

Energy Efficiency, Electrification, and Decarbonization of Buildings: Recent Policy Advances in Colorado

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ABSTRACT

To meet statewide greenhouse gas (GHG) emissions reduction targets, Colorado has enacted a unique set of policies to reduce emissions from buildings. These laws, in combination with ongoing efforts in the state, make Colorado a leader in building energy efficiency, electrification, and decarbonization.

First, the “Clean Heat” policy sets GHG reduction targets for gas utilities and requires them to submit plans that lay out a portfolio of energy efficiency, electrification, leak reductions, and renewable natural gas to meet the targets. Another new law requires gas utilities to pursue energy efficiency much more aggressively.

Next, a new beneficial electrification policy requires the state’s investor-owned electric utilities to set targets for electrification of end-uses that consume natural gas and propane, and develop and implement programs to achieve those targets.

Another new law sets benchmarking and performance standards for large buildings. Covered buildings are required to measure and report energy performance and reduce GHG emissions by 20 percent in 2030, compared with 2021.

To improve new construction, local jurisdictions updating building codes must adopt at least the 2021 International Energy Conservation Code (IECC) code with certain appendices. After 2026, jurisdictions must adopt a “low energy and carbon code” based on language selected by an Energy Codes Board.

Finally, another law provides a 10% tax credit for heat pumps, heat pump water heaters, energy storage, and panel upgrades.

This paper will present an overview of the policies and report on their implementation status, while also summarizing other building decarbonization efforts underway in Colorado.

Introduction and Background

In 2019 the Colorado legislature passed House Bill (“HB”) 19-1261 which requires statewide greenhouse gas (“GHG”) emissions reductions of 26% by 2025, 50% by 2030, and 90% by 2050 compared with a 2005 baseline (Colo. Rev. Stat. § 25-7-102(g)). HB 19-1261 also set specific GHG emissions reduction targets for the electric sector of 80% below 2005 levels by 2030 (Colo. Rev. Stat. § 25-7-105(e)(VIII)). Following the passage of HB 19-1261, Governor Jared Polis directed the state agencies of Colorado to develop a comprehensive roadmap that includes the strategies and policies the state will use to meet the economy-wide GHG emissions targets, with a focus on strategies outside of the electric sector.

Colorado’s GHG Emissions

As shown in Table 1, in 2005 total GHG emissions in Colorado were just over 139 million metric tons carbon dioxide equivalent (MMTCO₂e), approximately 2% of total GHG

emissions in the United States (EPA 2022). By 2019, statewide GHG emissions had declined to 126 MMTCO₂e. This decline was driven in large part by a significant reduction in GHG emissions associated with power generation due to a decline in coal-fired generation and a significant increase in renewable and gas-fired electric generation. However, GHG emissions from fuel usage in the residential, commercial, and industrial sectors (“RCI”) rose between 2005 and 2019 in absolute emissions as well as its share of statewide emissions, from 18% of total statewide emissions in 2005 to 22% in 2019 (Colorado APCD 2021). The growth in RCI emissions was mostly due to the large population growth in Colorado, with state population growing 23% in this time period (Colorado State Demography Office 2022).

Table 1. Colorado Statewide GHG emissions (MMTCO₂e)

Sector	2005	2010	2015	2019
Electric Power	40.3	39.5	36.3	29.8
Transportation	30.4	29.6	28.4	27.4
Residential, Commercial & Industrial Fuel Use	24.6	26.3	25.8	27.2
Natural Gas and Oil Systems	19.9	27.8	18.6	20.3
Agriculture	11.3	11.8	12.2	10.7
Coal Mining & Abandoned Mines	6.8	8.2	1.9	1.8
Industrial Processes	3.3	3.8	4.4	4.7
Waste Management	2.6	3.2	3.4	4.4
TOTAL	139.3	150.2	130.9	126.2

Source: Colorado APCD 2021

Colorado GHG Roadmap

Following passage of HB 19-1261, the State of Colorado developed the Colorado Greenhouse Gas Pollution Reduction Roadmap (“GHG Roadmap”) which lays out the suite of policies the state will rely on to meet the statewide 2030 GHG emissions reduction target, while also modeling pathways to achieve the 2050 GHG emissions target (State of Colorado 2021). As shown in Figure 1, the GHG Roadmap’s modeling found that policies adopted in 2019 and 2020 put the state on a trajectory to achieve approximately half of the emissions reductions needed to meet the 2025 and 2030 goals, and that implementing additional policies would be necessary to achieve these targets and to put the state on a path to achieve its 2050 GHG emissions reduction target.

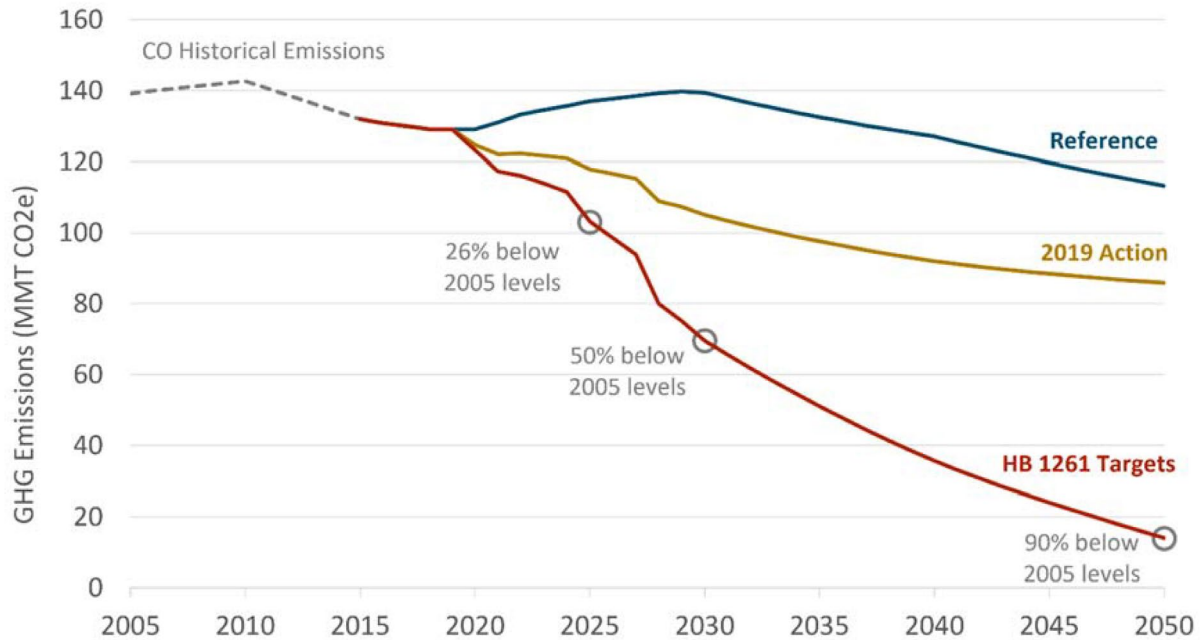


Figure 1. Scenario Projections of Colorado's GHG Emissions. *Source:* State of Colorado 2021.

Instead of focusing on an overarching policy, such as a cap-and-trade program or carbon tax to ensure the state meets its emissions reduction targets, the GHG Roadmap recommended a suite of near-term actions for the state. Together the near-term actions are expected to reduce emissions in all sectors and put the state on a trajectory to meet the 2030 GHG emissions reduction target.

Table 2 shows the near-term actions focused on reducing emissions from RCI fuel usage. Together, these actions are expected to reduce emissions in the RCI sector by 4.7 MMTCO₂e by 2030, or 17% below 2019 levels.

The GHG Roadmap also identified a pathway to meeting the state's 2050 GHG emissions reduction target. In this pathway, residential and commercial buildings in Colorado must be completely decarbonized by 2050. While some residential and commercial energy demand is met with renewable natural gas and zero carbon hydrogen, the vast majority of residential and commercial energy demand is met with electricity, through the electrification of end uses such as heating and hot water.

Table 2. Residential, Commercial, and Industrial Sector Near Term Action in the Colorado GHG Roadmap

Expand energy efficiency investments from gas utilities to support building shell improvements
Set carbon reduction targets and biogas requirements for gas utilities
Require large commercial buildings to track energy use and make progress toward energy and pollution performance standards
Support adoption of advanced building codes
Require regulated electric utilities to create programs that support customer adoption of electric heat pumps and other forms of beneficial electrification
Expand access to financing programs for building retrofits by capitalizing a green bank, expanding existing programs, and advocating for utility on-bill finance programs
Undertake Air Quality Control Commission (AQCC) action on industrial energy GHG emissions, including third-party audits and Best Available Control Technology requirements

Source: State of Colorado 2021

Colorado's New Building Decarbonization Policies

Since the finalization of the GHG Roadmap in January 2021, Colorado has taken major steps to enact new policies to electrify and decarbonize buildings. This includes a unique set of bills passed by the legislature that implements many of the policies identified in the GHG Roadmap. This paper will walk through each of these policies in detail, while also discussing other market development activities to support building electrification in Colorado.

Clean Heat Plans

In 2021 the legislature passed Senate Bill (“SB”) 21-264, known as the Clean Heat Bill – the first of its kind nationally (Colo. Rev. Stat. § 40-3.2-108). This law adopted GHG emissions reduction requirements for investor-owned natural gas local distribution companies in the state. The targets require each utility to reduce emissions by 4% by 2025 and 22% by 2030, from a 2015 baseline. In addition, the Colorado Public Utilities Commission must adopt emissions reduction goals for 2040, 2045, and 2050 no later than December 1, 2032. Emissions covered under the bill include methane leakage from gas distribution and service pipelines between the city gate and customer end use, emissions from the combustion of natural gas, and emissions of methane resulting from leakage from delivery of natural gas to other local distribution companies.

Each local distribution company will need to submit a Clean Heat Plan to the Colorado Public Utilities Commission that lays out the combination of strategies it will use to achieve the required emissions reductions. Allowable “Clean Heat Resources” that can be used to meet the requirements include demand-side management (“DSM”), recovered methane, distribution system leak reduction, green hydrogen, and beneficial electrification.

As it pertains to recovered methane, this category is defined to include biomethane, coal mine methane, and methane derived from municipal solid waste, wastewater treatment, and pyrolysis. Recovered methane projects must be located in Colorado and recovered methane can

only be used to meet a quarter of the emissions reduction required in 2025 (1% out of the total 4%) and just under a quarter emissions reduction required in 2030 (5% out of the total 22%).

In implementing Clean Heat Plans, each utility has a cost cap equal to 2.5% of total annual gas bills, although the Commission may require a Company to exceed the cost cap if it finds that the benefits of the plan exceed the costs, among other requirements. The costs and benefits of the plan include consideration of the social cost of carbon and social cost of methane. The Clean Heat legislation also includes requirements to consider the impacts on a utility's workforce and labor standards for DSM and beneficial electrification projects, which will be discussed in more detail below.

The Colorado Public Utilities Commission is currently conducting a rulemaking to implement the Clean Heat Plan requirements (Colorado Public Utilities Commission 2021). Xcel Energy, the largest gas utility in the state, must submit its first Clean Heat Plan by August 1, 2023, with the first plan from other gas utilities due by January 1, 2024.

The Colorado Department of Public Health and the Environment ("CDPHE") is also developing accounting rules to determine which emissions to include within the Clean Heat baseline, as well as quantify emissions reductions from clean heat resources (CDPHE 2022). CDPHE is also developing accounting standards and methods to quantify and certify emissions reductions from recovered methane projects (CDPHE 2022a).

Expanded Natural Gas Demand-Side Management

In 2021, the Colorado legislature passed legislation to modernize gas energy efficiency programs, HB 21-1238. This legislation removes the prohibition against natural gas utilities funding fuel switching and implements a number of changes designed to modernize and expand natural gas DSM programs.

First, the bill requires the Colorado Public Utilities Commission to set targets for natural gas DSM that are consistent with the state's GHG emissions reduction targets and reflect the maximum cost-effective and achievable energy savings within each utility's service territory (Colo. Rev. Stat. § 40-3.2-103). The Colorado Public Utilities Commission must also set DSM budgets needed to achieve the savings goals.

In addition, the legislation requires utilities to spend at least 25% of their residential DSM budget on programs for income-qualified households, except in the case of the smallest gas utility in the state, which must spend at least 15% of its residential budget on income-qualified programs.

To further support and expand energy savings by gas utilities, the legislation updates the state's cost-effectiveness methodology by requiring the inclusion of the social cost of carbon and social cost of methane within the state's Modified Total Resource Cost Test. In addition, the bill requires a discount rate that is relevant to the party funding any costs. Specifically, the use of a customer-focused discount rate is required for costs that are financed by ratepayers, such as fuel costs and the customer's contribution to equipment costs. It also requires the Colorado Public Utilities Commission to approve a decoupling mechanism for natural gas utilities that request one.

Finally, the law sets labor standards for work performed to install DSM projects rebated by the utility in commercial buildings over 20,000 square feet in floor area. The labor standards require the utility to use their own employees to perform work when practicable, while also requiring each utility to develop a certified contractors list containing contractors that participate in apprenticeship programs approved by the United States Department of Labor and

registered with the Colorado Department of Labor. Inclusion of these labor standards was key in securing support from the labor community for this, and the other bills passed during the 2021 legislative session.

Electric Utility Beneficial Electrification

Another bill adopted in 2021, SB 21-246, requires investor-owned electric utilities to set beneficial electrification targets and also develop and file beneficial electrification plans with the Colorado Public Utilities Commission (Colo. Rev. Stat. § 40-3.2-109). Each beneficial electrification plan must include programs to advance beneficial electrification for residential and commercial customers, and may offer programs for industrial customers. Beneficial electrification plans must devote at least 20% of total funding to programs that target income-qualified households or disproportionately impacted communities, as defined by the state. The plans must be cost-effective, using a cost-benefit analysis that includes the social cost of carbon and methane. Plans must also use a societal discount rate in cost-effectiveness analysis.

Electric utilities implementing beneficial electrification programs can recover their costs from customers on a current basis. Also, the Colorado Public Utilities Commission may provide electric utilities an opportunity to earn an incentive for the successful implementation of beneficial electrification programs.

Similar to the natural gas DSM programs described above, beneficial electrification programs in commercial, industrial, and multifamily properties with conditioned floor space that is 20,000 square feet or greater must use contractors on a utility's certified contractors list or employees of the utility.

The first beneficial electrification plans must be filed with the Colorado Public Utilities Commission by July 1, 2022. Beneficial electrification plans can be combined with DSM program plans or transportation electrification plans.

The law defines beneficial electrification as converting the energy source of a customer's end use from a non-electric fuel source to a high-efficiency electric source, or the avoidance of a non-electric source in new construction or industrial applications, if the conversion or avoidance both reduces net GHG emissions over the lifetime of the conversion and either reduces social costs or provides for a more efficient utilization of grid resources (Colo. Rev. Stat. § 40-1-102).

Building Benchmarking and Performance Standards

The final building decarbonization bill passed in 2021 addresses energy use in large commercial and multifamily buildings, and notably received support from organizations representing commercial building owners, commercial real estate, affordable housing, and labor. HB 21-1286 requires commercial and multifamily buildings over 50,000 square feet to benchmark and report their energy performance using the U.S. EPA's Portfolio Manager benchmarking tool (Colo. Rev. Stat. § 25-7-142). Beginning in December 2022 for 2021 energy usage data, all commercial and multifamily buildings that meet the size threshold are required to report their energy performance data to the state. Owners of covered properties must provide energy performance data to potential buyers or lessees. Also, the Colorado Energy Office ("CEO") will make the energy performance data of covered properties publicly available so that potential buyers and tenants can compare the energy performance of individual buildings.

In addition to requiring benchmarking and reporting of energy performance, the bill also requires that state to establish and implement building energy performance standards that will

achieve a 7% reduction in GHG emissions of all covered properties by 2026 and a 20% reduction in GHG emissions by 2030, from 2021 emissions levels based on energy consumption reported to the state through the benchmarking data. The emissions reduction standards cannot include GHG emissions reductions resulting from decarbonization of electricity supply, because the intent is for individual building owners to take action towards decarbonization rather than solely rely on the grid getting cleaner.

A task force has been established to provide recommendations on the design and mechanisms of the building performance standards, and will issue its recommendations to CEO and the state's Air Quality Control Commission ("AQCC") by October 1, 2022. The AQCC must promulgate final building energy performance standards that achieve the overall GHG emissions reductions called for in the bill no later than June 1, 2023.

Although the final building performance standards promulgated by the AQCC may change, the task force is recommending an approach whereby each building must reach a certain energy use intensity (energy use per square foot, or EUI) target that is specific to each building sector (e.g. offices, hospitals, hotels, etc.) This is the same approach taken by the City and County of Denver, which would make implementation easier for both building owners and government. An alternate compliance path involves switching at least 80 percent of heating and hot water loads to high-efficiency electric technology. Partial credit would be given for partial electrification, for on-site or off-site renewables, and/or demand flexibility. Buildings could petition CEO for a target adjustment or a timeline adjustment to work around unique building characteristics or situations.

Key to the bill's passage was guaranteeing a "seat at the table" for all major stakeholders – including commercial building owners, affordable housing representatives, building engineers, architects, labor representatives, contractor representatives, utilities, and energy/environmental advocates as part of the task force developing the performance standards.

Building Energy Codes

Colorado is a home rule state, where building codes are adopted and enforced by local jurisdictions. However, on three separate occasions the legislature has set minimums for those energy codes, including most recently in 2022.

Previously, in 2019, the legislature directed local jurisdictions with building codes to adopt and enforce one of the three most recent versions of the International Energy Conservation Code ("IECC"), upon updating any other building code. (Colo. Rev. Stat. § 31-15-602).

New legislation just passed in 2022 updated this requirement, in HB 22-1362. The new policy first requires local jurisdictions with building codes to adopt the 2021 IECC along with electric, electric vehicle ("EV"), and solar ready provisions, upon updating other building codes between mid-2023 and mid-2026. The second phase of the policy requires local jurisdictions to adopt a "low energy and carbon code" when updating any other building code after mid-2026. This low energy and carbon code will be based on either the 2021 IECC or the forthcoming 2024 IECC (whichever is stronger) along with any appendices that are selected. The exact code edition, appendices, amendments, and "ready" language will be determined by a new Energy Code Board. Similar to the task force in the benchmarking law described above, this new Energy Code Board has a guaranteed seat at the table for all major stakeholders, and this again was key to the bill's passage.

Since the carbon intensity of grid-based electricity in Colorado will be very low in 2030 and beyond, the legislation states that the estimated electricity use of new homes and commercial

buildings does not need to be offset by rooftop or community renewable energy generation, if the code requires renewable energy offsets to estimated on-site energy use. However, any on-site fossil fuel use would still need renewable energy offsets should the 2030 code require such offsets. This, in effect, will serve as a strong incentive for construction of all-electric new homes and commercial buildings without mandating all-electric construction, something that is not politically feasible in Colorado although certain local jurisdictions were moving in this direction prior to the state mandate.

Incentives for Heat Pumps and Low Global Warming Potential Building Materials

Finally, another law just passed in 2022 continues to chip away at the price tag of low-carbon equipment and building materials and make them the “easier choice.” The first part of SB 22-051 gives a 10% tax credit and state sales tax exemption for heat pumps, heat pump water heaters (HPWHs), energy storage, and associated equipment such as panel upgrades (for the equipment only, not the labor component) for systems purchased in 2023 and 2024. The second half of the bill gives a state sales tax exemption for low global warming potential (low-GWP) building materials, to be determined by the state architect.

Electrification Market Development and Education

The suite of policies discussed above are expected to make Colorado a leader in the electrification of buildings. However, implementing these ambitious policy directives will also require significant work to develop the market for heat pumps, HPWHs, and induction cooktops. In addition, there will need to be significant education of customers on the benefits of these technologies and of the contractors who sell and install the equipment. To complement the policies described above, utilities and other stakeholders have been engaging in work across the state to develop the contractor base and educate customers to support electrification. This work has been led by the Beneficial Electrification League of Colorado (“BEL-CO”), a state chapter of the national Beneficial Electrification League.

BEL-CO is currently co-led by SWEEP and CEO, and currently includes 15 supporting or “member” organizations, including electric utilities, environmental groups, and local governments (BEL-CO 2022). BEL-CO's mission is to advance beneficial electrification in Colorado's buildings and industrial facilities, but it has mainly focused on the residential sector so far.

Customer Education

To help educate Colorado homeowners on the benefits of electrification technologies, BEL-CO developed and launched the Love Electric website in May of 2021 (loveelectric.org). This website provides information on heat pumps, HPWHs, and induction cooktops. For heat pumps, it includes cost estimates for heat pump installations in existing Colorado homes with varying a) current heating systems (e.g., gas or propane), b) climate zones, and c) size of home. Love Electric also has a searchable list of all rebates for heat pumps and HPWHs, and all “qualified” installers of heat pumps and HPWHs.¹

¹ Qualified means that the installer has attended a required training sponsored by an electric utility such as Xcel Energy.

Contractor Education and Market Development

One of the biggest challenges for homeowners and building owners interested in a new heat pump is finding an installer who is knowledgeable about the latest advances in heat pump technology and will provide appropriate equipment at a reasonable cost. Contractors not comfortable with heat pump installations will tend to either try to talk the homeowner out of the heat pump or give an inflated cost estimate for installation.

To overcome this obstacle, BEL-CO formed a subgroup to discuss heat pump installation training/workshops. In 2021 the subgroup was led by Xcel Energy's residential heat pump program manager, with support from representatives of Tri-State Generation and Transmission Association, Platte River Power Authority, and Holy Cross Energy. The group discussed how to improve the utilities' respective training programs for heat pump installers, and how to share resources and training materials. Xcel Energy has the most comprehensive workshops (offered virtually in 2021), and Xcel has made its workshops available to installers in other utility service territories.

In addition to the heat pump installer training sessions, this BEL-CO subgroup also developed plans for a series of quarterly discussions with Colorado's largest heat pump distributors. BEL-CO representatives asked the distributors about supply chain issues, the perceived obstacles or challenges to selling and installing more heat pumps, and how BEL-CO can work with them. Two helpful and lively discussions have occurred to date, and these quarterly meetings will continue in 2022. Complementing these efforts, the Energy Efficiency Business Coalition of Colorado (EEBC) also has a sub-group of heat pump manufacturers, distributors, and installers, similarly boosting overall industry know-how.

Conclusions

To reach its GHG emissions reduction targets set forth in statute, Colorado must reduce emissions from buildings, with the complete decarbonization of residential and commercial buildings by 2050. To reach this goal the state has enacted an ambitious suite of policies to reduce GHG emissions from natural gas utilities and promote decarbonization of both new and existing buildings.

These policies generally take a technology and fuel-neutral approach to decarbonization, setting emissions performance standards for existing natural gas utilities and existing buildings and allowing regulated entities to develop solutions to meet those standards, while at the same time promoting complementary solutions, such as DSM and beneficial electrification.

Taken together these policies will make Colorado a leader in building decarbonization, while also fostering innovation in the state. These policies provide a potential roadmap for other states seeking non-prescriptive pathways to building decarbonization.

References

BEL-CO (Beneficial Electrification League of Colorado). 2022. "Who We Are." loveelectric.org/who-we-are/

Colorado APCD (Colorado Air Pollution Control Division). 2021. *Colorado 2021 Greenhouse Gas Inventory Update: With Historical Emission from 2005 to 2019 and Projections to 2050*.

Denver, CO: Colorado APCD.

drive.google.com/file/d/1SFtUongwCdZvZEEKC_VEorHky267x_np/view

Colorado Public Utilities Commission. 2021. *Amendments to Gas Rules Implementing SB 21-264 & HB 21-1238*. Proceeding No. 21R-0449G.

www.dora.state.co.us/pls/efi/EFI.Show_Docket?p_session_id=&p_docket_id=21R-0449G

Colorado State Demography Office. 2022. *State, Substate Regions, County Population Estimates, 2000 to Current Year*.

<https://demography.dola.colorado.gov/assets/html/state.html>

CDPHE (Colorado Department of Public Health and the Environment). 2022. “Clean Heat Plan Evaluation Development Process.” cdphe.colorado.gov/air-pollution/climate-change#rulemaking

CDPHE (Colorado Department of Public Health and the Environment). 2022a. “Recovered Methane Protocols and Crediting and Tracking System.” cdphe.colorado.gov/air-pollution/climate-change#rulemaking

Colo. Rev. Stat. § 25-7-102(g) (2019). tinyurl.com/yckpyxxm

Colo. Rev. Stat. § 25-7-105(e)(VIII) (2021). tinyurl.com/2p8exfpn

Colo. Rev. Stat. § 25-7-142 (2021). tinyurl.com/2p9a338a

Colo. Rev. Stat. § 31-15-602 (2019). tinyurl.com/2p8hrs8r

Colo. Rev. Stat. § 40-1-102 (2021). tinyurl.com/bdfhjvy2

Colo. Rev. Stat. § 40-3.2-103 (2021). tinyurl.com/hwauym8d

Colo. Rev. Stat. § 40-3.2-108 (2021). tinyurl.com/5n736sbj

Colo. Rev. Stat. § 40-3.2-109 (2021). tinyurl.com/bddtnz3w

EPA (U.S. Environmental Protection Agency). 2022. *DRAFT Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020*. Washington, DC: EPA.

www.epa.gov/system/files/documents/2022-02/us-ghg-inventory-2022-main-text.pdf

State of Colorado. 2021. *Colorado Greenhouse Gas Pollution Reduction Roadmap*. Denver, CO: State of Colorado. drive.google.com/file/d/1jzLvFcrDryhhs9ZkT_UXkQM_0LiiYZfq/view