inventories and Emission Projections; GHG Inventory/Projection Basics; Best practices and common questions; Difference between GHG and conventional inventories; how to select a base year and near-term and long-term future years; developing economy wide vs. sector inventories and projections; Existing Data and Tools; Local GHG Inventory Tool; Overview of GHG Reporting Program (GHGRP); National Emissions Inventory (NEI); and more.
  - EPA has developed four guidance documents to accompany the tool on Guidance for Accessing NEI Transportation Data, Guidance for County and Regional Inventories on Agriculture and Land Management, Guidance for County and Regional Inventories on Energy Sector Data Source.
- EPA's Tribal GHG Inventory Tool is a customizable Excel-based tool that helps tribes across the United States to evaluate their GHG emissions. The tool can assist the user compile a GHG inventory for an entire community or for tribal government operations.
  - The GHG Inventory and Emission Projections 101 (for Tribes and Territories) webinar provides an overview of CPRG Requirements on GHG Inventories and Emission Projections; GHG Inventory/Projection Basics; best practices and common questions; Difference between GHG and conventional inventories; how to select a baseline and near-term and long-term future years; developing economy wide vs. sector inventories and projections; Existing Data and Tools; Tribal GHG Inventory Tool; and an Overview of GHG Reporting Program (GHGRP) and National Emissions Inventory (NEI).
  - EPA has developed a guidance document to accompany the tool on Guidance for Accessing NEI Transportation Data.
- EPA's MOtor Vehicle Emission Simulator (MOVES) is a state-of-the-science emission modeling system that can be used to estimate emissions for mobile sources at the national, county, and project level for GHGs, criteria air pollutants, and air toxics. MOVES can also estimate energy consumption. MOVES estimates emissions from on-road mobile sources (i.e., on-road vehicles such as cars, trucks, and buses) and from most nonroad emissions sources as well (with the exceptions of locomotives, marine vessels, and aircraft). MOVES can be used to estimate inventories for states, territories, municipalities, and tribes. As MOVES can model through the year 2060, MOVES is the ideal tool to use for transportation sector emission projections for future years.

    - EPA's MOVES website provides guidance on mobile source emissions modeling:
        - Quantifying GHGs is covered in the MOVES Greenhouse Gas Guidance: Using MOVES for Estimating State and Local Inventories of Onroad and Nonroad Greenhouse Gas Emissions and Energy Consumption.
        - Quantifying co-pollutants (criteria pollutants/precursors and air toxics) is covered in the MOVES Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity.
    - EPA's MOVES Training website provides additional training resources.
- The Waste Reduction Model (WARM) is an Excel-based tool that estimates the potential GHG emissions, energy savings, and economic impacts of baseline and alternative waste management practices, including source reduction, recycling, combustion, composting, anaerobic digestion, and landfilling. The model calculates emissions, energy units, and economic factors across a wide range of material types commonly found in solid waste.
- The Agriculture and Land Use National GHG Inventory Software (ALU), hosted by Colorado State University, is a free tool that guides users through the process of estimating GHG emissions and removals related to agricultural and forestry activities following the Intergovernmental Panel on Climate Change (IPCC) guidance and includes mitigation module allowing users to quantify potential emissions impacts of changing agriculture and land use practices.
    - The Introduction to ALU Software video provides a walkthrough of the software that users can follow when learning how to incorporate the tool into regular practices.

Inventory Development Methods

Grantees are required to use commonly accepted GHG reporting protocols, including sector-based methods, to build GHG inventories for their PCAP.

- The GHG Quick Start User's Guide (pdf) (827.84 KB) purpose is to help municipalities, Tribes, and territories plan and complete their first greenhouse gas (GHG) inventory for inclusion in their Priority Climate Action Plans (PCAPs).
- The User's Guide to Incorporating Existing GHG Inventories for the Priority Climate Action Plan (PCAP) (pdf) (604.89 KB) provides guidance for metropolitan statistical areas (MSAs) developing or compiling greenhouse gas (GHG) inventories for their priority climate action plans (PCAPs).
    - The The PCAP Scaling Factors Data Guide (pdf) (784.14 KB, March 26, 2024) describes data sources that may help users scale existing emissions data for use in their own inventories.
- EPA's Port Emissions Inventory Guidance provides methodologies for developing port-related and goods movement emissions inventories, including future year projections of GHG emissions, criteria air pollutants and precursors, mobile source air toxics, and energy consumption. This document describes the latest, state of the science methods for preparing an emissions inventory for the various sources of emissions at a port or other goods-movement facility, including ocean-going vessels, harbor craft, recreational marine vehicles, cargo handling equipment, on-road vehicles, and rail, and includes how to project a future year inventory for each of these sources.
    - The Port Emission Inventory Guidance webinar covers the methodologies described in the guidance to prepare a port-related emissions inventory for landside and waterside emissions across six port-related sectors: ocean going vessels, harbor craft, recreational marine, cargo handling equipment, on-road vehicles, and rail. The webinar covered the data inputs, methods, and analysis approaches available for developing base year and future year inventories of varying levels of detail and geographic scopes based on user capacity, available resources, and intended end use of the inventory.

GHG Projections Tools and Methods

Comprehensive GHG emissions projections are not required for the PCAP, but are required for the CCAP. The tools described below can be used to create either comprehensive or sector-based estimates of future GHG emissions for use in the CCAP.

Projection Tools

Grantees can use the following tools to facilitate the comprehensive or sector-based estimates of future GHG emissions use required for the CCAP.

- EPA's State Inventory and Projection Tool is a customizable Excel-based model designed to help states develop GHG emissions inventories. The projection module of the tool allows users to create emissions estimates for 2021-2050 based on a combination of historic emissions and projected energy use, and animal and human populations.
    - The GHG Inventory and Emission Projections 101 (for States) webinar provides information on GHG Inventory/Projection Basics; Best practices and frequent questions; Difference between GHG and conventional inventories; How to select a baseline; Existing Data and Tools; Focus on National GHG Inventory Disaggregated data; State Inventory Tool and Non-CO2 marginal abatement curves; Overview of GHG Reporting Program (GHGRP) and National Emissions Inventory (NEI).
- The U.S. State-level non-CO2 Mitigation Analysis provides states with emission projections and mitigation cost curves to better understand the opportunities and costs for reducing emissions of non-carbon dioxide (non-CO2) GHGs, including methane, nitrous oxide, and fluorinated gases. The methodological approach for emission projections was used to estimate emission projections from 2020 through 2050, at 5-year intervals. Additionally, this report provides comprehensive technical and economic data on the opportunities and costs for reducing emissions. This data is available through the Non-CO2 GHG Data Tool.
    - The GHG Inventory and Emission Projections 101 (for States) webinar provides information on GHG Inventory/Projection Basics; Best practices and frequent questions; Difference between GHG and conventional inventories; How to select a baseline; Existing Data and Tools; Focus on National GHG Inventory Disaggregated data; State Inventory Tool and Non-CO2 marginal abatement curves; Overview of GHG Reporting Program (GHGRP) and National Emissions Inventory (NEI).
- GLIMPSE is model-based tool designed to support coordinated air, climate, and energy planning. At the heart of GLIMPSE is the Global Change Analysis Model (GCAM-USA), an open-source human-Earth system model with state-level resolution. GLIMPSE simulates the co-evolution of the energy, agriculture, water, land, economic, and climate systems, tracking technology and fuel use, as well as the resulting GHG and air pollutant emissions. GLIMPSE's strengths include its multi-sector, multi-pollutant coverage; however, it typically has less detail than sector-specific models. GLIMPSE may be useful for activities such as: developing emission projections, identifying strategies for meeting specific GHG reduction targets, and quantifying the long-term emission impacts of specific mitigation measures or of bundles of measures. Furthermore, GLIMPSE's state-, sector-, and pollutant-specific emission projections can be used in tools such as EPA's CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA) to estimate air quality and health benefits.
    - The GLIMPSE webpage will include announcements of upcoming information sessions and training opportunities. Additionally, subscribe to the GLIMPSE listserv by emailing glimpse-news-subscribe@lists.epa.gov. Please email glimpse@epa.gov to obtain a link to the GLIMPSE download folder, which also includes videos of training sessions. The Users Guide provides a set of tutorials.
- MOVES Model as described above for developing GHG and criteria pollutant emissions inventories and projections for the transportation sector portion of PCAPs and CCAPs.
- DOE's State and Local Planning for Energy (SLOPE) Scenario Planner can be used to compare scenarios for the future of energy, costs, and emissions for counties and states.
    - Webinar on SLOPE Scenario Planner

Projection Methods

Grantees can use the following as a guide while completing either comprehensive or sector-based estimates of future GHG emissions for use in the CCAP.

- The Port Emissions Inventory Guidance provides methodologies for developing port-related and goods movement emissions inventories, of GHG emissions, criteria air pollutants and precursors, mobile source air toxics, and energy consumption. The guidance includes information on how to project a future year inventory for each of these sources.

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