CPRG Tools and Technical Resources – Commercial and Residential Buildings Sector

This webpage provides a list of tools and resources that support CPRG Planning Grantees meet the sector-based requirements for the Comprehensive Climate Action Plan (CCAP) and Priority Climate Action Plan (PCAP) if it includes the commercial and residential buildings sector as a priority sector. 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 Commercial and Residential Buildings Sector Emissions Data, Commercial and Residential Buildings Sector Emissions Quantification Methods and Tools, and on Understanding Commercial and Residential Buildings Sector Emission Reduction Opportunities. These resources are further described below.

Note: EPA does not require the usage of a specific dataset or tool, or the inclusion of any particular measure type.

Visit the Greenhouse Gas (GHG) Inventory and Projections webpage for more information on GHG inventory and projections data, methods, tools, and resources.

Where to get started?

The resources below broadly describe commercial and residential buildings sector GHG emissions and strategies to reduce them. Grantees can use them to consider approaches to reduce emissions in their jurisdiction.

- Chapter 4 of the Low Emission Energy Program (LEEP) Report provides a snapshot of the building sector, reviews key measures, and models short term potential reductions at the national level. Results from this chapter can aid understanding of how policies and programs can be quantified and to assess potential GHG reduction measures for PCAPs and CCAPs.
    - Questions on the report can be submitted through an online form.
- The ENERGY STAR for Policymakers webpage provides an overview of tools, resources, and technical assistance that EPA ENERGY STAR provides to state, local, and tribal governments for their initiatives to

improve the energy performance of existing commercial and multi-family buildings. EPA's tools, resources, and technical assistance can apply to initiatives focused on government-owned buildings, voluntary programs for private buildings, or requirements on private buildings.

  - The ENERGY STAR Training Center provides live and recorded training webinars, energy efficiency guides, and other resources for commercial building energy benchmarking and conservation that may be useful to grantees.

- The EIA Uses of Energy Explained: Energy Use in Commercial Buildings webpage provides an overview of energy use in the U.S. commercial buildings sector. It includes information about commercial building space and a breakdown of energy use by fuel types and end uses in the sector. This information can be used to assess potential GHG reduction opportunities by commercial building type for PCAPs and CCAPs.
- The EIA Uses of Energy Explained: Energy Use in Homes webpage describes energy use in U.S. homes. It includes information about the primary energy sources for homes, changes in energy sources over time, factors that affect the amount of energy a home uses, and energy efficiency improvements over time. This information can be used to assess potential GHG reduction opportunities by residential building type for PCAPs and CCAPs.
- The Department of Housing and Urban Development (HUD) Energy Efficiency Resources webpage provides an extensive collection of resources focused on reducing energy waste and enhancing energy efficiency in buildings. Topics include energy auditing, retrofits, smart building technologies, energy management systems, and sustainable design principles. This information can be used to identify potential GHG reduction opportunities by residential buildings for PCAPs and CCAPs.
- The Department of Energy Office of Energy Efficiency and Renewable Energy Building Technologies Office webpage links to a variety of resources for improving the energy performance of commercial and residential buildings. Resources include the Better Buildings Residential webpage, which provides resources that allow organizations to share best practices and learn from other energy efficiency programs, access valuable resources, and expand the success of their residential energy efficiency programs. The EERE Commercial Buildings Integration (CBI) webpage seeks to advance a range of innovative building technologies and solutions, to produce significant energy savings, greenhouse gas emissions reductions and save businesses money.
- The EERE Zero Energy Resource Hub provides guidance on creating energy-efficient buildings and districts that can meet their energy needs with renewables. Links are also provided to information about emerging technologies, appliance and equipment standards, building energy codes, a resource dashboard, and other initiatives related to building energy. This information can be used to identify potential GHG reduction opportunities for commercial and residential buildings, focusing on schools, offices, and energy districts.
- EPA's Quantified Climate Action Measures Directory presents information on the quantified GHG emission reduction measures in state and local climate action plans published between January 2018 and August 2023. Grantees may use this tool to draw inspiration for PCAP and CCAP emissions reductions measures and understand how they were quantified by states, MSAs, and tribes of similar sizes, geographies, economic conditions, etc.

  - Access the State Quantified Measures Directory
  - Access the Local Quantified Measures Directory

- Questions, feedback, or problems with the Quantified Climate Action Measures Directory can be submitted through the form available at this link.

Note: There are commercial and residential buildings sector 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.

Commercial and Residential Buildings Sector Emissions Data

This section can help equip grantees with critical information needed to meet PCAP and CCAP requirements. The emissions data resources below can help grantees identify emission reduction opportunities and build a solid data foundation for quantifying and assessing the impact of their GHG reduction measures.

- The EIA Residential Energy Consumption Survey (RECS) Data and Dashboard is nationally representative sample of housing units, last surveyed in 2020, with detailed subnational information on residential energy characteristics, including fuels used and end users. Additionally, RECS tables are provided by geographic region and climate zone. This survey information can be used to assess potential residential building GHG reduction opportunities for PCAPs and CCAPs.
- The EIA Commercial Building Energy Consumption Survey (CBECS) is a nationally representative sample of commercial buildings, last surveyed in 2018. The survey data include building characteristics, energy consumption and expenditures, and microdata for all individual buildings surveyed. Additionally, CBECS tables are provided by geographic region and climate zone.
- The ENERGY STAR Portfolio Manager Data Explorer provides energy use data from over 150,000 U.S. commercial and multifamily properties. It can be used to explore energy use intensity, ENERGY STAR scores, and percentage of electricity across different property types. It can be used by climate action plan developers to better understand energy use intensity for buildings in their jurisdiction and compare it to buildings in other locations.
  - A user guide for the data explorer is available, and a video tutorial is coming soon.
- 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

Commercial and Residential Buildings Sector Emissions Quantification Methods and Tools

The following resources provide tools and methods for quantifying GHG emission reductions for the commercial and residential buildings sector. These methods and tools can be used by states, local governments, Tribes, and territories to quantify GHG reduction measures in their PCAPs and CCAPs.

Quantification Methods

The following resource provides methodologies for quantifying GHG emission reductions for the commercial and residential buildings sector. These methods can be used to quantify GHG reduction measures in climate action plans.

- The EPA Guidebook for Energy Efficiency Evaluation, Measurement and Verification is designed to help state, local, and tribal air and energy officials and other stakeholders to learn about, establish, or refine their evaluation, measurement, and verification (EM&V) approaches. EM&V compares actual energy use after an energy efficiency project or measure has been implemented with the best estimate of the likely energy use that would have occurred in the absence of that project or measure. This guidebook can be used to improve establish and improve EM&V approaches to estimate energy savings from energy efficiency measures in climate action planning.

Quantification Tools

The following resources provide tools for quantifying GHG emission reductions for the commercial and residential buildings sector. These tools can be used to quantify GHG reduction measures in climate action plans.

- ComStock is a U.S. Department of Energy model of the commercial building stock in the United States, developed and maintained by the National Renewable Energy Laboratory (NREL). ComStock enables the modelling of building stock improvements based on commercial building stock characteristics data, to identify which improvements save the most energy and money. The ComStock Data Viewer allows for easy interaction with the published data.
- ResStock is a large-scale residential energy analysis tool developed by NREL with the support of the U.S. Department of Energy. ResStock enables simulations or modelling of building stock improvements based on public and private residential building stock characteristics data, to identify which housing improvements save the most energy and money. ResStock offers visualization tools, state fact sheets, and publications based on the modelled results.
- EPA's AVoided Emissions and geneRation Tool (AVERT) is a web or Excel-based tool used to evaluate how energy policies and programs such as energy efficiency, renewable energy, and electric vehicle deployment lead to changes in emissions of fine particulate matter, nitrogen oxides, sulfur dioxide, carbon dioxide, volatile organic compounds, and ammonia from electric power plants. It operates at the regional electricity grid level and reports results down to the county level. To assess how power sector emissions may change from different building technologies (e.g. heat pumps), advanced AVERT users can enter hourly power profiles created externally from AVERT. To assess total emission changes from fuel switching, users would also need to calculate the change in emissions from avoided fossil-fuel building technologies (e.g. oil boilers). AVERT may be a useful tool for compiling the benefits analysis in the PCAP or CCAP.
    - This webinar page includes a recording and slides that outline the new features of the latest version of AVERT.

- The ENERGY STAR Portfolio Manager tool supports benchmarking — measuring building energy use and comparing it to past consumption and the energy use of similar buildings, as a reference for building energy and associated GHG emissions performance. Nearly 25% of U.S. commercial building space is already actively benchmarking in Portfolio Manager, making it the industry-leading benchmarking tool. The tool can be used to quantify existing building energy and GHG impacts and to project potential impacts of high performing buildings associated with PCAP/CCAP activities.
    - The help page on the ENERGY STAR Portfolio Manager website provides resources to help users find solutions to any challenges they may come across or a link to contact support.
- The Federal Life Cycle Assessment (LCA) Commons tool provides central access to data repositories for use in LCA. Transparent, publicly accessible, Federal LCA data, including GHG emissions and air emissions and toxic air pollution, can be used as data sources for construction materials' embodied carbon inventories and actions to meet PCAP/CCAP requirements.
    - The Federal LCA Commons Training Resources page provides short video trainings on accessing and navigating the LCA Commons that contains embodied carbon GHG and air pollution data for various building materials.
- Energy Savings and Impacts Scenario Tool (ESIST) is an Excel-based planning tool for analyzing the energy savings and costs from customer-funded energy efficiency programs, primarily on the electricity sector, and their impacts on emissions, public health, and equity for historical and forecast years between 2010-2040. ESIST allows users to select a study area based on states, utility types, specific utilities, or different customer sectors within a utility to then adjust inputs, including electricity sales growth forecasts, energy efficiency savings goals, program budgets, savings expiration schedules, discount rates, and first-year costs. ESIST may be useful to forecast the energy savings, emissions, and costs of energy efficiency programs in climate action plans.
    - The ESIST: Pilot Gas Version is focused on natural gas savings from energy efficiency or other gas-saving measures in the residential and commercial sectors.
    - The ESIST Version 1.1 User Manual describes the input process used to generate ESIST results. The manual also describes how users can generate tailored results within the optional modules and replace default values with user-specified assumptions.
    - Training for ESIST is available in the form of a recorded webinar with webinar slides also available.
- 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 has multi-sector, multi-pollutant coverage over the time period of 2015 through 2100 in 5-year increments. One of its strengths is in simulating the interactions among sectors; however, GLIMPSE has less sectoral detail than many 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. For building sector analyses, GLIMPSE allows users to specify measures such as heat pump sales targets, evaluating their impacts on capacity expansion and GHG and air pollutant emissions. GLIMPSE can also be used to explore the impacts of

measures implemented in combination, such as pairing electrification of buildings with a Clean Energy Standard.

  - The GLIMPSE Users Guide provides instructions and guidance for state, local, and tribal air and energy officials.
  - The GLIMPSE webpage will announce of upcoming information sessions and training opportunities. Interested grantees may email glimpse@epa.gov to obtain a link to the GLIMPSE download folder, which also includes videos of training sessions.

Understanding Commercial and Residential Buildings Sector Emission Reduction Opportunities

The resources below focus on areas of the commercial and residential buildings sector where opportunities for GHG emissions reductions might be found. The resources can help grantees refine emissions reduction strategies and select measures to implement their strategies in their PCAP and CCAP.

New Construction

The below tools and resources may be helpful for detailing measures both in the CCAP and PCAP (where relevant) related to new commercial and residential buildings.

- The ENERGY STAR Residential New Construction specifications can apply to single family, multifamily and manufactured buildings. Measures can incentivize or require new buildings to meet this specification.
  - Training for the ENERGY STAR Residential New Construction requirements is available in the form of webinars, technical bulletins, and other technical guidance document.
- The Energy and Environment Guide to Action – Building Codes for Energy Efficiency is an EPA guide which provides recommendations on establishing, implementing, and evaluating state building energy codes. The guide can inform PCAP/CCAP building code energy efficiency action development.
- The Tribal Green Building Toolkit shares approaches tribes can take to adopt or adapt green building standards and codes, as state and local building codes do not apply on tribal land. Chapters on Materials and Resource Conservation, Energy Efficiency and Renewable Energy, Resilience and Adaptability, Code Implementation and Compliance and Updating, Adapting or Adopting Codes or Developing New Codes may be informative for Tribal PCAP/CCAP development.

Existing Buildings

The below tools and resources may be helpful for detailing measures both in the CCAP and PCAP (where relevant) related to existing commercial and residential buildings.

- The ENERGY STAR Commercial Buildings program encourages improvement in energy performance through leadership commitment, tools and resources to support improvement, and recognition for top performance. This page can be used to help climate action plan developers benchmark their buildings and identify opportunities for enhancing energy efficiency.
    - Training for the ENERGY STAR Commercial Buildings resources is available in the form of live online training, how-to guides, demo videos, recorded webinars, and a library of past slide decks.
- The Building Performance Standards: Overview for State and Local Decisionmakers provides a launching point to learn more and receive technical assistance related to Building Performance Standard requirements, which set caps on energy use and/or emissions that existing buildings need to meet.
- The ENERGY STAR Products/ENERGY STAR Homes Energy Upgrade summarizes six high-impact actions that improve the energy performance of existing single-family homes. A PCAP/CCAP measure could leverage one or more or all the six high-impact actions.
- The resource Guidance for Utilities on Providing Whole-Building Energy Data to Enable Benchmarking in ENERGY STAR Portfolio Manager® can help states and utilities provide whole-building data that building owners need to properly benchmark their properties. Without access to accurate and complete whole-building data, owners of multi-tenant buildings like offices and multifamily housing may be unable to understand the whole-building performance of their properties, critical to making benchmarking data actionable to inform improvement efforts. As such, opening up access to this data can also be a keystone to existing building-focused program and policies.

Material Efficiency

The embodied carbon from extracting, processing, and manufacturing building materials can make up a large share of emissions from the buildings sector. These tools and resources may be helpful for detailing measures both in the PCAP and CCAP (where relevant) related to building materials and embodied carbon.

- What is Embodied Carbon? is an EPA website with an overview of the embodied GHG emissions in construction materials extraction, production, transport, and manufacturing and key products and initiatives to reduce embodied carbon.
- The Example Government Climate Action Plans that Address Materials Management and Waste is a tool for users to search for publicly available state, tribal and local government Climate Action Plans such as materials management actions. Grantees may find it useful to see other agencies' Climate Action Plans, especially for reducing embodied carbon in the built environment. This tool can potentially inform the development of PCAP/CCAP Building Sector requirements.
- The Sustainable Management of Construction and Demolition Materials website provides an overview of debris generated during the construction, renovation and demolition of buildings, roads, and bridges. EPA promotes a Sustainable Materials Management (SMM) approach that identifies certain C&D materials as commodities that can be used in new building projects, thus avoiding the need to mine and process virgin materials, and the associated greenhouse gas and life cycle impacts.

- The Sustainable Management of Industrial Non-Hazardous Secondary Materials webpage provides an overview on the beneficial use of industrial non-hazardous secondary materials (secondary materials), a key part of EPA's SMM effort. The appropriate beneficial use of secondary materials can advance the goals of EPA's SMM program, which emphasizes a materials management approach that aims to reduce impacts to human health and the environment associated with materials over their entire life cycle (e.g., extraction, manufacture, distribution, use, disposal). Through SMM, EPA is helping change the way our society protects the environment and conserves resources for future generations.
    - The Sustainable Materials Management (SMM) Web Academy series is a free resource that grantees can use to learn more about SMM principles from experts in the field. From these webinars, you can learn about key issues, successful projects and a variety of best management practices for creating stellar materials and waste management programs.

Financing

CCAPs require that measure costs be included and, if applicable, the funding source is identified. The resource below can be used to help climate action plan developers identify potential funding sources.

- The Clean Energy Finance Tools and Resources website provides information on tools for state and local governments to identify financing programs and resources to finance energy efficiency and renewable energy projects for commercial and residential buildings. This resource can be used to identify funding sources for climate action plan measures.
- The Clean Energy Finance Toolkit for Decisionmakers provides an overview of a dozen financing approaches for clean energy including related to the commercial and residential buildings sector, each with examples and links to more detailed information. Adequate financing can help enable both new construction and existing buildings to be energy efficient and to minimize or eliminate onsite GHG emissions.
- The Inclusive Utility Investment (IUI) ENERGY STAR website compiles information on IUI programs with multiple case studies and a resource library.

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