



Legislative Council Staff
Nonpartisan Services for Colorado's Legislature

Memorandum

November 21, 2024

TO: Interested Persons
FROM: Matt Bishop, Fiscal Analyst, 303-866-4796
SUBJECT: Regulatory Framework for Greenhouse Gas Emissions

Summary

Greenhouse gas emissions have been identified by the global scientific community as the major driver of climate change.¹ Globally, countries are committing to reduce greenhouse gas emissions to combat the effects of climate change. This memorandum provides background on the policies and programs related to greenhouse gas emissions reductions at the national, regional, and state levels within the United States.

Background on Greenhouse Gases

Greenhouse gases trap heat in the atmosphere by absorbing radiation, thereby increasing global temperatures. The major greenhouse gases emitted through human activities are carbon dioxide, nitrous oxide, methane, and several fluorinated gases (e.g., hydrofluorocarbons). Although some of these gases are naturally occurring in the atmosphere (e.g., carbon dioxide), human activities have significantly increased their atmospheric concentrations. These activities include burning fossil fuels, oil and natural gas resource development, agriculture, waste management, and industrial processes.

Greenhouse gases emitted by human activities are estimated to have increased the earth's mean surface temperature by approximately 1.1 degrees Celsius above pre-industrial levels (circa 1850), and are likely to reach an increase of 1.5 degrees Celsius by 2035, according to the Intergovernmental Panel on Climate Change. The warming of earth's temperature is changing the climate in ways that affect human health, safety, and well-being, including:

- increased risk from extreme temperatures, including heat-related morbidity and mortality;
- increased water-related risks from droughts and flooding;
- increased food-, water-, and disease-borne diseases;

¹Intergovernmental Panel on Climate Change, 2023. Climate Change 2023: Synthesis Report.



- increased mental health challenges;
- sea level rise caused by melting ice sheets, affecting coastal communities;
- displacement and migration of populations due to sea level rise and other climate impacts;
- biodiversity loss in all ecosystems;
- increased ocean temperatures and acidification, resulting in losses of marine resources; and
- food insecurity related to declining crop yields.

National Policies

A number of countries have committed to reducing greenhouse gas emissions. Although the United States has yet to commit to national greenhouse gas reduction targets, several acts direct agencies to promulgate regulations, programs, and standards that address greenhouse gas mitigation.² The most significant policy impacting emissions is the [Inflation Reduction Act of 2022](#). While this legislation is broad, several ways it affects greenhouse gas emissions include:

- promoting alternative energy sources and electric vehicles;
- providing funding for low- and zero-emissions manufacturing;
- providing funding for home energy efficiency;
- reducing methane emissions from natural gas facilities and marginal wells; and
- providing grants to states, local governments, and tribes for implementing emissions reduction plans.

Several examples of other federal policies are listed below.

- The [Clean Air Act](#) requires the U.S. Environmental Protection Agency (EPA) to regulate greenhouse gas emissions.
- The [Energy Independence and Security Act of 2007](#) requires the EPA and U.S. Department of Transportation to regulate greenhouse gas emissions by establishing fuel economy standards in motor vehicles.
- The [Energy Policy Act of 2005](#) establishes a number of programs on energy efficiency and renewable energy.
- The [American Recovery and Investment Act of 2009](#) provides funding for measures advancing energy independence and renewable energy technologies.

²The United States submitted intended nationally determined contributions to the United Nations Framework Convention on Climate Change, in accordance with the Paris Agreement, adopted in 2015, which established targets to reduce emissions by 26-28 percent below 2005 levels by 2025, and to make best efforts to reduce its emissions by 28%. However, in 2017, the United States announced its intent to withdraw from the Paris Agreement. <https://unfccc.int/news/unfccc-statement-on-the-us-decision-to-withdraw-from-paris-agreement>



- The [American Innovation and Manufacturing Act of 2020](#) requires the EPA to phase down the use of hydrofluorocarbons and facilitate the transition to next-generation technologies.
- The [Infrastructure Investment and Jobs Act of 2021](#) includes provisions promoting the adoption of electric vehicles, enhancing infrastructure resilience, and updating the electric grid.

In 2009, the EPA promulgated rules that require facilities that emit greenhouse gases above a certain threshold to report their emissions annually through the [Greenhouse Gas Reporting Program](#). To date, approximately 8,000 facilities report annual emissions, accounting for approximately 85 percent of total greenhouse gas emissions in the United States. In Colorado, 121 facilities reported greenhouse gas emissions in 2023, which accounted for 38 million metric tons of carbon dioxide equivalent.

Sub-National Policies

As of 2024, 24 states including Colorado, plus Washington, D.C., have adopted greenhouse gas emissions reduction targets.³ In addition, 13 states have imposed carbon pricing regulations through market-based, cap-and-trade programs. Cap-and-trade programs set a limit, or cap, on greenhouse gas emissions, and allow regulated entities to purchase and trade allowances that enable the regulated entities to emit a set amount of greenhouse gases. The two cap-and-trade programs in the United States are described below.

The [Regional Greenhouse Gas Initiative](#) (RGGI), established in 2005, operates a cooperative effort of 11 Northeast and Mid-Atlantic states to cap and reduce carbon dioxide emissions from fossil fuel-fired electric power generators with a capacity of 25 megawatts (MW) or greater. The regional carbon emissions cap under the RGGI is adjusted each year to reflect the reduction in total emissions allowances. Allowances are distributed by auction (although a limited amount can be held in reserve), and are tradable on secondary markets. The RGGI set a goal of reducing emissions 45 percent below 2005 levels by 2020, with an additional 30 percent reduction from 2020 to 2030.

[California's Cap-and-Trade program](#), signed into law in 2006, sets statewide limits on greenhouse gas emissions from sources responsible for 80 percent of California's emissions. The program regulates electricity generators, large industrial facilities, and fuel distributors. The program linked with the cap-and-trade program in Quebec, Canada, in 2014, and in Ontario

³Center for Climate and Energy Solutions. State Climate Policy. <https://www.c2es.org/content/state-climate-policy/>



starting in 2018. California has set a greenhouse gas emissions limit equal to 40 percent below the 1990 emissions level by 2030.⁴

[Washington's Cap-and-Invest Program](#), which started in 2023, covers 75 percent of statewide emissions, including fuel suppliers, electric and gas utilities, waste-to-energy facilities, and railroads. It supports the state's emissions reduction targets (relative to 1990 levels) of 45 percent by 2030, 70 percent by 2040, and 95 percent by 2050.

Colorado Policies

Statewide Policies

Colorado has implemented a series of measures to regulate greenhouse gas emissions. State law authorizes the Air Quality Control Commission (AQCC) in the Colorado Department of Public Health and Environment (CDPHE) to regulate greenhouse gas emissions. On October 21, 2010, the AQCC amended its regulations to address greenhouse gases in Colorado and established a definition of "greenhouse gas" that is the same as the EPA definition.⁵

Renewable Portfolio Standards

In 2004, Colorado enacted a renewable portfolio standard, which requires qualifying retail utilities to obtain a minimum percentage of their power from eligible renewable energy sources such as wind, solar, hydropower, and geothermal.⁶ The standard required all Colorado utilities with 40,000 or more customers to generate or purchase 3 percent of their renewable energy by 2010, 6 percent by 2014, and 10 percent by 2015. Following passage of House Bill 10-1001, the renewable energy requirements increased to 30 percent for investor-owned utilities. Following passage of Senate Bill 13-252, the renewable energy requirements for cooperative utilities increased to 20 percent.

According to the U.S. Energy Information Administration, Colorado currently generates 25 percent of its electricity from nonhydroelectric renewable energy sources (e.g., wind and solar), as shown in Figure 1.

⁴California Air Resources Board. <https://ww2.arb.ca.gov/ghg-2020-limit>

⁵CCR 1001-5, Parts A, B, C, and D.

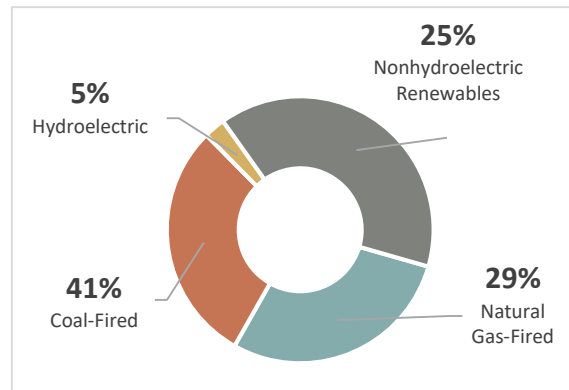
⁶Section 40-2-124, C.R.S.



Climate Action Plan

In 2011, under Governor Ritter, Colorado produced its first Climate Action Plan to address climate change in Colorado, which set a goal of reducing greenhouse gas emissions by 20 percent below 2005 levels by 2020. In 2013, House Bill 13-1293 directed the Governor to develop and periodically update a climate action plan that sets forth a strategy, including specific policy recommendations, to address the impacts of climate change and reduce greenhouse gas emissions. The bill also required annual reporting to the General Assembly on climate change issues in Colorado, including wildfires, pest infestation, snowpack, water storage, drought, and statewide greenhouse gas emissions. Revisions to the Colorado Climate Action Plan have been released in 2014 and 2018 and can be accessed at <https://cwcb.colorado.gov/focus-areas/hazards/climate>.

Figure 1
Colorado Net Electricity Generation by Source, June 2024



Source: United States Energy Information Administration, *Electric Power Monthly*.

Oil and Natural Gas Emissions

In 2014, the AQCC fully adopted the EPA’s Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution rules to reduce emissions in the oil and natural gas sector. The rules focus on identifying and repairing leaks in the oil and gas sector, and contain certain record-keeping and reporting requirements.

Regulated Utilities

Colorado’s Clean Air - Clean Jobs Act, enacted in 2010, required all rate-regulated utilities that own or operate coal-fired electric generating units to submit an emissions reduction plan for emissions from those units to the Public Utilities Commission. The plans were required to cover a minimum of 900 megawatts or 50 percent of the utility’s coal-fired electric generating units in Colorado, whichever is smaller.⁷

⁷Section 40-3.2-201, *et seq.*, C.R.S.



Greenhouse Gas Reduction Targets

In 2017, Governor Hickenlooper signed Executive Order [D 2017-015](#), committing the state to reduce greenhouse gas emissions by certain targets relative to 2005 levels. The General Assembly committed to similar goals in [House Bill 19-1261](#), and [Senate Bill 23-016](#) updated these goals, targeting a 26 percent decrease by 2025 with subsequent milestones leading to a 100 percent decrease by 2050.

Municipal Policies

In addition to statewide efforts to curb greenhouse gas emissions, local municipalities are setting their own targets and defining strategies to achieve them. Boulder's Climate Action Plan (CAP), for instance, sets climate targets of 80 percent emissions reduction by 2050, and 100 percent renewable electricity by 2030. In 2006, Boulder voters approved the nation's first tax dedicated to mitigating climate change. City residents and businesses pay a tax on electricity consumption, which generates about \$6.5 million per year to fund wildfire resilience measures and emissions reduction strategies.

Greenhouse Gas Reporting and Emissions Profile in Colorado

Greenhouse Gas Reporting

Greenhouse gas reporting requirements were first enacted in Colorado in 2008 with Executive Order D 004-08, issued by Governor Ritter. The Executive Order required CDPHE to report every five years on the estimates of greenhouse gas emissions by sector. The inventory assesses greenhouse gas emissions in the following sectors:

- agriculture;
- coal mining and abandoned mines;
- electric power generation;
- industrial processes;
- land use, land use change, and forestry;
- natural gas and oil systems;
- residential, commercial, and industrial fuel use;
- transportation; and
- waste management.



Global Warming Potential

Greenhouse gases have different global warming potentials based on their ability to absorb energy and how long the gas remains in the atmosphere (i.e., its lifetime). When reporting total greenhouse gas emissions in statewide inventories, it is therefore necessary to report emissions in carbon dioxide equivalents. For instance, methane has a global warming potential of 25 times that of carbon dioxide over a 100-year time horizon. Thus, methane emissions are multiplied by 25 when reporting emissions in carbon dioxide equivalent. Table 1 below lists the global warming potential of greenhouse gases accounted for in the Colorado greenhouse gas inventory.

Table 1
Global Warming Potentials (100-Year Time Horizon)

Gas	Global Warming Potential
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	25
Nitrous Oxide (N ₂ O)	298
Hydrofluorocarbons (HFC)	varies (124 - 14,800)
Perfluorocarbon (PFC)	varies (7,390 - 12,200)
Sulfur Hexafluoride (SF ₆)	22,800

Source: IPCC Fourth Assessment Report (2007).

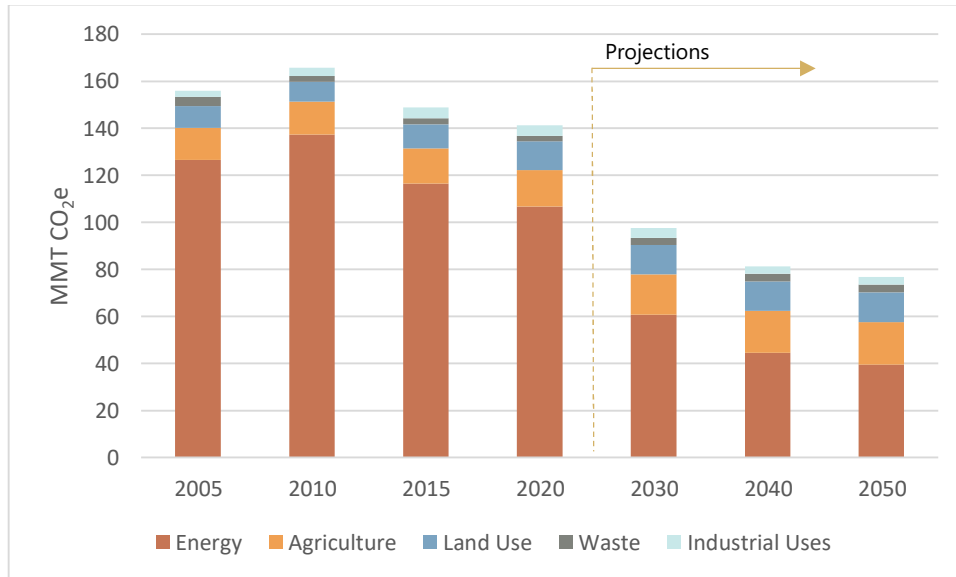
Colorado Greenhouse Gas Inventory

The first Colorado inventory of greenhouse gas emissions was released in 2014, and Senate Bill 19-096 requires it to be updated every two years. The inventory includes a comprehensive summary of greenhouse gas emissions estimates from 2005 to 2020, and emissions projections from 2021 to 2050. The inventory accounts for emissions and sinks, utilizing the EPA's State Inventory Tool that applies a top-down approach to calculating greenhouse gas emissions.

As shown in Figure 2, Colorado emitted about 141 million metric tons of carbon dioxide equivalent in 2020. Overall, emissions in Colorado increased through 2010, then decreased since then. The bulk (39 percent) of Colorado's greenhouse gas emissions in 2020 came from the combined impact of electric power plants and motor vehicles. Residential, commercial, and industrial fuel use comprised about 18 percent of greenhouse gas emissions, and natural gas and oil production accounted for 17 percent of emissions in 2020. The remainder of emissions come from the agriculture, mining, industrial, and waste management sectors, which comprise about one-fourth of total greenhouse gas emissions.



Figure 2
Estimated Colorado Greenhouse Gas Emissions by Sector, 2005-2050
Millions of Metric Tons of Carbon Dioxide Equivalent



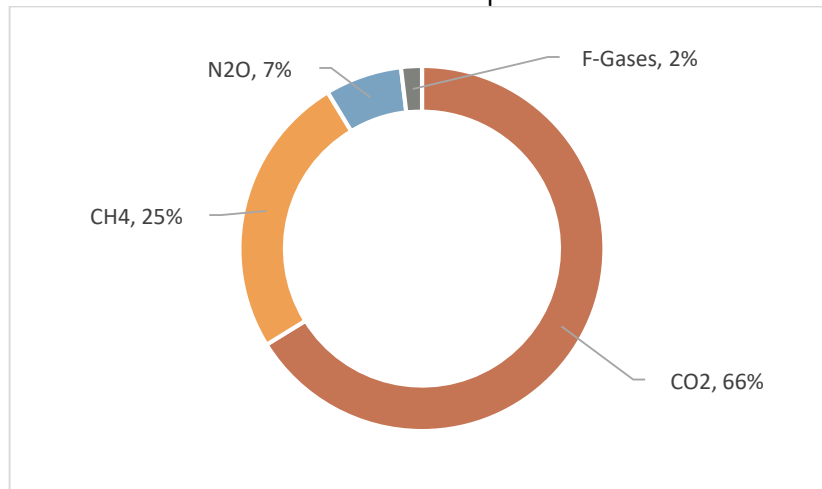
Source: Colorado Department of Public Health and Environment.

Emissions are projected to decline at similar rates to the state’s emissions reduction targets through 2030, largely driven by reductions in electric power, natural gas and oil systems, and industrial processes. Inventory projections are based on CDPHE’s baseline scenario, which accounts for the impact of state policy actions underway. Additional actions are required to meet the state’s net zero goal in 2050.

Figure 3 presents emissions by greenhouse gas type in 2020. Carbon dioxide accounted for two-thirds (66 percent) of greenhouse gas emissions in 2020. Methane accounted for 25 percent, and nitrous oxide and fluorinated gases accounted for the remaining 9 percent.



Figure 3
Greenhouse Gas Emissions by Gas, 2020
Carbon Dioxide Equivalent



Source: Colorado Department of Public Health and Environment