GHG Emission Reduction Progress Report to the Colorado Legislature

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Air Pollution Control Division
Climate Change Program

COLORADO
Department of Public Health & Environment

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Introduction

The Air Pollution Control Division[1] (Division), at the direction of the Colorado Air Quality Control Commission (Commission or AQCC), is tasked with reporting to the legislature every odd-numbered year on the tracking of statewide greenhouse gas (GHG) emissions and progress toward Colorado's GHG reduction goals.[2] This report to the legislature utilizes information included in the comprehensive 2023 Statewide GHG Inventory undertaken by the Division.[3] This report also includes updated cost-benefit and regulatory analyses from rulemaking along with any recommendations on future legislative action and Commission rules to achieve the GHG reduction goals set forth in C.R.S. § 25-7-102(2)(g).[4] Beginning with this 2023 report, progress toward the GHG reduction goals for the "oil and gas" and "industrial and manufacturing" sectors are specifically tracked in relation to the reduction goals for those sectors set forth in C.R.S. § § 25-7-105(1)(e)(XII) and (XIII).

The Division updates the Statewide GHG Inventory at least every two years. The latest inventory was completed in December 2023 and includes historical emissions estimated from 2005 to 2020 and projected emissions from 2021 to 2050. This most recent Inventory release advanced from using the IPCC's Fourth Assessment Report (AR4) to the Fifth Assessment Report (AR5) global warming potential (GWP) values. This change aligned with the EPA's National Inventory (NI) and proposed changes to their GHG Reporting Program (GHGRP), which forms the basis of Colorado's GHG reporting requirements[5]. There were also significant changes in data source and methodology choices. Notably, all prior inventories relied either exclusively or overwhelmingly on the EPA's State Inventory Tool (SIT). On its own, the SIT has undergone revisions to methods, emission factors, and default activity data estimates, meaning that historical records have shifted over time even when using the same tool. This Inventory has taken steps to advance beyond the SIT by drawing upon a combination of facility reported data (FRD) and EPA's Emissions and Sinks by State estimates (a disaggregation of emissions data from the 2022 NI). Other new sources are also leveraged. The organization of the Inventory report was also modified to better align with the methodologies established by the IPCC and EPA, such as presenting an Energy sector which encompasses subsectors like electric power generation. These decisions were driven by an improved understanding of the coverage of sources, the quality of the underlying assumptions, and the methods employed for estimating emissions. It is expected that future inventories will continue to integrate improved data and advanced methods to provide continually improved estimates of statewide emissions. As a result of these changes, both in data and methodology, all historical emissions data were recalculated and updated in the 2023 Inventory, including for baseline years.

In the 2019 legislative session Colorado passed House Bill 19-1261, the Climate Action Plan to

[1] The Division is housed within the Colorado Department of Public Health and Environment (CDPHE).

[2] C.R.S. 25-7-105(1)(e)(VII)

[3] Pursuant to C.R.S. 25-7-140 and the requirements set forth therein the Division is directed to undertake a statewide GHG Inventory.

[4] Cost-benefit analyses are included in Appendix B.

[5] Revisions and Confidentiality Determinations for Data Elements Under the Greenhouse Gas Reporting Rule, 88 Fed. Reg. 32852 (proposed May 22, 2023) (to be codified at 40 C.F.R. Part 98).

Reduce Pollution ("Climate Action Plan"), which includes science-based targets of reducing statewide greenhouse gas (GHG) pollution 26% by 2025, 50% by 2030, and 90% by 2050 from 2005 levels and directs the Commission to develop cost-effective regulations to make progress towards these goals.[6] In the 2023 legislative session Colorado passed Senate Bill 23-016, for Greenhouse Gas Emission Reduction Measures, which amended the statewide targets to be 26% by 2025, 50% by 2030, 65% by 2035, 75% by 2040, 90% by 2045 and now net zero emissions by 2050 from 2005 levels.

Additionally, in the 2021 legislative session, Colorado passed House Bill 21-1266, the "Environmental Justice Act", which added two sector-specific targets. The first applies to emissions from oil and gas exploration, production, processing, transmission, and storage operations, otherwise considered the "oil and gas" (O&G) sector. Emissions in this context are emissions from oil and gas operations that are not attributable to fuel combustion for energy. The O&G sector's emission reduction targets are 36% by 2025 and 60% by 2030 from 2005 levels[7]. The second sector-specific target applies to the "industrial and manufacturing" (I&M) sector, which comprises energy combustion and energy use by industry along with industrial processes. The I&M sector excludes O&G operations except for energy combustion emissions. The I&M sector has one target, a 20% reduction from 2015 levels[8].

Since 2019 the Commission and Division have taken significant administrative and regulatory steps toward addressing GHG emissions, with additional initiatives currently underway, and other state agencies have also taken important actions. Other state boards and commissions, including the Public Utilities Commission, the Transportation Commission, the Energy Code Board, and the Energy and Carbon Management Commission have also adopted significant rules and decided dockets that will achieve significant emissions reductions. In addition, numerous additional pieces of legislation have been adopted that contribute to emissions reductions.[9] As a result of these actions Colorado is achieving significant and cost effective reductions of GHG emissions and making progress towards the goals set forth in HB19-1261, HB21-1266, and SB23-016.

Progress Toward the Goals

Part of the Division's role in undertaking the statewide GHG Inventory is developing a forecast of GHG emissions for the state in the milestone years of 2025, 2030, 2035, 2040, and 2045.[10] The Inventory informed development of projections for the second Colorado Greenhouse Gas Pollution Reduction Roadmap ("Roadmap 2.0"). The projections are forward-looking emissions estimates intended to guide legislative, regulatory, and policy conversations and planning.

The Division published a draft of the most recent inventory for initial release in November 2023, soliciting public comments through December 17, 2023. The final 2023 Colorado GHG Inventory, including initial projections to 2050, is also being completed in late December of

[6] C.R.S. 25-7-102(2)(g)
[7] C.R.S. 25-7-105(1)(e)(XII)
[8] C.R.S. 25-7-105(1)(e)(XIII)
[9] 2019-2021 legislative summaries are included in Appendix A.
[10] SB19-096; CRS 25-7-140(2)(a)(II). While through 2045 is specified by statute, the Division includes projections through 2050.

2023 and is available on the Division's Colorado GHG Inventory website. Modeling of projections is still underway for Roadmap 2.0 and it is expected to be published in early 2024.

Preliminary modeling suggests existing policy alone is enough for Colorado to achieve approximately 84% of its 2030 emissions reduction goal[11], 71% of the industrial and manufacturing sector's 2030 goal[12], and that the oil and gas sector's emission reductions will exceed both its 2025 and 2030 goals[13]. Implementation of only the modeled near-term actions identified by Roadmap 2.0 shows Colorado can achieve at least 95% of the economy-wide 2030 reduction goal, with the oil and gas and industrial and manufacturing sectors both surpassing their sector specific reduction goals.

Historical Emissions

Table 1 includes a summary of GHG emissions, including by sector, for the years 2005 through 2020. The largest sources of GHG emissions from human activities in Colorado are in the Energy sector, including: electric power generation; transportation; fuel combustion to heat buildings and provide heat for industrial processes, shown in the inventory as "residential, commercial, and industrial fuel use" (RCI); and natural gas and oil systems. The inventory shows that Colorado's GHG emissions decreased 12% between 2005 and 2020, and 18% from 2010 to 2020, when emissions from land-use, land-use change, and forestry (LULUCF) are excluded from statewide totals.

Table 1: Historical Statewide GHG Emissions by Sector: 2005-2020 (MMT CO_2eq).

Sector	2005	2010	2015	2020
Energy	126.442	137.285	116.415	106.721
Electric Power	*41.801*	*41.281*	*38.422*	*29.688*
Residential, Commercial, and Industrial Fuel Use	*24.239*	*26.185*	*25.728*	*25.927*
Transportation	*29.138*	*28.210*	*27.453*	*25.038*
Natural Gas and Oil Systems	*22.122*	*31.155*	*21.433*	*23.989*
Coal Mining	*8.672*	*10.064*	*2.896*	*1.693*
Non-Energy Use of Fossil Fuels	*0.469*	*0.390*	*0.483*	*0.386*
Agriculture	13.705	14.012	14.982	15.394
Industrial Processes and Product Use	2.660	3.496	4.594	4.426
Waste	4.020	2.529	2.616	2.359
Total Excluding LULUCF	**146.827**	**157.322**	**138.607**	**128.901**
Land Use, Land Use Change, and Forestry (LULUCF)	9.134	8.480	10.196	12.234
Total Including LULUCF	**155.961**	**165.802**	**148.803**	**141.134**

[11] C.R.S. 25-7-102(2)(g)
[12] C.R.S. 25-7-101(1)(e)(XIII)
[13] C.R.S. 25-7-101(1)(e)(XII)

Projected Emissions

The projections included in the 2023 GHG Inventory showcase the new approach adopted by Colorado in the current development of the Colorado Greenhouse Gas Pollution Reduction Roadmap ("Roadmap 2.0") for creating forward-looking emissions estimates to guide legislative, regulatory, and policy conversations and planning.

The projections for Roadmap 2.0 are based on the Colorado Energy Policy Simulator (EPS)[14], co-developed by RMI and Energy Innovation. RMI's support for the Roadmap provides data under three policy scenarios: Business as Usual (BAU), Baseline, and Near-Term Actions (NTA) currently being considered, all spanning 2021 through 2050. As modeling is still underway, the forecasts presented below may change, and the Inventory and this report represent a snapshot in time. The latest modeling efforts and projected emissions are available through the online EPS.

The Business As Usual (BAU) scenario projects current trends, ignoring state policy actions and incorporating publicly available forecasts for energy demand and economic behaviors. It also reflects Inflation Reduction Act (IRA) tax credits and major formula funded provisions in the IRA and Infrastructure Investment and Jobs Act. This is considered a worst case scenario devoid of any level of intentional intervention, or any of the policies adopted over the past three years.

The Baseline scenario models trends the same way as in the BAU scenario, but factors in state policy actions that are "on the books" as of the end of 2023.

The Near Term Actions (NTA) scenario builds on the Baseline scenario, and reflects policies that are in process and pending adoption, as well as policies the State is considering to include in the updated Roadmap to pursue additional statewide emissions reductions. The NTA scenario also includes uptake of new and pending funding opportunities.

Table 2 includes GHG emission projections by sector under the NTA scenario from 2025 through 2050 and a comparison to the reduction goals established in HB12-1261. The projections in Table 2 include decreased GHG emissions from 2005 levels of 23% by 2025, 48% by 2030, and 69% by 2050. The 2025 and 2030 targets are expected to be achieved by 2027 and 2031 respectively. Emissions are projected to continue to decrease significantly in coming years as a result of current and anticipated emission reduction efforts including legislation, regulations, and policy initiatives. As shown in the table, emissions from LULUCF were not projected into the future and instead were held constant from 2021 onward.

[14] Energy Policy Simulator

Table 2: Projected Statewide GHG Emissions by Sector: 2025-2050 (MMT CO_2eq).

Sector	2025	2030	2035	2040	2045	2050
Energy	90.696	53.931	39.147	28.125	23.686	22.369
Electric Power	*25.753*	*7.449*	*3.595*	*1.947*	*2.050*	*2.116*
Residential, Commercial, and Industrial Fuel Use	*22.186*	*14.866*	*9.479*	*4.976*	*3.516*	*3.346*
Transportation	*28.021*	*23.702*	*19.218*	*15.331*	*13.021*	*12.492*
Natural Gas and Oil Systems	*23.989*	*13.872*	*7.279*	*6.142*	*5.139*	*4.382*
Coal Mining	*0.864*	*0.636*	*0.713*	*0.732*	*0.718*	*0.747*
Agriculture	16.291	16.548	17.020	17.203	17.324	17.407
Industrial Processes and Product Use	4.819	3.624	2.721	2.419	2.282	2.456
Waste	2.824	2.772	2.830	2.902	2.935	2.962
Total Excluding LULUCF	**114.629**	**76.875**	**61.718**	**50.649**	**46.226**	**45.194**
Land Use, Land Use Change, and Forestry (LULUCF)	12.636	12.636	12.636	12.636	12.636	12.636
Total Including LULUCF	**127.265**	**89.511**	**74.354**	**63.285**	**58.863**	**57.830**
Statewide Target	108.652	73.413	51.389	36.707	14.683	0.000
Gap, Excluding LULUCF	5.977	3.461	10.329	13.942	31.544	45.194

Figure 1 shows statewide historical emissions by sector from 2005 to 2020 and projected emissions from 2021 to 2050 under the NTA scenario. The Energy sector is the largest contributor, constituting 82% to 87% of Colorado's GHG emissions historically, from 2005 to 2020. Emissions from fuel use for energy in Colorado began decreasing around 2010 and are projected to continue to decrease through 2050.

Projected GHG emissions for the Energy sector include those from electric power; transportation; coal mining; residential, commercial, and industrial (RCI) fuel use; and natural gas and oil systems (NG&O). The NTA scenario shows a relatively steep decline in emissions between 2021 and 2030, then more gradual reductions through 2050. Major drivers of the more rapid emission reductions are from electric power, natural gas and oil systems, and industrial fuel use.

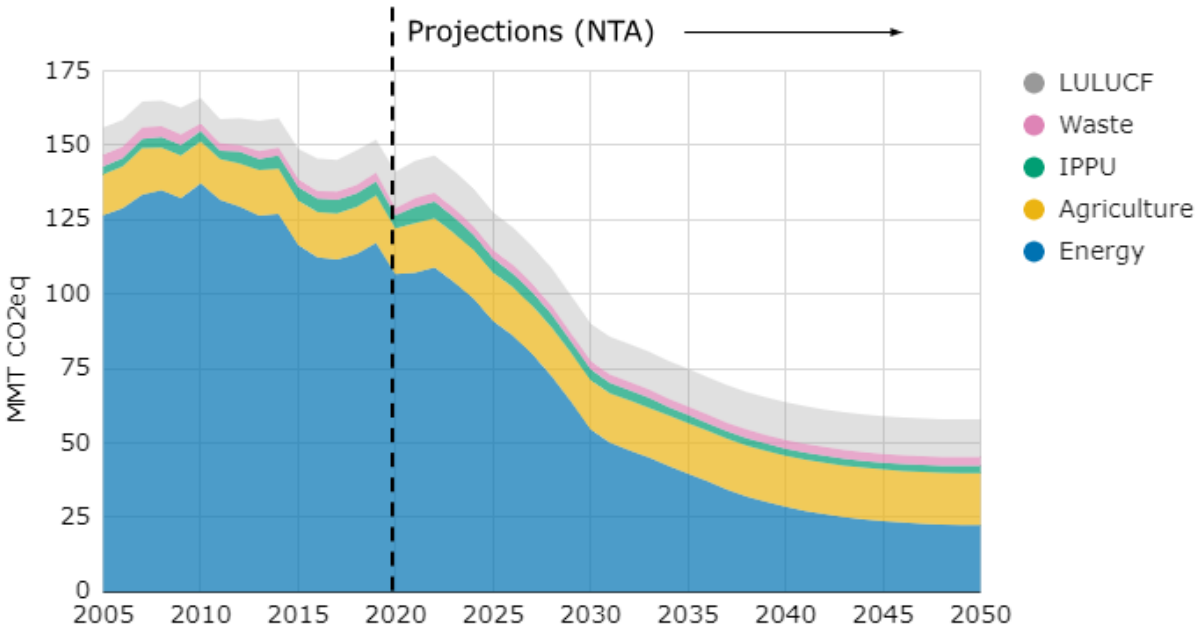
For the Agriculture sector emissions, the NTA projects a 19% increase in 2025, a 20% increase in 2030, and a 27% increase in 2050 relative to 2005 levels.

IPPU emissions are projected to increase by 81% in 2025 and 36% in 2030 relative to 2005 levels, but then decrease to 8% below 2005 levels in 2050.

In the Waste sector, the NTA scenario shows emissions decreases of 30% in 2025, 31% in 2030, and 26% in 2050 relative to 2005 levels.

Changes in LULUCF emissions were not modeled; instead, LULUCF emissions were held constant for 2021 onward.

Figure 1: Historical and Projected Statewide GHG Emissions by Sector in the NTA Scenario.



Progress Toward the Goals Set Forth in C.R.S. § 25-7-102 (2)(g) (Statewide)

As described in this report, Colorado is moving forward with a comprehensive, economy-wide set of strategies to achieve the statutory requirements.

With the passage of HB 19-1261 and then SB 23-016, "Colorado shall strive to increase renewable energy generation and eliminate statewide greenhouse gas pollution by the middle of the twenty-first century and have goals of achieving, at a minimum: a 26% reduction by 2025, a 50% reduction by 2030, a 65% reduction by 2035, a 75% reduction by 2040, a 90% reduction by 2045, and a 100% reduction by 2050, all measured relative to 2005 levels", (25-7-102 (g), C.R.S.). "Statewide GHG pollution" is defined in 25-7-103 (22.5), C.R.S. as "the total net statewide anthropogenic emissions of CO_2, CH_4, N_2O, HFCs, PFCs, NF3, and SF_6, expressed as CO_2eq calculated using a methodology and data on radiative forcing and atmospheric persistence deemed appropriate by the commission." The LULUCF sector has causal connections between natural and anthropogenic factors that are difficult to clearly distinguish. Precedent from prior Inventories, biannual implementation reports, and updates to the legislature and the Air Quality Control Commission has been to exclude LULUCF from statewide totals.

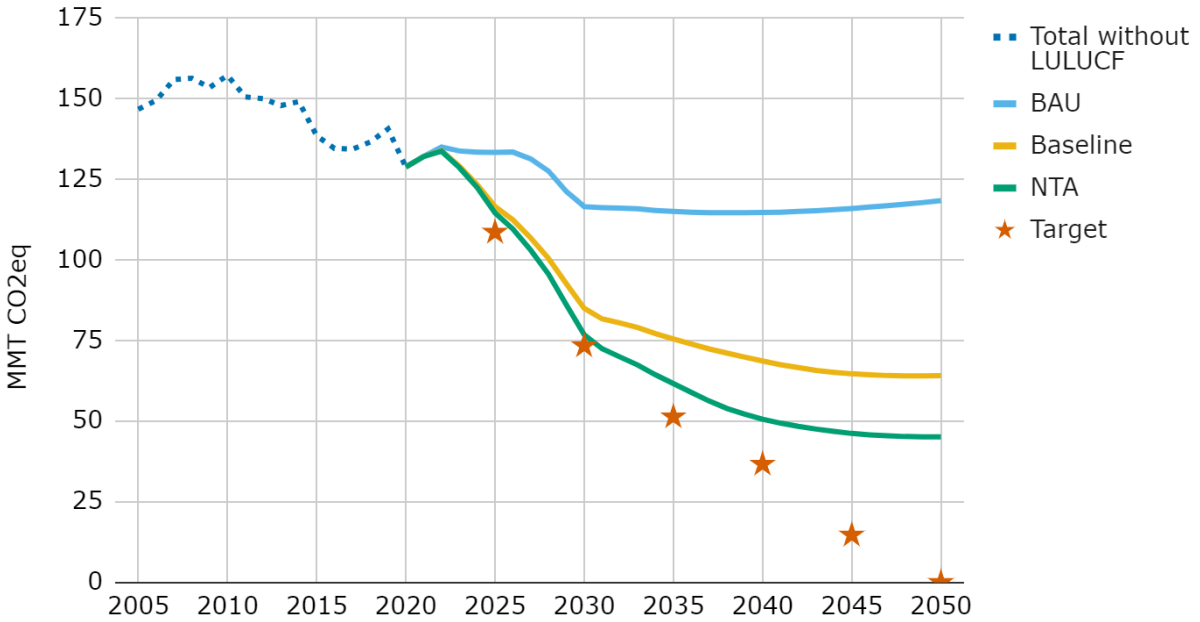
As shown in Figure 2, in 2025, projected emissions of 114.9 MMT CO_2eq in the NTA scenario are 84% of the way to the 2025 goal of 108.7 MMT CO_2eq. Under this scenario, Colorado will achieve the 2025 goal by 2027. In 2030, projected emissions of 77.5 MMT CO_2eq are 94% of the way to the 2030 goal of 73.4 MMT CO_2eq. There are a number of proposed near term actions

that are still being modeled, which will likely increase the projected reductions further. Colorado is predicted to achieve the 50% reduction target in 2031. Beyond these years, emission reductions are further from the targets, though emissions continue to decline. The 2035 goal of 65% reductions statewide, or 51.39 MMT CO_2eq, is modeled to be reached by 2040. Current modeling does not show Colorado meeting the 2040, 2045, or 2050 goals, with maximum emissions reductions of 69% in 2050. This is not surprising as the intent of the GHG Roadmap process has been to develop near-term action strategies. Future actions will be needed to continue making progress towards goals in the 2030 to 2050 time horizon.

Emission reductions under the Baseline scenario (excluding LULUCF) follow a similar pattern to those of the NTA scenario but with overall lower annual percent reductions. In 2025, the projected emissions are 116.64 MMT CO_2eq, which realizes 79% of the 26% reduction goal. Like the NTA scenario, that 26% reduction is fully realized in 2027 in the Baseline scenario. In 2030, 84% of the 50% reduction goal is achieved, but another seven years are required to attain the goal. By 2050, the emissions reductions are 56%.

The BAU scenario forecasts emissions furthest from Colorado's statewide goals. In this scenario, the 2025 goal of 26% reductions is not met before or in 2050. The greatest emission reductions achieved in the BAU scenario are 22% in 2038 when excluding LULUCF.

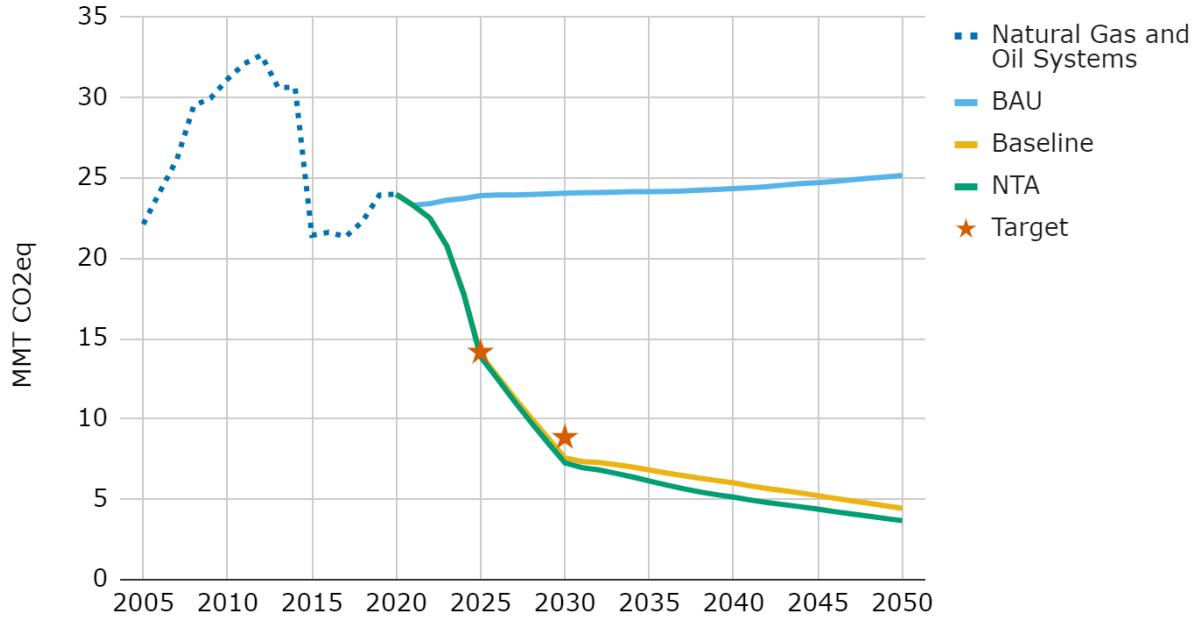
Figure 2. Historical and Projected Statewide GHG Emissions Excluding LULUCF, with Statutory Targets.



Progress Toward the Goals Set Forth in C.R.S. § 25-7-105 (1)(e)(XII) ("Oil and Gas Sector")

Colorado has established statutory emission reduction targets of 36% by 2025 and 60% by 2030 below 2005 levels for the oil and gas sector, referred to as "Natural Gas and Oil systems" (NG&O) in the Inventory. These targets were established under § 25-7-105(1)(e)(XII), C.R.S. for the combined emissions from oil and gas exploration, production, processing, transmission, and storage operations[15]. Emissions in this context are emissions from oil and gas operations that are not attributable to fuel combustion for energy. Calculated with AR5, these targets are equal to 14.16 MMT CO_2eq in 2025 and 8.85 MMT CO_2eq in 2030. Both the Baseline and NTA scenarios show Colorado reaching both of those targets (Figure 3 and Table 3). The Baseline scenario models emission reductions of 37% by 2025 and 66% by 2030 from 2005 levels. The NTA scenario models emission reductions of 37% by 2025 and 67% by 2030. Beyond 2030, both scenarios project continued emission reductions with 80% or greater reductions by 2050. The BAU scenario models emissions to remain close to current levels but increase slightly through 2050.

Figure 3. Historical and Projected GHG Emissions from the Oil and Gas Sector, with Statutory Targets.



[15] C.R.S. § 25-7-105(1)(e)(XII).

Table 3: Historical and Projected GHG Emissions from the Oil and Gas Sector in the NTA Scenario, and Statutory Targets (MMT CO_2eq).

O&G Sector	2015	2020	2025	2030	2035	2040	2045	2050
Natural Gas and Oil Systems	21.43	23.99	13.87	7.28	6.14	5.14	4.38	3.67
Target	-	-	14.16	8.85	-	-	-	-

Progress Toward the Goals Set Forth in C.R.S. § 25-7-105 (1)(e)(XIII) ("Industrial and Manufacturing Sector")

Colorado has established a statutory emission reduction target for the Industrial and Manufacturing (I&M) Sector of 20% below 2015 levels by 2030.[16] This equates to a 3.79 MMT reduction in emissions or total emissions of 15.15 MMT CO_2eq in 2030. The Industrial and Manufacturing sector is defined to include "energy combustion and energy use by industry as well as industrial processes, but does not include oil and gas exploration, production, processing, transmission and storage operations other than energy combustion." As shown in Table 4, this sector's emissions are a combination of Industrial Process and Product Use (IPPU) emissions and industrial fuel use, within the RCI subsector, as presented in the Inventory.

The modeled NTA scenario shows Colorado achieving the statutory goal, reaching a 47.5% reduction in 2030 from 2015 levels (Figure 4). This corresponds to emissions of 9.95 MMT CO_2eq, which is 5.21 MMT CO_2eq below the target. After 2030, emissions are projected to decrease on average by 3.3% annually through 2050. Projected emissions under the NTA scenario for 2025, 2030, 2035, 2040, 2045, and 2050 are provided in Table 4 alongside historical emissions for 2015 and 2020.

The Baseline scenario forecasts reduced emissions 93.2% of the way to the 2030 reduction target. In 2030, the Baseline emissions from the I&M sector are projected to be 16.25 MMT CO_2eq, which is 1.1 MMT CO2eq above the 15.15 MMT CO_2eq target. Under the Baseline scenario, the 20% reduction from 2015 levels is achieved by 2036. However, after 2036, the Baseline scenario emissions begin increasing at an annual rate of about 0.6% until 2050, and the projected emissions would surpass the 15.15 MMT CO_2eq target in 2047.

The BAU scenario models emissions to vary slightly over time but ultimately remain close to current levels through 2050.

[16] C.R.S. § 25-7-105(1)(e)(XIII).

Figure 4. Historical and Projected GHG Emissions from the Industrial and Manufacturing Sector, with Statutory Targets.

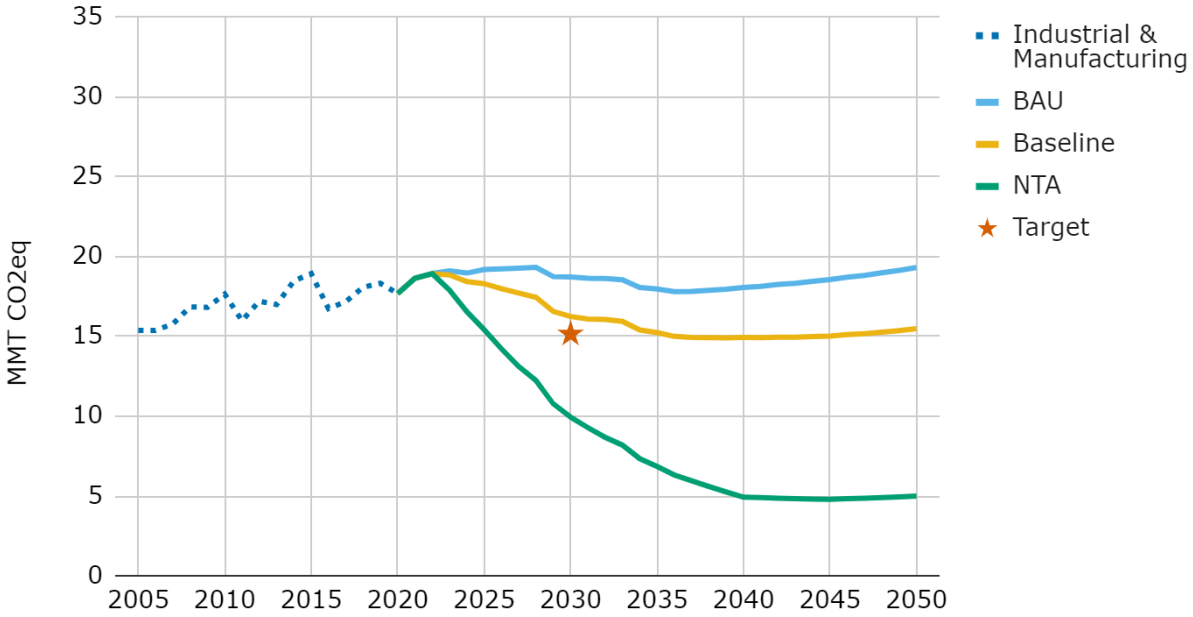


Table 4: Historical & Projected GHG Emissions from the Industrial and Manufacturing Sector in the NTA Scenario, and Statutory Target (MMT CO_2eq).

I&M Sector	2015	2020	2025	2030	2035	2040	2045	2050
Industrial Fuel Use	14.35	13.26	10.61	6.33	4.14	2.51	2.52	2.55
IPPU	4.59	4.43	4.82	3.62	2.72	2.42	2.28	2.46
Total I&M Emissions	**18.94**	**17.69**	**15.43**	**9.95**	**6.86**	**4.93**	**4.80**	**5.01**
Target	-	-	-	**15.15**	-	-	-	-

Newly Available, Final Cost-Benefit or Regulatory Analyses

Full reports for cost-benefit analyses and regulatory analyses developed for rules adopted to attain the state's GHG goals are provided in Appendix A and Appendix B respectively.

Appendix A includes the following cost-benefit analyses:

1. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 20, Colorado Clean Trucks, April 7, 2023.
2. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 28, Building Benchmarking and Performance Standards, August 4, 2023.
3. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 27, Greenhouse Gas Emissions and Energy Management for Manufacturing, September 8, 2023.
4. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 20, Colorado Clean Cars, October 19-20, 2023.
5. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 3 - Stationary Source Permitting and Air Pollutant Emission Notice Requirements, May 16-19, 2023

Appendix B includes the following regulatory analyses:

1. Regulatory Analysis: Air Quality Control Commission Regulation Number 28, Building Benchmarking and Performance Standards, August 4, 2023.
2. Regulatory Analysis: Air Quality Control Commission Regulation Number 27, Greenhouse Gas Emissions and Energy Management for Manufacturing, September 8, 2023.

Recommendations[17] on Future Legislation, Regulations and Policies

The state has achieved or is in the process of implementing more than 95% of the near term actions in the initial GHG Roadmap completed in 2022. GHG Roadmap 2.0 is currently being finalized and will be released in early 2024. As with the initial Roadmap, Roadmap 2.0 will help guide the State's near-term priorities to further align emissions forecasts with the state's climate targets. The following recommendations are near term actions being considered as part of the forthcoming GHG Roadmap 2.0. The recommendations include achievable administrative, regulatory, and legislative policy priorities for the coming three years. . These recommendations may change and additional actions may be added as the Roadmap is fully finalized. The near term actions currently being considered in Roadmap 2.0 are also included as one projection scenario in the 2023 Colorado GHG Inventory. Some actions have quantifiable emissions reductions that were modeled. While other actions do not have quantifiable emission reductions and so could not be modeled, they are nonetheless important for achieving Colorado's goals. Below are these draft Roadmap actions, with those identified as Administration priorities in 2024 listed first. The other actions may be taken up in 2024 or in subsequent years, in part depending on the final design of the roadmap as well as the potential for federal funds to support many of these efforts. The Business As Usual (BAU) scenario projects current trends, ignoring state policy actions and incorporating publicly available forecasts for energy demand and economic behaviors. Modeling reflects a conservative approach to Inflation Reduction Act (IRA) and Infrastructure Investment and Jobs Act (IIJA) provisions.

The Baseline scenario models trends the same way as in the BAU scenario, but factors in state policy actions that are "on the books" as of the end of 2023. The current BAU scenario – implying that no new actions are taken by the legislature or the executive branch by 2030 – puts Colorado 84% of it's way toward meeting the 2030 climate target.

The Near Term Actions (NTA) scenario builds on the Baseline scenario, and reflects policies that are in process and pending adoption, as well as policies the State is considering to include in Roadmap 2.0 that are modelable. The NTA scenario also includes uptake of new and pending funding opportunities. If an action was modeled in the Baseline scenario, it was also modeled in the NTA scenario. This scenario shows that Colorado will be roughly 95% to the 2030 climate goal, assuming very modest uptake of federal incentives and rebates.

[17] Development of the inventory and Roadmap 2.0 are being aligned, but the Roadmap will be released in early 2024, while the 2023 Statewide GHG Inventory and this report need to be released in advance. These are preliminary recommendations - see Roadmap 2.0 for final list. The recommended actions list represents significant stakeholder development, and CDPHE has no actions to recommend beyond these at this time. Not all actions are intended to take place in 2024, and many may require the next three years or more to implement. Recommendations represent efforts that would span beyond just CDPHE. This should not be construed as CDPHE speaking on behalf of other agencies or making recommendations directly to their commissions. Rather, this list is simply a compilation of recommendations that executive agencies are developing collaboratively.

As discussed in more detail in the sections above on Progress, the Baseline scenario shows the State achieving the 26% statewide GHG reduction target by 2027. Under the NTA scenario, based only on those actions modeled to date, statewide GHG emissions decrease from 2005 levels 23% by 2025 and 48% by 2030, achieving the 50% statewide GHG reduction target in 2031.[18]

Priority Actions for CY2024

Utilities

Update Clean Energy Planning for 2040

Action: Legislation

Modeled in Scenario(s): NTA

Recent modeling by the Colorado Energy Office shows that it is possible for electric utilities to meet a roughly 98.5% reduction in greenhouse emissions by 2040 (from a 2005 baseline) as well as achieve near-zero emissions from SOx and NOx by 2040 at no incremental cost. Significant strides have already been made by utilities, with some commitments exceeding the statutory requirements of their Clean Energy Plans (CEP). With that in mind, legislation could expand upon the CEP framework to provide a clear framework for continued emissions reductions in clean energy plans after 2030.

Reform Distribution System Planning for New Electric Loads

Action: Legislation and Regulation

Modeled in Scenario(s): Not modeled

The increased demand for grid access by a range of new electric loads such as all-electric multifamily and affordable housing units, industrial facilities, EV chargers, and oil and gas operation has demonstrated issues related to distribution system planning and utility investments. Analysis suggests Colorado's current policies, federal incentives, and market forces will continue to accelerate the transition to electric vehicles, increased electrification of space and water heating in buildings, and electrification of industrial facilities including in manufacturing and oil and gas. For instance, Gov. Polis has directed state agencies to work to reduce nitrogen oxide (NOx) emissions from oil and gas development 30% by 2025 and 50% by 2030, which will have a major impact on ozone pollution. In particular, the 2030 goal will require expanded use of electric equipment, which will lower both greenhouse gas emissions and local air pollution. Both in-state industrial emissions reductions grant programs, as well as the recent GEMM II industrial emissions reductions rules passed by the AQCC, demonstrate the increased need for large-scale electrification of manufacturing processes, where possible. These efforts have major implications for utility distribution grids, and in the absence of reforms, these goals will take longer to solve, leading to more pollution in the interim.

[18] See *supra* pages 8 and 9 - Progress Toward the Goals Set Forth in C.R.S. § 25-7-102 (2)(g) (Statewide).

Modernize Clean Energy Permitting and Siting

Action: Legislation

Modeled in Scenario(s): Not modeled

Many stakeholders have expressed concern about the pace of clean energy and transmission development in Colorado, as well as local governments' gaps in capacity to evaluate major projects, and the risks these projects may present to ecosystems and wildlife. One solution may be to create a clear and consistent framework for local governments to evaluate projects, which would help both local governments and project developers in assessing potential projects while retaining local authority to approve or deny projects. Several states including Illinois, Washington, and California have adopted legislation to update and modernize how state and local governments coordinate to approve clean energy resources in the state.

Pursue District Heat, Geothermal, or Targeted Electrification Projects to Improve Safety and Affordability of Natural Gas Distribution

Action: Legislation

Modeled in Scenario(s): Not modeled

This action, proposed in the Governor's FY24-25 Budget, would authorize and fund the PUC to have more flexibility in evaluating and approving proposals to avoid costly safety, capacity expansion, or replacement projects for natural gas distribution systems and instead pursue district heat, geothermal, or targeted electrification projects, stacking utility, state, and federal incentives, to avoid these investments and provide customers with a more affordable and safe alternative to natural gas.

Transportation

Expand and Increase Statewide Transit Service, including Front Range Rail

Action: Legislation

Modeled in Scenario(s): NTA

This action would expand Colorado's transit service, including implementation of Front Range Passenger Rail and new bus rapid transit routes. This could be accomplished through legislative or administrative efforts to raise additional funding for more transit service, which could include use of toll revenues to support transit operations, and may include investments in increased frequency or quality of service on existing routes, and/or investments in new routes statewide.

Reducing the growth in vehicle miles traveled is a critical element of reducing pollution from the transportation sector. Providing frequent and convenient transit service is a key strategy for reducing reliance on private vehicles, particularly when paired with investments in bike

and pedestrian infrastructure, and smart land use decisions as described in other proposed near-term actions. Improving transit service is also particularly important for disproportionately impacted communities, where typically a high proportion of residents rely on transit to access jobs and services due to the high cost of owning and maintaining personal vehicles.

CDOT will be conducting Town Halls and Stakeholder Summits across the state in fall/winter 2023 to gather information that will be used to inform updates to the required Federal Transit Administration (FTA) Intercity and Regional Bus Plan, as well as Colorado's Bicycle/Pedestrian Interconnectivity Plan[19] and Transportation Demand Management Plan[20]. These engagements would also be used to develop a comprehensive new state transit plan. In addition, CDOT would continue to support and advance efforts on the Front Range Passenger Rail project in coordination with the Front Range Passenger Rail District and are exploring passenger rail opportunities in other parts of the state, including mountain rail service from Denver to Steamboat, Craig, and Hayden.

Expand the Zero Fare Transit Program

Action: Legislation

Modeled in Scenario(s): NTA

This action would include extending and potentially expanding the state's existing zero fare transit program. SB22-180[21] created the Ozone Season Transit Grant Program, which provided $28 million to CEO to distribute to transit agencies statewide to provide zero fare transit service during the 2022 and 2023 summer ozone seasons (defined as June through August). The program was intended to reduce vehicle pollution during ozone season and help rebuild transit ridership following the COVID-19 pandemic. In its first year, the program supported RTD and 15 other agencies to offer zero fare service during the month of August. Ridership increased significantly for participating agencies, including Colorado Springs' Mountain Metro Transit with a 48% increase and RTD with a 36% increase over August 2021. In the summer of 2023, RTD offered two months of zero fare service, and 15 agencies participated statewide including several for multiple summer months.

In addition to improving and expanding transit service, offering free fares can be an important strategy to build transit ridership. Zero fare service can increase ridership by supporting new and existing riders to try new trips and build new habits, and can improve transit operations by reducing dwell times at transit stops and fare-related enforcement issues. Researchers have found discounted and zero fare programs also benefit low income existing transit riders.

Encourage Land Use Policies to Build More Housing, Grow Walkable Neighborhoods, and Increase Transit Access

Action: Legislation

[19] Colorado Statewide Bicycle and Pedestrian Plan
[20] Colorado Transportation Demand Management Plan
[21] SB22-180

Modeled in Scenario(s): Will be modeled in NTA (not yet complete)

This action was highlighted in the 1st GHG Roadmap and still requires progress. It includes legislative and administrative efforts to reduce barriers to and increase incentives for building housing located at in-fill and transit-oriented locations. This would be a marked change for the current trend of growing at the region's edges. These efforts may include, for example, encouraging the construction of accessory dwelling units; encouraging multi-unit housing near rail and frequent bus transit; reforming parking requirements; and aligning state funding and resources with compact and infill development. These actions could occur starting with the 2024 legislative session.

Buildings

Develop 2035 Clean Heat Targets

Action: Regulation

Modeled in Scenario(s): NTA

Senate Bill 21-264[22] requires gas utilities – those that provide gas service to Colorado homes and businesses – to develop clean heat plans to achieve greenhouse gas pollution reduction from both the utility system and customer use of gas. The legislation set pollution reduction targets for 2025 and 2030, and requires the PUC to adopt targets for the years beyond 2030.

To help inform long-term planning, the Colorado Energy Office is working with a steering committee that includes conservation groups, utilities, environmental justice representatives, and labor groups to study scenarios on the future of gas in the building sector. By no later than December 2024, the PUC, in consultation with the APCD, has to set clean heat targets for 2035. This work will be informed by the initial clean heat plans filed in 2023 and 2024, as well as the initial thermal utility pilots filed in 2024 and outcomes of a study on the future of gas in the building sector. Statute requires the PUC to set 2035 targets by Dec 31, 2024.

Expand Low-Income Access to Distributed Solar

Action type: Administration

Modeled in Scenario(s): Not modeled

CEO is seeking federal funding for the Solar For All program, which is focused on saving low-income households money on their energy bills by significantly expanding access to distributed solar for low-income households. The program has a particular focus on the most cost-effective approaches, including low-income community solar and solar for multifamily housing.

The Colorado Solar for All (COS4A) program, if funded, would provide single-family rooftop solar, multifamily rooftop solar, and community solar to serve the highest energy-burdened residents. It would also maximize resident cost savings and emissions reductions, and

[22] SB21-264

optimize the market transformation potential of such a large scale program. If the full $250 million request was funded, COS4A is positioned to deliver the benefits of solar to more than 40,000 households living in low-income or disadvantaged communities (LIDC). The EPA's Solar for All[23] grant will complement Colorado's robust solar market by enabling the state to increase the number of LIDC that can take advantage of distributed solar investments. This will improve access to affordable, resilient, and clean solar energy, while delivering other important benefits including lower utility bills, better air quality, and economic and job growth opportunities in local communities. These efforts will contribute to achieving the Governor's objective of 100% carbon-free electricity for Colorado by 2040, while protecting Colorado consumers from the high and unpredictable costs of natural gas and other fossil fuels used to generate electricity.

Adopt Low-Energy and Low-Carbon Building Codes

Action type: Administration

Modeled in Scenario(s): Baseline, NTA

House Bill 22-1362[24] directed the state's Energy Code Board (coordinated by CEO and DOLA) to develop a low energy and carbon code that is based on the 2024 International Energy Conservation Code (IECC)[25]. This code could also include updates to pre-wiring requirements for rooftop solar, electric appliances, and EV charging and additional appendices or base code requirements that will reduce energy use and emissions from new and majorly renovated buildings. The low energy and carbon code is required to be adopted by the Energy Code Board in June 2025, and Colorado's local governments must begin adopting it in July 2026. When local governments across Colorado adopt this code, it will result in significant energy savings and reduced emissions from on-site fossil fuel use (as well as demand for electricity generated by fossil fuels). It will also save consumers on their utility bills, improve indoor air quality and occupant comfort in new and renovated buildings, and drive investment in low- and zero-carbon building technologies and building electrification.

This code adoption can be combined with additional funding to assist local governments in rapidly updating their codes to meet these new minimum standards, and to adopt standards above minimum code requirements. The overall objective of this work is to accelerate adoption of minimum energy codes and drive greater adoption of more ambitious codes through training, technical assistance, and direct funding to local governments.

[23] EPA, Solar for All
[24] HB22-1362
[25] International Energy Conservation Code

Oil & Gas

Enforce Intensity Requirements for Preproduction and Production Operations

Action: Legislation and Administration

Modeled in Scenario(s): Baseline, NTA

The intensity requirements defined in Regulation Number 7 for pre-production and production operations (standards set by the AQCC in December 2021 and verification requirements set by the AQCC in July 2023) require all operators in Colorado to account for and reduce GHG emissions from all pre-production and production activities. The rule began for new operations in January 2023 and will begin for all existing and new operations in January 2025. The rule includes emissions from non-road engines (i.e. drill rigs, vapor recovery units, frac engines), production equipment (i.e. storage tanks, separators, engines, heaters), and well maintenance activities (i.e. well unloading, swabbing, plugging). The rule also requires any new operations within disproportionately impacted communities be designed, constructed, and operated to have a lower intensity than any other operation in the state, regardless of ozone attainment status. Reducing localized ozone precursor emissions, ozone formation, and GHG emissions associated with O&G development will benefit disproportionately impacted communities who are more vulnerable to poor air quality and the impacts of climate change.

Full implementation and enforcement of this rule will:

1. Ensure all emissions are properly accounted for by using direct methane measurement.
2. Identify new opportunities for emission reductions through direct measurement as well as through the reporting requirements for operators. Between 2023 and 2031, each operator will be expected to report to the state three emission reduction plans (with additional emission reduction plans if an operator ever fails to meet a single year standard) and nine emission inventory reports. For those operators using an operator specific program, there will be an additional nine measurement strategies with an evaluation of the effectiveness of the strategy and three reports from an independent third party auditor, including inventory adjustments made as a result of the audit. The state anticipates receiving between 2,400 and 4,800 reports covering all 15,000 active well sites in Colorado.
3. Ensure individual operator compliance and overall state progress toward the 2025 and 2030 GHG reduction targets.
4. Create an intensity verification protocol defining the nationwide standard for creating a measurement informed inventory, expected to be referenced nationally and internationally.
5. Encourage operators to: electrify drill rigs and well operations, design tankless and centralized well production facilities, decrease inefficiencies at existing well facilities, and innovate new strategies to reduce emissions.

This rule was designed to ensure we meet 2025 and 2030 reduction targets. Sufficient implementation, compliance assistance, review and analysis, and enforcement is required to ensure it works as designed. At this time, the rule implementation needs additional state staff

and financial support (for both staff, database/OIT support systems, and the aerial/ground monitoring discussed above). With enough resources, the state will be able to: 1) create a database for emission reporting that will be available publicly; 2) review and vet the many reports received; 3) follow up with operators who fail to meet standards for compliance assistance and enforcement as needed, and 4) update the intensity verification protocol to keep up with technological advances in methane and GHG measurement.

Develop Strategies for Net-GHG-Neutral Oil and Gas Development and Operations

Action: Legislation and Regulation

Modeled in Scenario(s): NTA

This action would expand the intensity program and/or the ECMC BMP program to consider frameworks for the development of net-GHG-neutral oil and gas development and/or comprehensive area plans across company operational footprints. It would set a goal for 50% oil and gas development plans to be net-GHG-neutral by 2035 and 100% to be net-GHG-neutral by 2040. Company-wide plans could achieve net-GHG-neutral emissions targets through some combination of such activities as carbon capture, plugging and abandoning existing wells, and purchasing offsets. This action would also include provisions to enable the modification of existing operations to phase in emissions reductions strategies. Reducing ozone formation associated with oil and gas development and GHG emissions will benefit disproportionately impacted communities who are most vulnerable to poor air quality and the impacts of climate change.

Track and Reduce Truck Emissions from Oil & Gas Operations

Action: Regulation

Modeled in Scenario(s): Not modeled

This action would update Form 2Bs that are used to track emissions from truck trips associated with oil and gas operations. This would help ECMC understand the impact of emissions from truck trips during drilling, completions, and production. It would also assist in determining how to reduce those emissions. Based on this information, the state could require emissions reductions from truck trips. This could include such options as requiring "tank lite" facilities, or piping all liquids (oil, gas, produced water) instead of storing on site and picking up via trucks. Reducing ozone formation associated with oil and gas development and GHG emissions will benefit disproportionately impacted communities who are most vulnerable to poor air quality and the impacts of climate change. There also may be equity benefits in reducing nuisance/safety impacts of truck traffic on proximate communities. In addition to reducing emissions associated with oil and gas activities, reducing truck trips will contribute to state transportation emissions reduction efforts.

Achieve Emissions Reductions from Well Plugging

Action: Administration

Modeled in Scenario(s): NTA

This action would provide emissions reduction credits for operators that plug wells and retire production facilities to create incentives for operators to encourage them to plug more old wells on a timely basis. This could be part of a broader net-GHG-neutral OGDP program (see above) or implemented independently. ECMC will analyze emissions reduction benefits from plugging orphan wells and plugging older and/or lower-producing wells/equipment to offset emissions from new wells that will be drilled. The commission will identify opportunities to incorporate emissions reduction benefits from well plugging into new OGDP applications. The ECMC would take particular focus on any additional emission reductions that would not only reduce ozone formation associated with oil and gas development and GHG emissions but would also benefit disproportionately impacted communities who are most vulnerable to poor air quality and the impacts of climate change.

Industry

Pass Midstream Combustion Rule

Action: Regulation

Modeled in Scenario(s): NTA

The operation of fuel combustion equipment in the oil and gas midstream segment is a significant source of greenhouse gas emissions. This equipment includes engines, turbines, heaters, reboilers, and boilers. The Division and the Midstream Steering Committee are currently developing a plan to reduce greenhouse gas emissions from midstream fuel combustion equipment statewide. This includes facilities like compressor stations and natural gas processing plants. Combustion equipment at these facilities emit greenhouse gases and other air pollutants. This equipment includes engines, boilers, reboilers, heaters, and turbines.

To help develop an Emission Reduction Plan, the division selected a diverse group of industry experts, community groups, and elected officials to serve on a Midstream Steering Committee. The plan will reduce greenhouse gas emissions across Colorado from midstream segment fuel combustion equipment. This planning process was established by Regulation No. 7, Part B, Section VII., and will culminate in a regulatory proposal. The committee will deliver a proposed plan to the division in March 2024. The division will present a rule proposal to the Air Quality Control Commission in August 2024. This action is currently on the Air Commission’s calendar in 2024.

Establish Statewide Regulations for Carbon Management

Action: Legislation and Regulation

Modeled in Scenario(s): NTA

This action would feature developing a regulatory framework to regulate the siting, permitting, construction, and operations of CCS and DAC projects in a manner that protects public health, safety, welfare, the environment, and wildlife resources. A key component of developing the regulatory framework would involve coordination with EJ communities to ensure community involvement in siting decisions. This would include addressing issues such as pore space ownership and unitization that need to be resolved to allow deployment of sequestration. In addition, CEO would work with private sector partners to support development of near term CCS projects that can contribute towards the state's 2030 GHG reduction targets.

Enable the Clean Hydrogen Economy

Action: Legislation and Regulation

Modeled in Scenario(s): Not modeled

In order to create a clean hydrogen economy, the state would develop a regulatory framework to address the siting, permitting, construction, and operations of hydrogen projects in a manner that protects the public health, safety, welfare of disproportionately impacted communities, as well as the environment and wildlife resources. It would feature the creation of GHG accounting for hydrogen projects that is compatible with federal approaches, and that enable use of the state clean hydrogen tax credits. In addition, this action would call for the support of clean hydrogen economic development activities for the technology's use in hard-to-decarbonize industrial operations such as aviation, heavy duty transportation, long duration energy storage, load-following services in the power sector, existing gray hydrogen applications, and, when appropriate, process heat.

Expand Funding For Voluntary Industrial Decarbonization Projects

Action type: Administrative

Modeled in Scenario(s): NTA

The legislature authorized $25 million in industrial clean air grants through SB22-193[26], and $168 million in industrial competitive decarbonization tax credits through HB23-1272[27]. These investments will support transformative technologies such as industrial heat pumps, thermal energy storage, use of clean hydrogen, and industrial carbon capture. In order to expand the reach of these programs, the Energy Office will seek additional federal funding made available by the Inflation Reduction Act, with a particular focus on industrial decarbonization

[26] SB22-193
[27] HB23-1272

investments that will also reduce local air pollution in disproportionately impacted communities. While no one project is guaranteed to be successful, we expect that collectively these efforts will go well beyond statutory emissions targets to reduce both GHGs and local air pollutants at an unprecedented pace.

Agriculture & Natural and Working Lands

Augment Funding for Renewable Energy & Energy Efficiency Projects on Agricultural Operations

Action: Legislation

Modeled in Scenario(s): NTA

Through legislation and stimulus funding, CDA's ACRE3 (Advancing Colorado's Renewable Energy and Energy Efficiency)[28] program has funded 140 on-farm energy projects in 27 of Colorado's counties. In 2022-2023 alone, ACRE3 projects are delivering 3,900 tons per year in CO_2eq emissions reductions, $231,000 in annual energy cost savings for Colorado producers, and the equivalent of 9.7 million kilowatt-hours in annual energy savings.

Reducing on-farm energy and increasing renewable energy on farmland improves the resilience of Colorado's agricultural communities by reducing energy costs, increasing availability of local energy, and diversifying the economy. There has been recent funding through SB23-92[29] to support agrivoltaic research and development. Further funding is needed to a) support on-farm renewable energy and energy efficiency; b) increase renewable distributed generation opportunities, including agrivoltaic projects; and c) leverage new federal funding opportunities.

Actions in Development for After CY2024

Utilities

Ensure Fairness in Distributed Energy Resource Compensation

Action: Administration and Legislation

Modeled in Scenario(s): Not modeled

To ensure distributed energy resources continue with strong growth in our state – while decreasing emissions and managing costs and grid resilience – a framework for a stable, long-term net metering (NEM) structure in Colorado is needed. This requires a collaborative, transparent partnership between the solar industry, storage industry, utilities, the state, and other stakeholders. The following issues will be addressed, at minimum, by a NEM working group, which was established by CEO as directed by the Governor:

- Addressing potential changes to existing net metering policy and other policies for

[28] CDA, ACRE3
[29] SB23-92

customer-sited generation and storage to further the clean energy transition and maximize access for all customers including lower-income customers.
- Analyzing costs and benefits, including accounting for the inherent value and improved resiliency of microgrids and distributed energy solutions and cost shifts including both utility and third party data.
- Considering how a future net metering policy should enhance technological and financial solutions. This would ensure the infrastructure necessary to support our reliable, affordable, and functional electricity system into the future (including transmission and distribution infrastructure, the resilience of microgrids, and storage and dispatchable generation needed to complement wind and solar).
- Developing the conditions and timeframe under which individual utilities should transition to an agreed upon alternative to current net metering.

Recommendations from the group will be finalized in Summer 2024, and the state will work to adopt those recommendations through the appropriate policy mechanism(s).

Transportation

Streamline Local EV Charger Deployment

Action: Legislation

Modeled in Scenario(s): Not modeled

This action would include exploring ways to incentivize best practices to streamline EV charger deployment in local zoning and permitting. EV charging providers report a wide variability and unpredictability in permitting times, with some permits taking less than 90 days, while others taking six months or longer. For many jurisdictions, EV chargers are a new use that they may not have established a process for, which can create uncertainty and increase permitting times.

Long permitting timelines threaten to hamper the state's EV deployment goals for light-, medium-, and heavy-duty vehicles, which rely on having sufficient charging infrastructure available. The state has identified needs for EV charging deployment to support its EV adoption goals by 2030[30] and has included charging installation goals in its 2023 EV Plan[31]. Achieving these goals are critical for reaching the state's greenhouse gas goals for transportation. Highly variable permitting timelines could also result in inequitable outcomes, with charging providers potentially avoiding placing charging stations in jurisdictions with long and complex processes – an action that would reduce the local air quality benefits those jurisdictions may experience.

CEO proposes working with a facilitator in 2023 and 2024 to engage with stakeholders including local governments, charging developers, and nonprofits to better understand the permitting and zoning processes, and identify strategies to create consistency across

[30] Colorado charging infrastructure needs to reach electric vehicle goals, February 2021
[31] 2023 Colorado EV Plan

jurisdictions and expedite approvals. Outcomes may include an inspection checklist, model ordinance, education and outreach, technical assistance, a legislative proposal, and others.

Enact a Clean Miles Standard

Action: Legislation and/or Regulation

Modeled in Scenario(s): NTA

This action would include legislative and/or regulatory action to adopt a standard that requires transportation network companies (TNCs), and potentially taxis and rental car fleets, to reduce their GHG emissions over time. This approach would complement proposed incentive programs to support electrification of TNCs from the Clean Fleet Enterprise[32] and Xcel Transportation Electrification Plan[33] to ensure that these fleets, which often include vehicles that are driven many more miles than the average vehicle, shift to electric vehicles over time. A Clean Miles Standard would also support lower air pollution emissions in communities subject to high levels of air pollution from vehicle traffic. From an equity perspective, pairing this standard with incentives and ensuring drivers, particularly low-income drivers, are well supported to switch to cleaner vehicles will be an important consideration of policy design.

Build More Complete and Connected Streets

Action: Administration and Legislation

Modeled in Scenario(s): Not modeled

This action would include implementing key steps to improve bicycle and pedestrian facilities, particularly along and across major arterial roads in Colorado's urban areas. This would include updating the Bicycle and Pedestrian Plan[34] for Colorado, as well as funding and implementing network connectivity improvements along major arterial roadways.

Key elements of this action involve: updating the Statewide Bicycle and Pedestrian Plan; better integrating the Bicycle and Pedestrian Plan into the overall Statewide Transportation Plan; updating the Colorado Downtown Streets Guidebook; and improving statewide data on bicycle and pedestrian facilities in order to identify existing gaps in bicycle and pedestrian networks.

CDOT would also focus on funding and implementing local and regional bicycle and pedestrian priorities, with a particular attention to implementing network connectivity improvements on major arterial roadways that often cross through disproportionately impacted communities. These roadways often have higher rates of pedestrian and bicyclist injuries and fatalities, and several are also planned for bus rapid transit and other transit improvements in the coming years. Ensuring safe access for bicyclists and pedestrians will be critical for ensuring the

[32] Colorado Clean Fleet Enterprise
[33] Xcel Transportation Electrification Plan
[34] Colorado Statewide Bicycle and Pedestrian Plan

success of transit on these routes, in addition to increasing the use of walking and biking for transportation more broadly.

Reduce Pollution from Urban Freight

Action type: Administration

Modeled in Scenario(s): Not modeled

Approximately 77% of all shipments, by tonnage, to and from Colorado, are carried by the surface transportation network and through medium- and heavy-duty vehicle fleets. This action would look at administrative efforts to help address the rapid growth of e-commerce and change the dynamics of freight movement within the urban setting. The state is developing its new Colorado Freight Plan, required under 49 U.S.C. 702002. This plan, which is also undergoing public consultation and comment before publication in 2024, will outline the state's strategy for freight movement, transportation projects and programs that support freight movement within the states, and performance objectives. Reducing the environmental impact, including greenhouse gas emissions and other air pollution, of freight logistics while continuing to support e-commerce and other trends is one of the primary objectives of this plan. In addition, the plan is to continue examining strategies that continue to improve safety for communities around the state. These strategies could include innovating solutions for how we deliver goods in the urban setting; improving congestion; identifying impacts of larger trucks and other freight vehicles on disproportionately impacted communities; examining strategies to help improve safe movement of freight vehicles appropriate for specific communities; and devising solutions for alternative fuels for delivery and freight vehicles.

Buildings

Develop a Strategic Plan for Electrification of Buildings and Appliances

Action type: Administration

Modeled in Scenario: NTA

Colorado's 2.4 million homes and 250,000 commercial buildings represent the fourth largest source of emissions across the state and $7 billion in annual energy expenditures. Globally, buildings represent 40% of emissions with the hardest-to-reduce emissions coming from direct, fossil-based consumption at the building. In contrast, Colorado's renewable energy generation has grown four-fold since 2010 as we've adopted clean energy plans that will achieve an 84% to 87% GHG pollution reduction from electricity generation by 2030. Beneficial conversion of heating from fossil fuel combustion to electric energy in buildings is an important strategy for reducing GHG pollutants. While other means of reducing direct, fossil-based emissions in buildings are and will continue to be available, building electrification at scale across the state will require coordinated strategic planning using building energy stock, use, age, location, and cost data for modeling and evaluation. Leveraging building stock analysis currently underway, CEO would overlay data points,

including building load shapes by sector and location; anticipated equipment failure based on building age and equipment type; current and planned gas infrastructure requirements; household income and energy burden; utility costs and anticipated rates; building equipment innovation and improvements; whole building approaches; and available incentives, rebates, financing and workforce availability. Using this data, CEO could model scenarios to better understand where and how to seed targeted and diverse electrification pilots followed by scaled deployment across the state in partnership with utilities, cooperatives, municipal governments, NGOs, and community organizations. Modeling will inform planning, which will account for new distribution, generation and anticipated peak requirements. These would allow the state to take advantage of new renewable resources coming online; potentially lower energy costs through strategic spatial deployment and pruning of the gas system; build a sustainable building workforce and high quality jobs; and access demand flexibility and grid-integration capabilities at the building. This could be analogous to the EV Plans that have guided state work on transportation electrification over the last six years.

Existing and shorter term planning and programming for buildings takes advantage of available time-limited federal and state funding, including tax credits, rebates, grants, and financing. For example, Colorado building owners could take advantage of expanded federal tax credits and rebates for home efficiency improvements under IRA 179D tax credits for commercial building energy investments; 45L for single family and multifamily home energy upgrades; and new heat pump tax credits included under Colorado House Bill 23-1272[35]. These programs will assist households and businesses in making investments to reduce energy costs, through tax liability and direct funding and offset any incremental additional cost of improvements. In the shorter term (while long term strategic planning takes place), the state can leverage these resources to kickstart markets for beneficial building electrification and efficiency upgrades. CEO proposes to supplement and/or enhance current tax programs to target low- and moderate-income communities and to identify innovative methods of deployment to round out market transformation efforts and ensure that benefits reach diverse and disproportionately impacted communities.

The result of this analysis and planning will be a data-driven strategy and approach that ensures a consistent, equitable and highly impactful program that utilizes available short-term, time-limited resources and outcomes that can be scaled to achieve longer-term emissions reduction goals, economic development and job creation opportunities.

Increase Energy Efficiency and Electrification for State Affordable Housing Programs

Action type: Administration

Modeled in Scenario(s): NTA

Colorado is currently lacking more than 120,000 affordable units necessary to properly house its population. While the state is investing in affordable housing through numerous programs, Colorado must ensure these investments align with its greenhouse gas reduction goals. In

[35] HB23-1272

other words, we must deliver additional units while simultaneously reducing future GHG emissions and providing the co-benefits of healthier and lower utility costs to residents of affordable housing. Often residents of affordable housing developments are from populations that have historically experienced disproportionate impacts in housing location, cost, and quality. Providing decarbonization co-benefits (healthier indoor air quality, better comfort, safer heating and cooling systems, more durable and resilient envelopes, and lower utility costs) through improved energy efficiency and sustainability will drive improved equity in housing, and protect low income populations from the variability inherent in national gas prices. In order to ensure new housing is built to align with climate goals, the state proposes including minimum energy efficiency and electrification requirements as well as technical assistance on how to take advantage of existing rebates, grants and tax incentives. Requirements should be built into individual state program guidelines as well as partner policy documents such as the Qualified Allocation Plan for multifamily tax credit projects.

Extend GHG Reduction Targets for Existing Large Buildings

Action: Regulation

Modeled in Scenario(s): NTA

Beginning in 2022, HB21-1286[36], or the Energy Performance for Buildings law, directed the Colorado Energy Office to develop a statewide benchmarking program that requires commercial, multifamily, and public buildings that are 50,000-square-feet or more to report their annual energy use to the Colorado Energy Office. HB21-1286 also created sector-wide greenhouse gas (GHG) reduction targets for buildings. The law calls for a 7% reduction by 2026 and 20% by 2030 (from a 2021 baseline). These goals are to be met through building performance standards (BPS). These standards create energy performance targets, such as specific levels of energy or GHG emission performance, that buildings must meet and that help drive energy efficiency improvements and the reduction in GHG emissions from buildings over time.

CEO and CDPHE conducted a rulemaking in August 2023 and adopted rules for the covered buildings under this program. CEO has begun implementing this program and in coordination with the CDPHE team, plans to provide annual updates to the AQCC. CEO and CDPHE anticipate a secondary rulemaking sometime in 2027 to review progress, enhance flexibility, and to incorporate additional actions or improvement. CEO proposes to evaluate program deployment and progress in order to inform the development of additional greenhouse gas performance standard targets beyond 2030. These new targets will continue driving efficiency and electrification improvements across the Colorado commercial building stock and make progress toward legislatively adopted economy-wide GHG pollution targets.

[36] HB21-1286

Expand On-Bill Financing for Building Energy Improvements

Action: Legislation

Modeled in Scenario(s): NTA

Shifting from gas-fired furnaces and water heaters to all-electric can help save money for home owners and reduce greenhouse gas pollution from buildings, which are one of the leading sources of pollution in Colorado. The Colorado Clean Energy Fund (CCEF) along with Tri-State Generation and Transmission, which is one of Colorado's largest utilities, is piloting tariff-based on-bill repayment of all-electric housing for both new and existing affordable homes. The state is working with other utilities, CCEF, local governments, and additional stakeholders to evaluate the potential to expand on-bill repayment programs to other utilities and to scale on-bill finance offerings to residents including multifamily housing and commercial buildings.

Accelerate Heat Pump Deployment for Equitable Access to Heating and Cooling

Action: Legislation

Modeled in Scenario(s): NTA

High efficiency electric heat pumps can reduce emissions and ensure households have access to both heating and cooling. Vulnerable populations, including low-income residents, older populations, children, and people with disabilities are susceptible to severe health risks when living without access to heating and cooling. CEO would pursue several strategies to increase deployment. First, it would support legislation that requires local governments to track heat pump installations separately from gas appliances and to set heat pump permit costs no higher than gas heating. Second, it will explore the potential for replacement of air conditioning units on failure. CEO proposes to continue documenting the benefits of this type of upgrade, facilitate training for heat pump contractors, and collect and share cost and performance data in support of legislation or regulation requiring the replacement of failed A/C systems with heat pump units where applicable. These actions are intended to meet Colorado's joint commitment, along with 24 other governors, to quadruple heat pump deployment across signatories by 2030.

Oil & Gas

Study Alternative Uses of Oil & Gas Wells

Action: Regulation

Modeled in Scenario(s): Not modeled

This proposal calls for conducting a study on potential re-use of low producing, inactive, and/or orphaned wells (for such options as geothermal energy, biogenic hydrogen production, gravity based energy storage, burying of biochar, and carbon sequestration). ECMC would explore regulatory/policy changes needed to encourage operators to convert low producing, inactive, and/or wells in the State orphan well program in lieu of plugging and abandonment. If successful, this program would lower the cost or increase the rate of mitigating emissions from low-producing, inactive and/or orphaned wells, while also creating new clean energy opportunities using existing oil and gas infrastructure.

Industry

Expand Methane Regulations for Landfills and Coal Mines

Action: Regulation

Modeled in Scenario(s): NTA

This action would develop additional policies to enable landfill methane capture and coal mine methane and coal seep methane capture (beyond those participating in recovered methane projects). About 2.2 MMT CO_2eq is emitted annually from waste (1.3 from landfills and 0.8 from wastewater treatment). Currently, Colorado has 59 active landfills (with only 20 currently required to report under Regulation Number 22 given the tie to the federal reporting threshold). Coal mines in Colorado emit roughly 1.7 MMT CO_2eq annually (80% of which comes from active and abandoned underground mines).

To support reductions from the coal mine sector, DNR proposes to create a regulatory pathway for methane capture from active, inactive and abandoned coal mines. DNR divisions, including ECMC and DRMS, would collaborate with CEO, CDPHE, relevant federal agencies, and stakeholders to develop a regulatory framework that could enable the capture and either beneficial use or combustion of methane emissions, thereby reducing GHG emissions in the state.

While the impacts of such a policy are modest, relatively simple policy changes, such as clarifying permitting or expanding existing capture requirements, will foster reductions of this potent greenhouse gas by allowing private actors to more easily undertake reduction projects or through expanding measures already being undertaken at the local level.

Develop a Statewide Industrial Decarbonization Strategy

Action type: Administration

Modeled in Scenario(s): Not modeled

Meeting Colorado's goal of net-zero greenhouse gas emissions by 2050 will require significant research, innovation, and investment for Colorado's industrial facilities – both those currently regulated by existing GHG rules and those that are not. CEO will lead an effort to analyze industrial decarbonization pathways, and to develop a strategy that can guide future policy and programmatic efforts.

This would include analyzing emissions from smaller manufacturing operations (for manufacturers smaller than the GEMM 2 threshold of 25,000 tons per year), and identifying high-priority existing and emerging on-site emission reductions strategies for different industrial facilities. This action would require CEO, in consultation with other state agencies, to develop a statewide strategy that recognizes the unique circumstances of each major industrial emitter while building a framework to achieve deep emissions reductions from industry. Such an effort would not only rely on existing grants from SB 22-193 or tax credits from SB 23-1272 but also look at the broader landscape of industrial decarbonization strategies, fit to each need, and how the state can support Colorado companies in achieving deep decarbonization.

Reducing Waste: Circular Economy, Renewable Energy Decommissioning, and Composting

Action: Legislation

Modeled in Scenario(s): Not modeled

Conduct Statewide Waste Assessment

This action calls for conducting a statewide assessment of Colorado's recycling infrastructure needs, including assessing the capacity for the management of end-of-life electric vehicle batteries and other waste streams generated from the renewable energy sector, such as wind turbine blades and solar panels. This assessment will be documented in an update to Colorado's 2016 Integrated Solid Waste Management Plan[37]. The plan, due July 1, 2025, will identify the current generation of waste streams; predict future quantities; and identify existing resources and facilities for managing the waste streams.

Anticipating future waste streams, the state would work with renewable energy companies and other stakeholders to ensure adequate decommissioning requirements for end-of-life wind and solar projects. The policy would likely require that before a project is built developers create a plan for removing equipment and restoring landowners' property to a useful condition similar to pre-construction conditions once the project is no longer operational. Legislation could ensure the incorporation of decommissioning plans are updated periodically over the life of a renewable energy facility to account for new technologies and

[37] Colorado Integrated Solid Waste and Materials Management Plan

processes for decommissioning, salvaging, or repowering a renewable energy facility. Thoughtful considerations of costs, including through financial assurance timeframes and salvage value calculations, are important components of a thorough strategy.

Evaluate Circular Battery Economy

Identify opportunities to complement federal domestic sourcing and battery reuse and recycling programs for a circular battery economy. Policies could include: 1. battery traceability requirements (consistent with applicable federal or global standards); 2. EV battery transportation requirements; and 3. clear assignment of end-of-life battery management responsibility. CDPHE will closely monitor state and federal recycling policies for batteries and incorporate them into national systems, as they arise.

Embodied Carbon and Methane Reductions

This effort would also scope out additional considerations for the reuse of materials. This could include the evaluation of lifecycle emissions and waste associated with embodied carbon in building materials and other energy-intensive products, for integration into voluntary building costs or other local and state policies. To augment existing policies to reduce embodied carbon, including Colorado Buy Clean (HB21-1303[38]), the Colorado Department of Transportation and Office of the State Architect will explore opportunities to partner with local governments in aggregated procurement, analysis, and reporting of lower-carbon materials.

This effort would include completing a statewide consumption-based emissions inventory that identifies the impact of greenhouse gas emission reductions through material reuse, recycling, composting, and source reduction. This consumption-based emissions inventory will account for those emissions reductions from recyclable materials that are currently diverted in Colorado. The consumption-based emissions inventory will also identify potential reductions in greenhouse gas emissions if more materials were diverted for recycling or composting, or if the materials were never generated due to source reduction and reuse. This analysis can inform future local recycling or composting programs, as well as CDA's Soil Health Program[39].

Lead a Regional Strategy on Direct Air Capture (DAC)

Action: Regulation

Modeled in Scenario(s): NTA

This initiative would seek to expand Colorado's work on direct air capture with other Western States. This would entail building on Colorado's DAC MOU[40] with Wyoming as well as activities with the private sector to develop a common accounting, measurement and verification, and credit platform for DAC projects. This action would also aim to establish DAC as an eligible compliance pathway for GHG emissions reductions for industrial, aviation, and utility-sector

[38] HB21-1303
[39] CDA, Saving Tomorrow's Agricultural Resources Program
[40] Colorado and Wyoming Direct Air Capture Memorandum of Understanding

emitters. It would also include considering aggregating demand for DAC through Advance Market Commitments in the region, and supporting the commercialization and scaling of Colorado DAC companies through a common demonstration sequestration facility in Wyoming and Colorado, if the states' joint effort to create a DAC Hub receives federal funding. In addition, this effort would develop standards in coordination with environmental justice communities to promote responsible voluntary carbon market projects and practices, and would integrate the development of these markets and procedures into the CDR Roadmap. In all these efforts, the state would consider national and international standards where applicable.

Agriculture & Natural and Working Lands

Expand Methane Emission Reductions from Agricultural Operations

Action: Administration

Modeled in Scenario(s): Not modeled

CDA will lead a stakeholder engagement process to discuss methane emissions reduction strategies in agriculture. We will work with Colorado State University, industry partners, farmers, and ranchers to address:

1. Current technologies and solutions focused on reducing methane emissions from animal agriculture, as well as existing barriers, and potential strategies for overcoming barriers to implementation.
2. Recommendations for voluntary program development to decrease methane emissions.
3. Recommendations for improving agricultural methane emissions modeling that is included in the statewide GHG inventory.

The 2021 Colorado GHG Inventory reports that Colorado's agriculture methane emissions were equivalent to 7.39 million metric tons carbon dioxide equivalent ($MMTCO_2e$) in 2019, which is 5% of total emissions. This number is based on national modeling tools and could be further refined with more state-specific data. Determining how to both reduce methane emissions and capture it so that it can be used productively will bolster Colorado's emission reduction goals and support the energy transition.

This stakeholder process will bring together researchers, industry experts, and interested stakeholder groups to discuss potential solutions and create a set of recommendations to incentivize methane capture, anaerobic digestion, including biodigesters, and enteric fermentation reduction strategies.

Expand Renewable Energy Development and Transmission on State Lands

Action: Legislation

Modeled in Scenario(s): Not modeled

This action would advance a state policy to maximize clean energy and transmission resources. This would be done by, among other actions, developing priority areas for renewable energy development. This policy may direct the Colorado Land Board to increase marketing of state lands to renewable energy developers, for use on transmission, and to establish priority and variance areas for carbon-sequestration, geothermal, wind, and solar energy development. This action would require land classifications to be reviewed at least once every three years, with modifications if necessary.

Regulate the Production and Use of Biochar

Action: Administration

Modeled in Scenario(s): Not modeled

Biochar is a charcoal-like material that is produced from biomass sources such as agricultural and forest residues that are decomposed at high temperatures. Biochar has many potential applications, including:

1. Soil amendment to increase carbon sequestration and water retention.
2. Cap abandoned oil and gas wells,
3. Remediation of contaminated soils.

Biochar can be developed in many different ways, and the materials used to create biochar and the process by which it is created is critical to ensure a carbon benefit of this new technology. The state sees a need for clear guidance on production methods and how biochar can best be used. These recommendations will consider a) best available science on biochar production and use; b) the lifecycle carbon impacts of biochar production strategies and applications; and c) any potential environmental justice impacts of biochar production and use.

Implement the Natural & Working Lands Strategic Plan

Action: Legislation

Modeled in Scenario(s): Not modeled

In 2023, DNR, CDA, CSFS, and Colorado Natural Heritage Program developed Colorado's Strategic Plan for Climate-Smart Natural and Working Lands[41]. This plan, a deliverable from the first GHG Pollution Reduction Roadmap, outlines strategies to ensure Colorado's cropland, rangeland, grasslands, forests, wetlands, riparian areas, and urban greenspaces are managed

[41] Colorado Strategic Plan for Climate-Smart Natural and Working Lands

to maximize climate resilience, sequester carbon and reduce GHG emissions. The strategies in this plan require collaboration across jurisdictions, along with a wide range of stakeholder groups and federal partners.

The Strategic Plan includes near-term actions for the next three years. Implementing these actions will be key to reaching the GHG goals outlined in this Roadmap.

Secure Permanent Funding for Soil Health Program

Action: Legislation

Modeled in Scenario(s): NTA

Agricultural soils are an important sink for carbon dioxide. Not only do healthy soils sequester carbon, but they also increase water retention, increase crop yields, reduce needs for additives, and can reduce erosion and improve air quality.

Since 2021, CDA's Saving Tomorrow's Agricultural Resources (STAR)[42] Program has supported more than 400 farmers to improve the soils on their farms and ranches. This program provides financial and technical support for farmers and ranchers working to improve soil health, using practices such as no-till, reduced-till, cover crops, managed grazing, and compost application. The funding for this program has come from the state, federal, and private sources. Now that the program is established, CDA will prioritize finding permanent funding for this program to continue to incentivize climate-smart agricultural practices.

As a general estimation, 100 acres of agricultural land in Colorado can sequester 14 tons of CO_2eq annually. If 10% (~3.8 million acres) of Colorado's farms and ranches were managed for healthy soils, they would sequester approximately 470,000 metric tons of CO_2eq annually. CDA has received a federal grant to expand the program through 2026. Permanent funding should be identified by 2026.

Extend Existing Tax Incentives for Beetle-Killed Wood

Action: Legislation

Modeled in Scenario(s): Not modeled

Currently, all sales, storage, and use of wood from salvaged trees killed or infested in Colorado by mountain pine beetles or spruce beetles, including, but not limited to, products such as lumber, furniture built from the salvaged trees, and wood chips or wood pellets generated from the salvaged trees, are exempt from Colorado sales and use taxation through July 1, 2027 (HB21-1261[43]). This law is meant to incentivize the use of beetle-killed wood and ideally sequester carbon in long-lived wood products.

[42] CDA, Saving Tomorrow's Agricultural Resources Program
[43] HB21-1261

Multi-Sector/Cross-Cutting

Maximize Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act (IRA) Investments in Colorado

Action type: Administration

Modeled in Scenario(s): Baseline, NTA

State agencies are currently reviewing, prioritizing, and applying for IIJA and IRA funding opportunities to advance agency and state goals for climate pollution reduction. The Governor's Office of Economic Recovery is coordinating across state agencies and supporting local governments and Tribes on priority projects. Priority IIJA and IRA-funded projects related to Greenhouse Gas Pollution Reduction are shown in the table below. This is not a static list as the state reviews opportunities as they are announced on an ongoing basis.

Purpose	**Funding Sources**
Build-out of electric vehicle infrastructure	IIJA: DOT National Electric Vehicle Infrastructure Formula Program
Plug orphan gas wells (methane emissions reductions)	IIJA: DOI Orphan gas well formula an competitive grants
Renewable energy and energy efficiency improvements for agricultural producers and rural small businesses	IRA: USDA Rural Energy for America grants directly to agricultural producers and rural small businesses
Public transit electrification	IIJA: DOT Low and No-Emission Bus Grants
Electric school bus electrification	IIJA: EPA Clean School Bus Program (coupled with state funding)
Weatherize low-income homes	IIJA: DOE Weatherization Assistance Program (increased funding over base program)
Grid resilience and hardening	IIJA: DOE GRID formula funding and GRIP competitive funds
Updating building codes	IIJA: DOE Building Codes Implementation for Efficiency and Resilience; and IRA: DOE Assistance for Latest and Zero Building Energy Code Adoption
Home electrification	IRA: DOE High Efficiency Electric Home Rebate Program
Home energy efficiency improvements	IRA: DOE Home Energy Performance-Based, Whole Home Rebates (HOMES)
Solar for low-income households	IRA: EPA Solar for All
Energy efficiency and renewable energy for affordable housing	IRA: HUD Green and Resilient Retrofit Program

Deploy Emerging Technologies for Accurate Methane Emissions Monitoring

Action: Administration, Legislation

Modeled in Scenario(s): Not modeled

The state legislature appropriated funds for a three-year aerial and ground methane monitoring program starting July 1, 2022 with funding through June 30, 2025. Aerial and ground methane monitoring includes methane measurement from: satellite observations, large and small planes, drones, ground vehicles, and continuous ground based sensors. The initial program was focused on oil and gas monitoring, but the monitoring efforts have also yielded beneficial information on landfills, agricultural operations, and coal mines.

In 2021, the ECMC sponsored aerial and ground methane measurement campaigns, executed by the APCD, in the Denver-Julesburg Basin.[44] These efforts discovered various emissions sources, including, but not limited to, oil and gas facilities. These findings highlighted opportunities for enhanced reporting accuracy. CDPHE has been building on the 2021 campaign to collect additional aerial and ground methane data. We have been able to obtain Colorado data in 2022 from flights funded by another entity, and we are working on developing additional campaigns to collect data in multiple Colorado basins in 2023 and 2024.

This data is going to be used in support of multiple things:

1. Making overall progress tracking toward GHG emission reduction targets from all sectors.
2. Identifying other (O&G and non-O&G) sources of methane emissions.
3. Verifying that the upstream GHG intensity requirements in Reg 7, Part B, Section VIII are met by operators.

The AQCC has adopted a rule revision to create a regulatory mandate that pre-production and production operators account not only for bottom up calculated emissions, but also for any un- or under-reported emissions measured as part of the aerial and ground emissions monitoring efforts (i.e. direct measurement of methane emissions).[45]

This action intends to fund equipment and data management to ultimately:

1. Organize and fund independent aerial and ground methane measurements.
2. Work directly with academic, research, and technical experts.
3. Create a portal for methane emission monitoring that will be available publicly.
4. Review and analyze data collected.
5. Provide outreach to operations (i.e. oil and gas, landfills, agriculture) where large (i.e. super emitter) emission observations occur.
6. Develop a statewide measurement-informed inventory for all sectors.
7. Identify further reduction opportunities for landfills, wastewater treatment plants, coal mines, oil and gas operations, and agricultural operations.

[44] Continuous Airborne Measurements and Analysis of Oil & Natural Gas Emissions During the 2021 Denver-Julesburg Basin Studies
[45] Regulation Number 7

8. Support the upkeep of the intensity verification protocol. There is an opportunity to tie this to pipeline monitoring and orphan well monitoring in the future.

Enable Local Government Climate Action

Action: Legislation

Modeled in Scenario(s): Not modeled

There are many potential climate actions that may not be appropriate for statewide implementation but may be of interest to local communities. State statutes may inhibit local action, or state law lacks explicit enabling language that may limit counties and statutory cities. CEO will conduct a stakeholder process with local governments to identify priority areas where statutory changes could enable voluntary climate action by local governments. CEO will also support local government climate policy adoption and other actions through inclusion of local government strategies in its Priority Climate Action Plan for the EPA Carbon Pollution Reduction Grants[46] to incentivize scalable climate solutions among local governments and account for their success and impact in the statewide plan.

Provide Long-Term Funding for State Programs

Action: Legislation

Modeled in Scenario(s): Not modeled

Colorado Energy Office

The Colorado Energy Office has played a central role in the development and coordination of the state's GHG policy and much of the implementation. The legislature has created sustainable and growing revenue streams to support CEO's work on transportation electrification and low-income weatherization. However, much of CEO's work over the last several years has been funded by one-time allocations, or by one-time federal funding. In order to maintain momentum on clean energy and GHG reduction, additional funding sources must be identified to support CEO's work on policy, buildings and industry. Over the coming three years the Polis Administration will work to identify long-term funding solutions for the Colorado Energy Office to carry on this work after federal funds retire.

Just Transition Office

As Colorado has developed its climate and energy policies, it has also made a commitment to the coal communities and workers who have powered our state for generations. Colorado's six remaining coal-fired power plants will close or be converted to other sources by the end of 2030, and most of its seven remaining coal mines will likely close in the same timeframe. To address the impact of coal retirements on Colorado communities and workers, Colorado created the nation's first state Office of Just Transition[47] (OJT) in 2019 to help meet these

[46] EPA, Climate Pollution Reduction Grants (CPRG) Program
[47] CDLE, Office of Just Transition

challenges.

OJT works with coal communities to diversify local economies and support coal workers and their families to find other career opportunities. These are both long-term commitments for the state. OJT is guided in this work by its Action Plan, which it updated in 2023. Initial state funding includes committing over $15 million for community grants between 2022 and 2025, and another $15 million for a worker transition program set to launch in 2024. With major layoffs not expected until after 2025, OJT's strategy is to engage workers and their families well ahead of closures so that they can prepare and begin to implement their own plans.

More substantial and ongoing funding will be needed to successfully implement OJT's long-term Action Plan[48]. This includes meaningful and long-term support for communities to diversify their economies and regenerate lost property tax revenues, and for workers and families to complete their own transitions to new futures that are financially secure. The Polis Administration is committed to continuing this support and to handing off to the next administration a robust and effective program with sufficient resources to succeed in meeting the state's commitment to coal communities and workers.

DPA Office of Sustainability

DPA is requesting funding in FY24-25 and FY25-26 to institutionalize sustainability practices within state agency operations and facilities through the creation of the Office of Sustainability. This office will ensure the State of Colorado continues its progress toward critical environmental and financial goals by reducing energy and other costs of state operations and drawing down significant federal resources to invest in state operations such as clean vehicles and energy efficient heating and cooling. The FY25 budget includes $2.1 million for this office to transition state government use of gas- and diesel-powered garden equipment to electric alternatives. This will reduce ozone-causing pollution and noise. In addition, the office will develop a year-by-year approach to strategies, including but not limited to energy performance contracting, adoption of electric vehicles, advancing water efficiency measures for State facilities, and improving state operations. The office will seek to maximize federal incentives, reduce pollution from state owned assets, adapt to climate change impacts, and reduce costs for State operations. The office will also partner with other agencies, such as CDPHE, to execute pollution reduction policies, such as developing a policy to phase out the use of gas-powered push and hand-held lawn and garden equipment in the ozone nonattainment area. The office will also advise the Governor on achievable regular revisions to greening government directives and other initiatives for the state to continue to lead by example of sustainability.

[48] Colorado Just Transition Action Plan

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Appendix A: 2022 and 2023 Cost-Benefit Analyses

1. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 20, Colorado Clean Trucks, April 7, 2023.
2. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 28, Building Benchmarking and Performance Standards, August 4, 2023.
3. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 27, Greenhouse Gas Emissions and Energy Management for Manufacturing, September 8, 2023.
4. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 20, Colorado Clean Cars, October 19-20, 2023.
5. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 3 - Stationary Source Permitting and Air Pollutant Emission Notice Requirements, May 16-19, 2023

1. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 20, Colorado Clean Trucks, April 7, 2023.

Cost-Benefit Analysis

In performing a cost-benefit analysis, each rulemaking entity must provide the information requested for the cost-benefit analysis to be considered a good faith effort. The cost-benefit analysis must be submitted to the Office of Policy, Research and Regulatory Reform at least ten (10) days before the administrative hearing on the proposed rule and posted on your agency's web site. For all questions, please attach all underlying data that supports the statements or figures stated in this cost-benefit analysis.

DEPARTMENT:	Colorado Department of Public Health and Environment	**AGENCY:**	Air Quality Control Commission
CCR:	5 CCR 1001-24	**DATE:**	April 7, 2023

RULE TITLE OR SUBJECT:

REGULATION NUMBER 20

Per the provisions of 24-1-103(2.5)(a), Colorado Revised Statutes, the cost-benefit analysis must include the following:

1. **The reason for the rule or amendment.**

   The proposed regulatory revisions establish new emission reduction requirements applicable to manufacturers of new medium and heavy duty vehicles sold in Colorado commencing with vehicle model year 2027. The proposed revisions also establish a one-time reporting requirement applicable to certain vehicle fleets operating in Colorado.

   The federal Clean Air Act establishes a framework for adoption and implementation of emission standards applicable to vehicles. Under this framework, the US Environmental Protection Agency (EPA) is responsible for establishing new vehicle emission standards for vehicles sold across the United States. In general, under the Clean Air Act, states are pre-empted from establishing their own emission standards for new vehicles. However, the act creates an exception to this general pre-emption, allowing California to adopt its own new vehicle emission standards. Pursuant to Section 177 of the Clean Air Act, if California adopts its own new vehicle standards, other states can then adopt the California standards to apply in their states.

   Prior to 2018, Colorado relied solely on the federal vehicle standards that EPA adopted. In 2018, the Air Quality Control Commission (AQCC) adopted California's Low Emission Vehicle (LEV) standards applicable to light duty vehicles commencing with model year 2022. These standards established more stringent greenhouse gas emission requirements than those set forth in the federal rules. In 2019, the AQCC adopted requirements for the Zero Emission Vehicle (ZEV) program. Under this program, manufacturers of light duty vehicles sold in Colorado must sell a specified credit percentage of zero emission vehicles commencing with Model Year 2023.

   The proposed revisions represent Colorado's next step in considering whether to adopt additional California new vehicle emission requirements. These proposed rule revisions are intended to reduce air emissions from medium and heavy duty vehicles sold and operating in Colorado. The rules are needed to support the state in reaching its statutorily established greenhouse gas reduction goals, bring the Denver Metro/North Front Range area back into attainment with the federal National Ambient Air Quality Standards for ozone, and accomplish reductions of pollutants in disproportionately impacted communities in support of Colorado's commitment to Environmental Justice.

Over the past several years Colorado has taken a multitude of steps, both regulatory and non-regulatory, to help us achieve the broader goal of achieving an inherently lower emitting vehicle fleet including rapidly transitioning to zero emission vehicle technology. These proposed revisions represent an important next step in these efforts.

The proposed revisions consist of three distinct strategies directed at achieving these broader goals. They are:

1) The Heavy-Duty Low NOx rule (Low NOx), that establishes emission standards for nitrogen oxide emissions from heavy-duty engines and vehicles sold in Colorado commencing with model year 2027. The rule incorporates California engine and vehicle emission standards as required under Section 177 of the federal Clean Air Act. These standards establish criteria and procedures for the manufacturing, testing, distribution and sale of new on-highway heavy-duty trucks and engines in Colorado.

2) The Advanced Clean Trucks rule (ACT), that requires manufacturers of medium and heavy duty vehicles, that offer such vehicles for sale in Colorado, sell a specified percentage of zero emission vehicles (ZEV). Specifically, beginning with the 2027 model year, any manufacturer that certifies on-road vehicles over 8,500 pounds' gross vehicle weight rating (GVWR) for sale in Colorado, must, at minimum, contain at least the same percentage of ZEVs subject to the same requirements set forth in California Code of Regulations.

3) The Large Entity Reporting rule (LER) that requires certain vehicle fleet owners to submit a one-time report regarding their fleet to support ongoing efforts to develop strategies to increase the percentage of zero emission vehicles operating in Colorado. These fleet owners must submit information regarding their fleet vehicles to the department by November 20, 2024. This report is intended to provide additional specific information about individual vehicle fleets, which will be critical in assessing whether to pursue additional strategies for transitioning to a cleaner statewide vehicle fleet.

In addition to creating these three new programs, the proposed revisions include updating existing incorporations by reference related to Colorado's Low Emission Vehicle and Zero Emission Vehicle programs for light duty vehicles so that these provisions are aligned with the most recent version of California's regulations. These revisions are administrative in nature and are not expected to add to alter the costs and benefits of the existing LEV and ZEV programs. Finally, the proposed revisions reorganize the regulation, clarify existing provisions, and make typographical corrections.

Adoption of the proposed revisions to Regulation Number 20 serves to advance Colorado's three most critical air quality priorities: 1) reduction of greenhouse gas emissions in support of Colorado's ambitious climate change goals; 2) reduction of ozone precursors in support of efforts to bring the Denver Metro/North Front Range area into attainment with ozone National Ambient Air Quality Standards (NAAQS); and 3) promotion of Environmental Justice through the reduction of harmful pollutants that directly impact Colorado residents living and working in disproportionately impacted communities. While no one set of strategies will solve these critical problems, adopting the proposed revisions would be an important step in addressing all three, bringing both important near term benefits in the form of reduced impact from new trucks, and helping Colorado transition to a zero emission vehicle fleet, which is among Colorado's most important long term efforts to fight climate change, significantly reduce ozone concentrations, and ensure that all Coloradoans have clean, healthy air to breathe.

Vehicle emissions are a critical part of Colorado's overall greenhouse gas emissions. Based on the most recent Colorado inventory, vehicles are the second largest source of greenhouse gas emissions in Colorado.[1] Vehicles are projected to remain the second largest sector of GHG emissions in the state through 2035.[2]

[1] 2021 Colorado Greenhouse Gas Inventory Update at pg. 4.

[2] Id.

And while vehicle GHG emissions in Colorado are expected to dramatically decline by 2050, that expectation is premised on the assumption that there will be a rapid transition from fuel burning vehicles to electric and other zero emission vehicles.[3] Colorado has previously taken action to reduce GHG emissions from the light duty fleet through the adoption of its LEV and ZEV program, but has not adopted parallel requirements for the heavy-duty fleet. This is a lost opportunity given that medium and heavy-duty vehicles emit approximately 22% of the overall fleet emissions, while making up only 9% of the total number of vehicles in the state.[4]

In addition to being an important source of GHG emissions, vehicles play an extremely significant role in the formation of dangerous levels of ozone pollution within the Denver Metro/North Front Range nonattainment area. Based on recent source apportionment modeling, vehicles are the largest in-area contributor to ozone concentrations at ozone monitors that register the highest measured eight-hour ozone concentrations in the nonattainment area. For example, vehicles contribute approximately 31% of the in area ozone formation at the NREL monitor.[5] And though medium and heavy duty vehicle emissions produce a small amount of VOC emissions relative to the light duty fleet, they are a significant contributor of NOx emissions, representing approximately 30% of all vehicle NOx emissions in Colorado.[6] Further, as light-duty vehicles become cleaner and transition toward zero emission technologies, medium and heavy-duty vehicles are making up a larger portion of the overall vehicle NOx in the nonattainment area.[7]

Finally, adoption of the ACT and Low NOx programs, can play an important role in the addressing environmental injustice in Colorado. While a number of source sectors contribute to the disproportionate impacts from pollution that certain communities face, vehicle pollution is a key contributor to this injustice. A myriad of health studies shows that communities that are located near busy roadways face significant negative health consequences from exposure to vehicle pollution in general. Studies further establish that exposure to diesel exhaust from trucks is particularly harmful.[8] Given that medium and heavy-duty vehicles account for approximately 30% of the vehicle NOx and 40% of the vehicle particulate matter across the state[9], if Colorado wants to truly address these direct exposure problems, it must move forward with strategies to reduce emissions from the medium and heavy-duty vehicle sector.

2. **The anticipated economic benefits of the rule or amendment, which shall include economic growth, the creation of new jobs, and increased economic competitiveness.**

The adoption of the proposed ACT and Low NOx rules will have an overall positive economic benefit for Colorado. It will generate new opportunities and prospects in the state. The rule will result in economic growth, the creation of new jobs, and increased economic competitiveness. For each $1 in spending, implementing this rule will generate a benefit worth $2.1. The benefits result from reduced GHG emissions, the avoided adverse health incidences, and lower fuel and maintenance costs. The following subsections describe each of these specific benefits in detail.

[3] Colorado Greenhouse Gas Pollution Reduction Roadmap at pp. 53-62.
[4] Colorado Clean Truck Strategy at pg. 9.
[5] State Implementation Plan for the Denver Metro/North Front Range Nonattainment Area (Ozone SIP) at pg. 5-28
[6] Colorado Clean Truck Strategy at pg. 9.
[7] Compare Ozone SIP at pg. 2-3 and pg. 4-26, showing that medium and heavy duty vehicles emitted 20.7% of the NAA vehicle NOx in 2017, but will emit 25.9% in 2023.
[8] selected References on Health Effects of Diesel Exhaust
[9] Colorado Clean Truck Strategy at pg. 9

Job Creation

By advancing the introduction of electric and other zero emission vehicles and establishing more stringent engine and vehicle emission control standards for conventional vehicles, this rule will shift spending patterns in Colorado's transportation sector. A significant enough shift in spending patterns can affect a state's workforce. To assess this effect, we use forecasted transportation related expenditures and their corresponding multipliers. Multipliers, which are quoted as the number of jobs that are created/lost per a million dollars' worth of investment moving into/out of an industry, map the interdependent relationships between all industrial sectors by tracking the flow of commodities and money[10]. Since different subsectors in the transportation sector have their respective production processes and corresponding labor needs, the multipliers that apply to each industry are equally varied.

Increased spending in a sector will cause more jobs to exist in that sector. Accordingly, the increased spending on cars, as measured by the incremental cost, and the investment in EV charging stations will lead to job creation. The reduced need for maintenance as well as the reduced spending on fuel use will lead to job loss, though these job trends will occur over a period of time that lessens any immediate effect. Specifically, the consumption of electricity as a transportation fuel creates increased demand for and spending on electricity, leading to more jobs being created in that sector. The shift away from the use of gasoline and the corresponding lower demand for it will lead to a lower number of jobs existing in that sector over time. The net fuel saving, which is the difference between the amount spent on electricity and the amount spent on diesel, is used to estimate the impact on jobs as it relates to fuel use. The totality of the mechanisms considered include: new car sales (incremental), EV charging infrastructure, maintenance, and fuel use.

Whereas some of these jobs (gained/lost) are direct, the rest are either indirect or induced. Direct jobs (gained/lost) are those jobs in industries supplying goods and services such as EV manufacturing jobs. Indirect jobs, such as workers refining raw metals from which EVs are built, are created in industries that supply goods and services to industry more directly involved in the making of EVs. Induced jobs represent those jobs supported through broader economic activity stimulated by the creation of direct and indirect jobs, including grocery store workers and health care providers. The figures estimated are quoted in "job-year" or FTE (Full-time Equivalent), which is equivalent to employing one person for one full year, or two employees for six months each, or any other combination of employees that adds up to one year's worth of labor.

The results show that considerable net job gains will result from this rule. Between 2027 and 2050, a total of 24,117 job years are expected to occur as a result of the rule.

Table 1 estimates the number of jobs (gained/lost) through the mechanisms of new car sale (incremental), EV charging infrastructure, maintenance, and fuel use.

Table 1
Estimated Job Gains and Losses

Year	Gain		Loss		Net (Gain - Loss)
	New sale (incremental)	EV charging infrastructure	Maintenance	Fuel use	
2026-2030	908	3118	185	153	3689
2031-2035	3013	11018	1645	1986	10399
2036-2040	3758	13214	3799	5657	7515
2041-2045	4182	14145	5346	9683	3298
2046-2050	4343	14334	6080	13382	-784

[10] UCLA Luskin Center for Innovation: Workforce Impacts of Achieving Carbon-Neutral Transportation in California (2022) Workforce Impacts of Achieving Carbon-Neutral Transportation in California (ucla.edu).

While some of the positions might be retained if the industry shifting product to other uses, such as for aviation and maritime purposes, jobs in oil and gas extraction, support activities for mining, petroleum refineries and gasoline retail will be lost or hiring delayed. Similar reductions will occur in occupations dealing with the maintenance and repair of vehicles. This is exacerbated by the skillset necessary for a technician to maintain a zero emission vehicles versus a conventional vehicle. As a policy response, nonprofits, government agencies, post-secondary education institutions and public workforce development agencies should work with employers and labor unions to create training programs for workers in declining occupations. This will be even more important for occupations that are highly specialized, where the skills are not as easily transferable.

Health Benefits

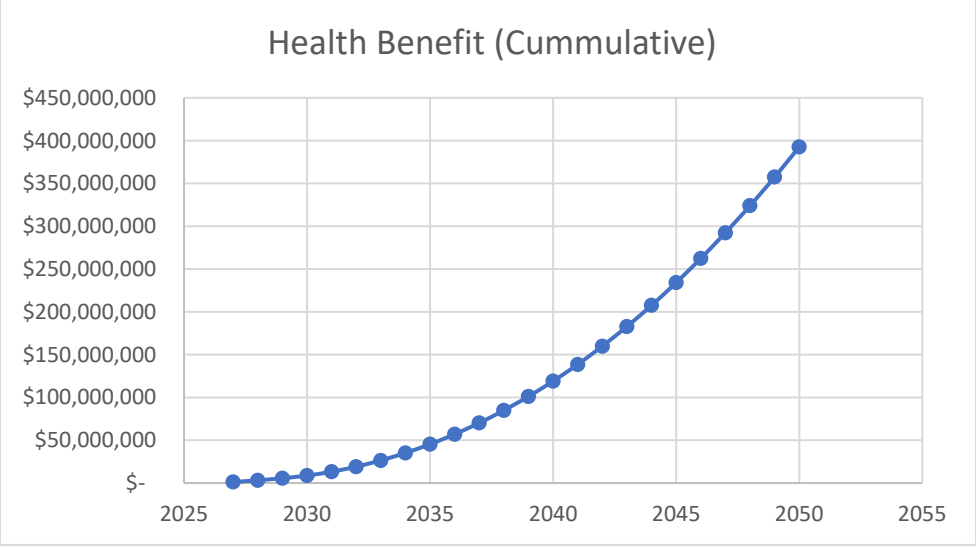
The rule will result in health benefits that improves the well-being of people in Colorado. As stated previously, heavy-duty fleet vehicles comprise one of the largest sources of mobile source emissions. Through this rule, harmful vehicle emissions of nitrogen oxides and fine particulate matter will be reduced from these vehicles. The Department estimates that implementation of these rules through Model Year 2050 will reduce NOx by 32,120 tons and PM2.5 by 275 tons.

Benefits of these health impacts will be distributed statewide, affecting all of Colorado, but especially disproportionally impacted communities. Communities that may be located near heavy-duty truck fleet operations and major highways and roadways.

Data and analysis from the Northeast States for Coordinated Air Use Management (NESCAUM) using the EPA's COBRA model that indicate that health benefits will include:

- 25-45 avoided premature deaths,
- 4 avoided hospitalizations for cardiovascular illness,
- 4 avoided hospitalizations for respiratory illness, and
- 14 avoided ER visits.

Using concentration response functions to link the changes in particulate matter to epidemiological studies along with cost of illness and other statistics, the state determined the economic value of illnesses and deaths avoided resulting from this rule. Between 2027 and 2050, the rule is expected to generate health benefits worth $392,641,606.



The health incidences covered in this analysis include Adult Mortality, Infant Mortality, Non-fatal Heart Attacks, Respiratory Hospital Admissions, Cardiovascular-related Hospital Admissions, Acute Bronchitis, Upper Respiratory Symptoms, Lower Respiratory Symptoms, Asthma Exacerbations (attacks, shortness of breath, & wheezing), Asthma Emergency Room visits, Minor Restricted Activity Days, and Work Loss Days.

Another way of looking at total health benefits from this rule is presented in Table 2. Table 2 gives the yearly breakdown on health benefits for the ACT and Low NOx rules according to EPA's COBRA model.

Table 2
Health Benefit Savings
(3% Discount Rate)

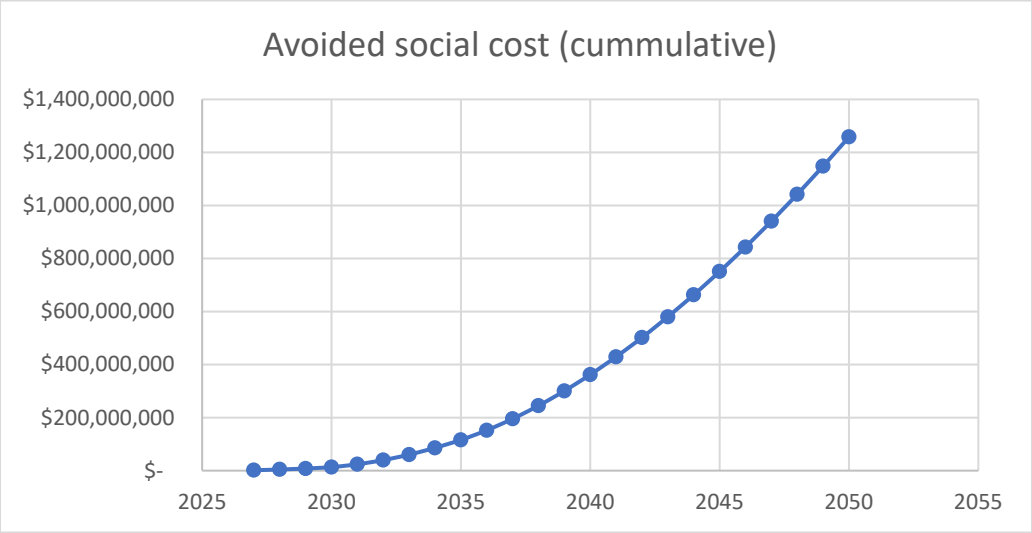
Year	ACT (millions of dollars)	Low NOx (millions of dollars)	ACT + Low NOx (millions of dollars)
2027	0.6	0.9	1.2
2028	0.9	1.3	1.8
2029	1.2	1.8	2.5
2030	1.6	2.3	3.1
2031	2.7	3.0	4.5
2032	3.8	3.7	5.9
2033	4.9	4.4	7.3
2034	6.1	5.1	8.7
2035	7.3	5.9	10.2
2036	8.5	6.7	11.7
2037	9.7	7.5	13.2
2038	11.0	8.3	14.7
2039	12.3	9.2	16.3
2040	13.5	10.1	17.8
2041	15.0	10.9	19.5
2042	16.5	11.7	21.3
2043	18.0	12.5	23.0
2044	19.6	13.3	24.8
2045	21.1	14.2	26.6
2046	22.6	14.9	28.3
2047	24.1	15.7	30.0
2048	25.6	16.5	31.7
2049	27.2	17.3	33.5
2050	28.8	18.1	35.3
TOTAL	302.7	215.2	392.6

Greenhouse Gas Reductions and the Social Cost of Carbon

One principal benefit of this rule is the reduction in Greenhouse Gases (GHG) achieved through the adoption of electric and other zero emitting vehicles through the ACT. Switching to electrical generation for motive power, from the internal-engine combustion of conventional fuels, will result in lower emissions of GHGs, especially as Colorado's electrical grid becomes cleaner, with a larger percentage of electrical generation coming from renewal sources. This, as well as the intrinsic increased energy efficiency from the use of electric vehicles, permitting vehicles to travel further on the same amount of energy, will permit carbon emissions to be reduced.

Reductions in greenhouse gas emissions will impact climate change to an extent which has social implications attached to them. These implications may be quantified in terms of the social cost of carbon, as derived from the Interagency Working Group on Social Cost of Greenhouse Gases, dated February 2021.

Adoption of this rule will result in considerable reductions in GHG emissions. The Department estimates that implementation of the rules through Model Year 2050 will reduce GHG emissions by 21.89 million metric tons. Using the social cost of carbon detailed in Table 3, the monetary value of this reduction in GHG emissions is $1,258,155,868.



This value is determined by using the social cost of carbon, which is the monetary value of the net harm to society associated with adding a metric ton of GHG to the atmosphere in a given year. It includes the value of all climate change impacts, including changes in net agricultural productivity, human health effects, property damage from increased flood risk, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services.

Table 3 Social Cost of Carbon per ton of Carbon	
Year	Social Cost of Carbon/mtCO2e (2.5% discount rate)
2027	$ 85.56
2028	$ 86.87
2029	$ 88.18
2030	$ 89.48
2031	$ 90.84
2032	$ 92.21
2033	$ 93.57
2034	$ 94.93
2035	$ 96.30
2036	$ 97.66
2037	$ 99.02
2038	$ 100.39
2039	$ 101.75
2040	$ 103.11
2041	$ 104.45
2042	$ 105.79
2043	$ 107.12
2044	$ 108.46
2045	$ 109.79
2046	$ 111.13
2047	$ 112.46
2048	$ 113.80
2049	$ 115.14
2050	$ 116.47

The social cost of carbon may also be calculated on an annual basis. Table 4 provides a yearly breakdown of the benefit the rule has on the social cost of carbon.

Table 4 Savings for Social Cost of Carbon (2.5% Discount Rate)	
Year	ACT (millions of dollars)
2027	1.5
2028	2.9
2029	3.5
2030	4.9
2031	11.0
2032	15.6
2033	20.7
2034	25.6
2035	29.8
2036	36.3
2037	43.4
2038	49.6
2039	55.6
2040	61.5
2041	67.3
2042	72.8
2043	78.2
2044	82.9
2045	88.1
2046	92.1
2047	97.2
2048	101.7
2049	106.0
2050	110.3
TOTAL	1258.2

Fuel Savings

Businesses, fleets, and vehicle owners that use and operate battery-electric vehicles will experience economic benefits from the use of electric vehicles through substantial fuel and maintenance economic savings.

Electric vehicles are fundamentally more efficient than internal combustion powered motor vehicles. This increased efficiency directly translates into improved fuel economy. In fleet use, where most medium and heavy-duty electric vehicles operate, electrical costs will also be lower. It is projected that fuel cost savings will be 23.6 billion dollars through model year 2050 vehicles, when a 3% discount rate is applied. Table 5 gives a yearly breakdown of fuel cost savings for the ACT rule. Fuel prices and the cost of electricity is derived from the Annual Energy Outlook 2022 published by the Energy Information Agency.

Table 5
Fuel Savings
(3% Discount Rate)

Year	ACT (millions of dollars)
2027	0.5
2028	6.2
2029	21.4
2030	44.1
2031	81.8
2032	127.9
2033	181.9
2034	243.5
2035	312.9
2036	384.2
2037	457.6
2038	532.2
2039	605.0
2040	674.1
2041	743.2
2042	827.8
2043	904.5

2044	984.4
2045	1065.6
2046	1141.8
2047	1215.7
2048	1289.1
2049	1361.9
2050	1434.9
2051	1332.8
2052	1264.5
2053	1126.5
2054	1021.3
2055	913.8
2056	803.1
2057	690.5
2058	575.4
2059	458.3
2060	340.3
2061	221.2
2062	101.3
2063	67.6
2064	33.9
TOTAL	23592.6

Reduced Maintenance Costs

As well as being more fuel efficient, battery electric vehicles are also much simpler mechanically than conventional vehicles with far fewer moving parts to wear out or that need to be maintained or adjusted. Due to this, maintenance costs will be lower on these electric vehicles.

It is projected that maintenance savings for electric vehicles that are adopted through this rule will be 3.7 billion dollars through model year 2050 vehicles, when a 3% discount rate is applied. Table 6 details the yearly breakdown maintenance cost savings for the ACT and Low NOx rules. Data from California's Advanced Clean Trucks - Regulation Standardized Regulatory Impact Assessment (SRIA), as published August 8, 2019, was utilized in these calculations.

Table 6 Maintenance Savings (3% Discount Rate)	
Year	ACT (millions of dollars)
2027	0.2
2028	2.1
2029	6.7
2030	13.5
2031	21.0
2032	30.3
2033	41.0
2034	53.1
2035	66.3
2036	79.5
2037	92.5
2038	105.3
2039	116.8
2040	126.4
2041	134.8
2042	147.0
2043	156.8
2044	166.0
2045	174.8
2046	181.5
2047	186.7
2048	191.5
2049	195.9
2050	199.8
2051	183.3
2052	167.1
2053	151.1

2054	135.1
2055	119.2
2056	103.5
2057	87.8
2058	72.3
2059	57.0
2060	42.0
2061	27.2
2062	12.7
2063	8.3
2064	4.1
TOTAL	3659.6

Summary of Costs and Savings

Accounting for all the costs and benefits, the overall savings from adoption of ACT and Low NOx is expected to be approximately 15.8 billion dollars through Model Year 2050, as detailed in the chart.

Proposed Advanced Clean Truck and Low NOx Costs/Savings through Model Year 2050 at 3% Discount Rate with IRA		
COSTS/SAVINGS	**Through 2050 Model Year**	**Note**
Incremental Vehicle Costs+	$4,811,620,585	Cost
Fuel Cost Savings	-$23,592,601,032	Saving
Maintenance Savings	-$3,659,619,755	Saving
Infrastructure Costs+	$8,318,115,566	Cost
Health Benefit Savings	-$392,641,607	Saving
Social Cost of Carbon	-$1,258,155,869	Saving
TOTAL SAVINGS*	**-$15,773,282,112**	**SAVINGS**
+Adjusted by IRA		

3. **The anticipated costs of the rule or amendment, which shall include the direct costs to the government to administer the rule or amendment and the direct and indirect costs to business and other entities required to comply with the rule or amendment.**

Direct Costs to Government

Adoption of the ACT, Low NOx and the LER rules will result in the need for an additional 2.0 full time equivalent (FTE) positions within the Air Pollution Control Division, Colorado Department of Public Health and Environment. The two additional FTE will be required to administer the provisions contained in ACT and Low NOx emissions programs, including the monitoring and tracking of credits/debits of medium and heavy-duty manufacturers, as well as aiding in the enforcement of these programs. These new positions would also undertake other program duties as assigned.

The cost to the state is expected to be approximately $211,500 for the first year, of which $175,200 would be for staff salary and benefits. Associated support equipment and administrative costs will be $26,300, and $10,000 in computer, office equipment, and indirect (overhead). Staff salary and benefits are annual costs that will continue as long as the program is operating. The Division expects that the nominal costs will slowly increase from year to year but doesn't have sufficient information to quantify these increases. It is not, however, expected to increase by more than the inflation rate at the time.

Direct and Indirect Costs to Businesses and Other Entities to Comply

One-Time Fleet Survey

Businesses, government fleets, and other entities that are required to submit a one-time fleet reporting survey will be affected by this rule. This survey is expected to take a minimum of time and effort for most fleets but will still incur a cost to businesses and fleets.

The survey is required for fleets of 20 or more vehicles. Based upon available data, the Division estimates that this rule will affect 1215 fleets.

Most large fleet records are maintained electronically, so fleet information should be relatively obtainable. At an estimated cost of $1600 per fleet, principally staff time and effort, the total cost of this survey is expected to be $1,944,000 based on 1215 fleets reporting.

Increased Vehicles Costs

Both the ACT and Low NOx rules will result in increased vehicle costs to businesses, fleets, and vehicle purchasers. For the ACT program, the innovative and emerging state of battery-powered heavy-duty electric vehicles, along with economies of scale that have yet to be developed, increase the cost of these vehicles as related to conventional fueled vehicles. For the Low NOx component of proposed Regulation Number 20, the increased stringency of emissions standards and vehicle lifetime and warranty requirements will result in additional engine after-treatment equipment and other methods of reducing vehicle emissions, as well as designing and building more robust and durable vehicles.

It is presumed that these costs will be passed on in the form of the selling price of the vehicle. Using incremental costs differentials developed by California Air Resources Board (CARB) applied to projected vehicle sales in Colorado, it is estimated that this rule will cost businesses, fleets, and vehicle purchasers 4.81 billion dollars in increased vehicle costs through model year 2050 vehicles. Most of this cost will be for the purchase of electric vehicles, estimated to be 4.75 billion dollars. The Low NOx component is estimated to have an incremental vehicle cost of 61.48 million dollars

The assumptions used in this analysis are conservative in that they remain constant after model year 2035. If the incremental cost per electric vehicle reaches parity sooner than the assumptions used in this analysis or after 2035, the total incremental costs will be less. Similarly, if costs associated with meeting the Omnibus standards are reduced, then the incremental costs per vehicle will again be reduced. Table 7 quantifies the yearly increased vehicle costs associated with the ACT and Low NOx rules.

Table 7 Vehicle Technology Costs (Compliance Costs, 3% Discount Rate)			
Year	ACT (millions of dollars)	Low NOx (millions of dollars)	Total (millions of dollars)
2027	3.9	1.1	5.0
2028	43.2	1.0	44.2
2029	111.4	1.0	112.3
2030	94.9	0.9	95.8
2031	124.5	2.9	127.3
2032	152.3	2.8	155.0
2033	178.3	2.7	181.0
2034	202.8	2.6	205.4
2035	214.7	2.5	217.3
2036	219.2	2.6	221.8
2037	223.2	2.7	225.9
2038	226.8	2.7	229.5
2039	230.0	2.8	232.8
2040	232.9	2.8	235.7
2041	243.5	2.9	246.4
2042	253.4	2.9	256.3
2043	262.5	3.0	265.5
2044	270.8	3.0	273.8
2045	278.4	3.1	281.5
2046	283.5	3.1	286.6
2047	288.1	3.1	291.2
2048	292.1	3.1	295.3
2049	295.7	3.1	298.8
2050	298.8	3.1	302.0
TOTAL	5025.0	61.5	5086.4

Infrastructure Costs

The other major cost to businesses and other entities is the cost of purchasing, installing, and maintaining the infrastructure necessary to support battery-electric and hydrogen fueled vehicles. This is limited to the ACT portion of the proposed rule. Fueling and maintenance infrastructure requirements for the Low NOx component are the same as for existing vehicle rules.

Conventional powered vehicles have established support infrastructure that has been developed over the decades, ranging from fleet operation centers and garages, and maintenance facilities, to refueling infrastructure and fuel distribution networks.

This contrasts with the infrastructure for electric vehicles, which is still being developed. Fleet facilities including charging stations, as well as power network and the electrical grid all need to be expanded or upgraded to handle electric vehicles.

For this CBA Infrastructure cost assumptions are based on an analysis conducted by from the International Council on Clean Transportation (ICCT). Cost information for charging infrastructure from ICCT is given in the following chart.

Table ES-1. Charging infrastructure for increasing electric truck volume in three applications

Application	Case	Number of trucks	Charging outlets	Infrastructure cost per truck (thousand)	Vehicle ownership cost versus diesel
Delivery (Class 6, 9.75-13 tons)	Low volume	100	130	$82	0% to +5%
	Medium volume	1,000	820	$40	-15% to -10%
	High volume	10,000	6,300	$27	-25% to -20%
Drayage (Class 7-8, 13+ tons)	Low volume	100	100	$58	+10% to +25%
	Medium volume	1,000	810	$38	0% to +5%
	High volume	10,000	7,300	$28	-15% to -10%
Long haul (Class 8, 16.5+ tons)	Low volume	100	150	$189	+13% to +18%
	Medium volume	1,000	1,200	$114	+5% to +10%
	High volume	10,000	9,700	$71	-5% to 0%

For high-powered level 2 chargers, the average cost of chargers had been estimated using available state charger cost data including equipment, installation and utility upgrade costs. It assumes a price of $27,667 for each charging port for a level 2 unit for class 4-5 vehicle recharging, with one charge port per vehicle. Table 8 provides a yearly breakdown of total projected increased infrastructure costs associated with the ACT rule.

Table 8 ACT Infrastructure Costs (Compliance Costs, 3% Discount Rate)	
Year	ACT (millions of dollars)
2027	4.3
2028	52.3
2029	141.6
2030	213.3
2031	285.2
2032	250.6
2033	297.7
2034	341.8
2035	383.1
2036	389.6
2037	395.4
2038	400.5
2039	404.9
2040	408.8
2041	425.3
2042	440.6
2043	454.6
2044	467.3
2045	479.0
2046	486.5
2047	493.1
2048	498.9
2049	504.0
2050	508.3
TOTAL	8726.5

Ownership Taxes

One cost to businesses, fleets, and vehicle owners is the cost to register or reregister a vehicle. The increased cost of vehicles resulting from this rule will have a direct impact on businesses, fleets, and vehicle owners, especially for electric vehicles purchasers under ACT, though vehicles subject to the Low NOx program are also affected to a lesser degree.

It is estimated that businesses, fleets, and vehicle purchasers will incur an increase in registration and re-registration costs of 481.1 million dollars through 2050. Table 9 provides a yearly breakdown on increased registration costs for the ACT and Low NOx rules. Data from the Colorado Department of Revenue was used in this projection.

Table 9
Ownership Taxes
(3% Discount Rate)

Year	ACT (millions of dollars)	Low NOx (millions of dollars)	Total (millions of dollars)
2027	0.2	2.3	2.5
2028	2.1	2.2	4.3
2029	5.5	2.0	7.5
2030	8.2	1.8	10.0
2031	10.8	1.7	12.5
2032	13.1	1.6	14.8
2033	15.4	1.5	16.9
2034	17.5	1.5	18.9
2035	19.4	1.4	20.8
2036	19.8	1.4	21.2
2037	20.2	1.4	21.6
2038	20.5	1.4	21.9
2039	20.8	1.4	22.2
2040	21.0	1.4	22.4
2041	21.9	1.4	23.4
2042	22.8	1.5	24.3
2043	23.6	1.5	25.1
2044	24.4	1.5	25.8

2045	25.0	1.5	26.5
2046	25.5	1.5	27.0
2047	25.9	1.5	27.4
2048	26.2	1.5	27.7
2049	26.5	1.5	28.0
2050	26.8	1.5	28.3
TOTAL	443.1	38.0	481.1

Sales Taxes[11]

A cost to businesses, fleets, and vehicle owners is taxes connected to the purchase of vehicles that are more expensive to purchase. This is more so for electric vehicles subject to ACT, though vehicles subject to the Low NOx program are also affected. Sales taxes vary throughout Colorado. To simplify this cost analysis, sales taxes for the City and County of Denver are used.

Using this assumption, it is projected that businesses, fleets, and vehicle purchasers will have an increase in sales taxes on vehicle purchases of 938.0 million dollars through 2050. Table 10 gives the yearly increase cost of vehicle collected sales taxes between ACT and Low NOx vehicles.

Table 10
Sales Taxes
(Compliance Costs, 3% Discount Rate)

Year	ACT (millions of dollars)	Low Nox (millions of dollars)	Total (millions of dollars)
2027	0.7	0.2	0.9
2028	7.9	0.2	8.1
2029	20.4	0.2	20.6
2030	17.4	0.2	17.6
2031	22.9	0.6	23.5
2032	28.1	0.6	28.7
2033	33.0	0.6	33.5
2034	37.5	0.5	38.1
2035	39.7	0.5	40.2
2036	40.5	0.5	41.0
2037	41.2	0.6	41.8

[11] While businesses will incur additional sales and ownership taxes associated with the higher incremental costs of the vehicles, they will also realize fuel tax savings, which are reflected as part of the overall fuel savings from the rules discussed.

2038	41.8	0.6	42.4
2039	42.4	0.6	43.0
2040	42.9	0.6	43.5
2041	44.9	0.6	45.5
2042	46.7	0.6	47.3
2043	48.3	0.6	48.9
2044	49.8	0.6	50.5
2045	51.2	0.6	51.8
2046	52.1	0.6	52.8
2047	52.9	0.6	53.6
2048	53.7	0.6	54.3
2049	54.3	0.7	55.0
2050	54.9	0.7	55.5
TOTAL	925.2	12.8	938.0

4. **Any adverse effects on the economy, consumer, private markets, small businesses, job creation, and economic competitiveness.**

   The rule implementing the ACT and Low NOx programs will have overall health and environmental cost benefits, as well as significant economic savings for vehicle owners.

   As with any new technology, the introduction of electric vehicles will create disruptions in current vehicle sales and usage practices. This rule will speed up these disruptions, but given current manufacturing trends, these disruptions will occur absent the rules. In fact, the adoption of proposed Regulation Number 20 may smooth out the transition to the introduction of heavy-duty electric vehicles into the vehicle fleet through early adoption, and prevent more lasting adverse effects later by encouraging the development of vehicle markets, infrastructure, and operational awareness of these vehicles in the near term. This may improve Colorado's economic competitiveness in the future.

   Vehicle fleets and the businesses associated with the introduction, operation and maintenance of heavy-duty vehicles will experience economic impacts, detailed earlier, when purchasing, operating, or registering a vehicle. Fleets will have to put into place the infrastructure necessary to support the adoption, operation, and maintenance of electric vehicles, from recharging units to electrical distribution upgrades, and changes to their maintenance shops. Electric providers will have to expand and upgrade their energy generation and distribution network. All of these changes will occur over a period of time, lessening their impacts.

   Small businesses may be unable to afford a new electric vehicle or purchase the electric vehicle that they need to conduct their business. In this case, conventionally fueled vehicles will remain available to these businesses, perhaps at slightly higher purchase price as influenced by the stricter emissions, vehicle lifetime, and warranty requirements of the Low NOx rule.

Vehicle technicians that are involved in vehicle maintenance may be impacted, though it will take decades to fully transition to an all-electric fleet. While not quantified, additional training may be necessary for those technicians working on electric ACT vehicles. Reduction in the need for maintenance of these vehicles may also have an impact. There will be a loss of 3.7 billion dollars in maintenance costs through the model year 2050 vehicle's lifetimes.

Fuel providers, distributors, and marketers will be impacted by the loss of business with the introduction of heavy-duty electric vehicles. As stated, fuel providers will lose 23.6 billion dollars of business through the 2050 model year vehicle's lifetimes. Much of this loss will be from product imported into the state, so the localized impact may be mitigated to a certain extent.

5. At least two alternatives to the proposed rule or amendment that can be identified by the submitting agency or a member of the public, including the costs and benefits of pursuing each of the alternatives identified.

Section 177 of the federal Clean Air Act (CAA) allows states to adopt California standards for vehicles sold within their borders.[12] Under the Identicality requirements of Section 177, states are not allowed to develop their own standards. This Identicality standard was adopted to create a very narrow exception to the Federal government's broad jurisdictional preemption of new motor vehicle emission standards.[13] The CAA is clear, however, that states must utilize either Federal or California vehicle standards. Given this jurisdictional preemption, Colorado's alternatives with respect to medium and heavy duty vehicle standards are very limited. The most obvious alternative, is the no-action alternative whereby the Commission would not adopt any new program and instead allow Colorado to continue to be subject to federal vehicle standards. Alternatively, the Commission could adopt pieces of the Division's proposal. While Colorado cannot create its own vehicle standards, it is not prohibited from adopting portions of the California program. Accordingly, the Commission could adopt the ACT program alone, or could adopt the Low NOx program alone. The costs and benefits of these three options are further discussed.

By definition, the no-action alternative will not result in any additional costs or benefits relative to the current state. However, because the package of proposed rules is projected to result in both significant emission reduction benefits and significant cost-savings, the no-action alternative will result in a lost opportunity to achieve the projected benefits and savings. As detailed, the package of proposed rules is projected to reduce GHG emissions by 21.89 million metric tons, NOx emissions by 32,210 tons, and PM2.5 by 275 tons. Overall financial savings from the proposed rules are estimated at approximately 15.8 billion dollars. These benefits and savings will not be achieved under the no-action alternative. Adoption of ACT alone would result in substantial GHG and NOx reductions, as well as create substantial cost savings primarily resulting from the fuel and maintenance savings attributable to electric vehicles. From an emission reduction perspective ACT alone is projected to reduce GHGs by 21.89 million metric tons and NOx by 16,355 tons through Model Year 2050. Costs and savings from the ACT alone scenario are summarized in the following chart.

[12] 42 U.S.C § 7507.

[13] *Id. See also* Washington v. General Motors Corp., 406 U.S. 109 (1972).

Proposed Advanced Clean Trucks Costs/Savings through Model Year 2050 at 3% Discount Rate with IRA		
COSTS/SAVINGS	**Through 2050 Model Year**	**Note**
Incremental Vehicle Costs+	$4,750,137,529	Cost
Fuel Cost Savings	-$23,592,601,032	Saving
Maintenance Savings	-$3,659,619,755	Saving
Infrastructure Costs+	$8,318,115,566	Cost
Health Benefit Savings	-$302,714,921	Saving
Social Cost of Carbon	-$1,258,155,869	Saving
TOTAL SAVINGS*	**-$15,744,838,482**	**SAVINGS**
+Adjusted by IRA		

Table 2 through Table 10 and the accompanying text, provide additional detail on the costs and benefits of the ACT alone alternative

Adoption of Low NOx alone would result in projected NOx reductions or 21,090 tons through Model Year 2050. The adoption of Low NOx alone will also result in a net cost to vehicle owners of approximately 61 million dollars associated with the increased incremental vehicle costs necessary to achieve the more stringent NOx emission standards. These increased costs will be offset by health savings of approximately 215 million dollars. Costs and savings from the Low NOx alone alternative are summarized in the following chart.

Proposed Low NOx Costs/Savings through Model Year 2050 at 3% Discount Rate with IRA		
COSTS/SAVINGS	**Through 2050 Model Year**	**Note**
Incremental Vehicle Costs+	$61,483,056	Cost
Fuel Cost Savings	$0	Saving
Maintenance Savings	$0	Saving
Infrastructure Costs	$0	Cost
Health Benefit Savings	-$215,213,557	Saving
Social Cost of Carbon	$0	Saving
TOTAL SAVINGS*	**-$153,730,501**	**SAVINGS**

Tables 2, 7, 9, and 10 and accompanying text provide additional detail on the costs and benefits of the Low NOx alone alternative.

2. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 28, Building Benchmarking and Performance Standards, August 4, 2023.

COST-BENEFIT ANALYSIS

In performing a cost-benefit analysis, each rulemaking entity must provide the information requested for the cost-benefit analysis to be considered a good faith effort. The cost-benefit analysis must be submitted to the Office of Policy, Research and Regulatory Reform at least ten (10) days before the administrative hearing on the proposed rule and posted on your agency's web site. For all questions, please attach all underlying data that supports the statements or figures stated in this cost-benefit analysis.

DEPARTMENT: Colorado Department of Public Health and Environment

AGENCY: Air Pollution Control Division

CCR: 5 CCR 1001-32

DATE: August 4, 2023

RULE TITLE OR SUBJECT:

REGULATION NUMBER 28: Building Benchmarking and Performance Standards

Per the provisions of 24-1-103(2.5)(a), Colorado Revised Statutes, the cost-benefit analysis must include the following:

1. The reason for the rule or amendment;

The Division is proposing a new Regulation Number 28, Building Benchmarking and Performance Standards, to satisfy the requirements the General Assembly in House Bill 21-1286 (Concerning Measures to Improve Energy Efficiency) (HB 21-1286) directing the Commission's adoption of building benchmarking and performance standards for covered buildings. The Colorado Air Pollution Prevention and Control Act Section 25-7-142(8)(c) directs the Commission to adopt rules to establish building performance standards on or before June 1, 2023, later amended to September 1, 2023[1], "that will achieve a reduction in greenhouse gas emissions of [7%] by 2026 as compared to 2021 levels" and "a reduction in greenhouse gas emissions of [20%] by 2030 as compared to 2021 levels," as set forth in Section 25-7-142(8). Building benchmarking and performance standards will require covered buildings to implement measures that benchmark and report their energy use and implement measures to reduce energy use and greenhouse gas (GHG) emissions. Reduction targets for buildings covered under this regulation are based on 2021 benchmarking data as reported in 2022.[2] Covered buildings constructed after 2021 will be required to comply with the performance standards. In 2022, using benchmarking data from 2021, covered buildings subject to these rules were responsible for approximately 8,878,000 metric tons of carbon dioxide equivalent emissions resulting from the energy consumption of those buildings.[3] These standards, which cover commercial, multifamily, and public buildings that are 50,000 square feet and larger, are expected to, among other things, help reduce statewide GHG emissions, lower energy costs, and foster job growth.

The proposed regulation was developed in conjunction with Colorado Energy Office (CEO) and considering the BPS Task Force Recommendations, a Task Force directed by HB 21-1286 and led by CEO. In addition, the Division held public listening sessions and engaged with parties to the rulemaking to further inform the proposal.

Further discussions about the rule can be found in the Division's request for hearing and rulemaking documents.[4]

2. The anticipated economic benefits of the rule or amendment, which shall include economic growth, the creation of new jobs, and increased economic competitiveness;

   A. Economic growth

[1] *See House Bill 23-016 (Concerning Measures to Promote Reductions in Greenhouse Gas Emissions in Colorado) revising 25-7-142(8)(a)(II), C.R.S.*
[2] *See https://docs.google.com/document/d/1S4HhTnvT7jmv8mrTECsjQ0DKWkJ1RJpDhp60d6OC2-g*
[3] *See Rebuttal Proposal, SBAP at p. 30*
[4] *See https://drive.google.com/drive/u/0/folders/16Lxsl3tNw7E6ScmKcx_lxFpah7err-SF*

The cost associated with generating the benefit expected to result from implementing this rule are estimated using the U.S. Department of Energy's (DOE) report on the economics of efficiency improvement measures (Advanced Energy Retrofit Guide: Office Buildings (pnnl.gov)). Given these analyses on the cost and benefits of various energy efficiency measures, including the corresponding energy saving, the cost of implementing this rule and its breakdown in terms of the different cost components are estimated by working backwards from the energy savings estimated to result from implementing this rule. The capital and operation and maintenance (O&M) costs are the costs for obtaining, installing, and operating and maintaining the equipment to meet the performance standard. The net present value of the capital and O&M costs are determined using a discounting analysis.

The energy savings and GHG reduction from implementing the rule are expected to result in a total benefit of $6,393,832,373.[5]

This revised benefit is an update to what was included in the Division's initial and final Economic Impact Analyses (EIA). This update is a result of three different factors: additional and cleaned benchmarking data; changes to future or new building energy metrics; and correction of a miscalculation in the 2030 greenhouse gas Intensity (GHGi) targets. After the submission of the initial EIA, additional benchmarking data was submitted to the State that allowed the EUI and GHGi targets to be refined for better representation of Colorado-specific targets. After the submission of the final EIA, CEO and the Division were informed by CEO's consultant, Group 14, that the 2030 GHGi targets incorrectly used the 2026 emission factors, which resulted in revised targets once the correct 2030 emission factors were applied. Lastly, the new building energy use was adjusted in the analysis for the current targets based on information obtained from the U.S. Department of Energy's Pacific Northwest National Laboratory regarding projected EUI reductions for new buildings, as well as the City and County of Denver's Energize Denver requirements for new buildings. Future building energy demand must be accounted for in order to reduce sector-wide building emissions to meet the future emission reduction goals.

Considering the revised targets, the Division recalculated the costs and benefits of the proposed regulation and found that energy and emission savings decreased by approximately a third, resulting in decreases in the corresponding costs. The updated analysis still finds that the proposed regulation provides an overall positive return, approximately $3.60 for every dollar spent when considering energy savings and the social cost of GHG emissions avoided. When considering only the energy savings, there is still a projected benefit of approximately $2.91 for each dollar in cost.

As discussed in the above referenced initial and final EIA[6], the Division found that the cost-benefit ratio stays above 1 even under scenarios where the cost of capital and operation and maintenance are higher than what was assumed for the analysis, meaning the proposed rule still results in an overall benefit to Colorado. The price of electricity and natural gas as well as the costs of capital and operation and maintenance were analyzed by differences of 25% and 50% in the analysis, creating four different scenarios for each cost-benefit component that are 50% less than the original value, 25% less than the original value, 25% more than the original value, and 50% more than the original value.

When the price of electricity and natural gas increase, the benefit/cost ratio increases because it represents greater savings, with the highest ratio being 4.88 when the price of electricity is 50% higher than the figure used in the initial analysis.[7]

When higher cost figures are used for capital and operation and maintenance, the benefit/cost ratio decreases, with the lowest ratio being 2.6 when the cost of capital is 50% more than the figure used in the initial analysis.[8]

The results of these sensitivity analyses show that the benefit/cost ratio is above 1 even when higher cost figures are considered, demonstrating that even under such cost scenarios the benefit of implementing this rule is greater than the cost.

[5] *See APCD Final Economic Impact Analysis at p. 3*
[6] *Id. at p. 4*
[7] *Id. at p. 4*
[8] *Id. at p. 4*

Benefits		Costs	
Avoided Social Cost	$1,239,234,731	Capital Cost	$1,496,120,487
Electricity Savings	$4,577,040,161	O&M Cost	$229,705,746
Natural Gas Savings	$577,557,481	Benchmarking Cost	$34,654,360
		Program Administration Cost	$8,855,599
Energy Savings	*$5,154,597,642*		
Total	**$6,393,832,373**		**$1,769,336,191**

B. Creation of new jobs

It is uncertain exactly how many new jobs will be created from the implementation of the building performance standards but evidence supports the creation of new jobs in Colorado as a result of this rule. According to the International Energy Agency, six to fifteen jobs are created for every $1 million USD spent on building efficiency.[9] Based on the estimated direct total costs expected to be incurred by the government and buildings subject to the proposed rule (i.e., $1,769,336,191[10]), approximately 10,616 to 26,540 additional building efficiency jobs will be created in Colorado between 2024 to 2050. The Division anticipates that future job growth will be closer to the scenario where six jobs are created for every $1 million. The building performance standards will create more labor demand in the buildings and renewable energy industries, increased demand for union and non-union trade workers in these industries, and will support workforce growth and development in these industries throughout its implementation. On average, workers in the energy efficiency industry "earn 28% above the national median wage, and union workers have higher median earnings than non-union members."[11]

C. Increased economic competitiveness

As discussed in the Division's EIA, one of the benefits of this rule is the utility cost savings that may be realized by the building owner or payer of the building's natural gas and electricity. Reduced energy bills for a given year are determined by multiplying the energy savings that are projected for that year by the projected price of natural gas and electricity that applies to that year. The value, thus computed, is discounted to find its present value equivalent. The electricity and natural gas savings resulting from this rule are estimated to be $4,577,040,161 and $577,557,481, respectively.[12]

A study from the Institute for Market Transformation showed that green buildings or buildings that are more efficient than average can generally charge a premium for leased space and that occupancy retention is also higher in these buildings.[13] Buildings implementing building performance standards can see increased economic competitiveness from improvements made to the building that add value and consumer desirability. Much of the added value stems from the level of compliance the building is currently at and reductions in energy usage. If a building were to meet 2030 building performance standards today, it would be more desirable to a purchaser or lessee because the building would already be in compliance with the regulation and would not be required to focus on further improving building operations until new standards are set.

Another advantage that comes from implementing energy efficiency measures is the cost savings from onsite reductions in energy demand. ENERGY STAR® certified buildings, which follow efficiency upgrades similar to the proposed State requirements, average energy bills that are "at least $0.50 per square foot lower per year, or 35% lower than the average office building."[14] Implementing efficiency measures to reduce energy usage in buildings comes with many benefits to increase savings, building

[9] *See https://www.iea.org/reports/energy-efficiency-2020/energy-efficiency-jobs-and-the-recovery*
[10] *See APCD Final Economic Impact Analysis at p. 3*
[11] *See https://www.whitehouse.gov/briefing-room/statements-releases/2022/01/21/fact-sheet-biden-harris-administration-launches-coalition-of-states-and-local-governments-to-strengthen-building-performance-standards/*
[12] *See APCD Final Economic Impact Analysis at p. 3*
[13] *See https://www.imt.org/wp-content/uploads/2018/02/PCC_Benefits_of_Benchmarking.pdf at p. 10*
[14] *see https://dc.beam-portal.org/api/v3/media/helpdesk/attachments/kb/BEPS/79/BEPS_Cost-Benefit_Study.pdf at p. 14*

value, and revenue. Energy efficient buildings are found to have increased resale value (2-17%), increased rental rates (5.8 - 35%), higher occupancy rates (0.9 -18%), lower operating expenses (30%), and higher net operating income (5.9%).[15] These same buildings were also found to have lower maintenance costs (25 - 30%) and increased production (20 - 25%), showing that energy efficient implementation will also help to lower overall operation and maintenance costs for a building.[16]

D. Other benefits

a. Social Cost of Greenhouse Gases

In line with Sections 110.5(4)(f) and 25-7-101, et seq, C.R.S., the social cost of GHG analysis is assessed using a discount rate of two and one-half percent or the social cost of GHG that is established by the federal interagency working group, whichever is higher. The benefit of reducing GHG emissions for a given year is quantified in dollar values by multiplying the projected reduction in GHG emission of that year by the social cost of carbon that applies to that year. This value is then discounted to find its present value equivalent. For the time frame considered, the implementation of the proposed rule is expected to lead to a cumulative reduction of 18,166,886 metric tons of carbon dioxide equivalent.[17] The avoided cost of climate change that is avoided each of those years adds up to $1,239,234,731.[18]

		2026	2030
Target Percentile		40th Percentile	20th Percentile
Assumed Compliance Rate (% of Buildings)		All Covered Buildings	All Covered Buildings
% Reduction Pathway		13%	29%
	2021	**2026**	**2030**
BAU Energy (MMBtu)	80,367,852	82,344,423	83,292,422
BAU % of Energy from Fossil Gas (%)	54%	53%	52%
2021 Baseline Emissions (mt CO_2e)	8,877,564	4,977,622	3,618,551
BAU Emissions with NC (mt CO_2e)	8,877,564	5,107,886	3,716,831
Sector-Wide GHG Reduction Goal (%)		**7%**	**20%**
Emissions Reduction Goal (mt CO_2e)		348,434	723,710
BPS Emissions Target (mt CO_2e)		**4,629,188**	**2,894,841**
Emissions Reduction Below Baseline with NC (%)		**10%**	**23%**
Projected Emissions Savings (mt CO_2e)		**484,765**	**845,936**
Projected Emissions (mt CO_2e)		**4,623,121**	**2,870,895**
Percent Reduction from Baseline (%)		**7.1%**	**20.7%**
% of Buildings Pursuing % Reduction Pathway		**64%**	**60%**
% of Buildings Pursuing Target Path		**36%**	**40%**

3. The anticipated costs of the rule or amendment, which shall include the direct costs to the government to administer the rule or amendment and the direct and indirect costs to business and other entities required to comply with the rule or amendment;

A. Direct costs to the government to administer the rules

The direct costs estimated to be incurred by the State from this rule come from the anticipated governmental program administration costs. These costs are attributed to the implementation and maintenance of the rule and are estimated at $8,855,599.[19] As mandated in statute, the costs to administer the program are intended to be covered through the annual $100 per covered building fee. Additional costs to the government may occur when or if governments' public buildings become subject the building performance standards; these costs were estimated and accounted for in the direct costs to buildings and not specifically addressed in the direct cost analysis to the government.

[15] *Id. at p. 14*
[16] *Id. at p. 14*
[17] *See APCD Final Economic Impact Analysis at 5*
[18] *Id. at p. 3*
[19] *Id. at p. 3*

Recognizing the potential increase in compliance assurance work to implement this program, the General Assembly approved expenditures for additional personnel beginning in Fiscal Year 2022-23. More information about future State full time employee cost expenditures can be found in the Energy Performance for Buildings Final Fiscal Note.[20]

B. Direct and indirect costs to business and other entities

The Division estimates that approximately 8,000 buildings may be impacted by the proposed regulation. As discussed in the Division's EIA, for the timeframe of 2024-2050 the capital retrofitting cost associated with implementing the rule is estimated to cost $1,496,120,487.[21] The corresponding O&M cost is estimated to be $229,705,746.[22] Other entities besides covered building owners that may be impacted by the proposed regulation may include supporting businesses such as building energy consultants, equipment providers and installers, trade workers, or other industries closely related to building operation and maintenance.

Analysis from the City and County of Denver shows that partial electrification of gas furnaces using ductless mini-split with gas backup can cost up to 8.5% more in capital cost ($20,750) and operation costs ($609) as compared to a standard gas furnace/air conditioning (AC) unit, but can reduce use of natural gas by up to 82%.[23] Full electrification of gas furnaces using a ducted mini-split system with gas backup can cost up to 30% more in capital cost ($24,750) and 5% in annual operating cost ($661) as compared to a standard gas furnace/AC unit, but would reduce use of natural gas by 100%.[24]

Some measures can also lower operating cost. Full electrification measures such as installing a heat pump rooftop unit with electric resistance backup heating ($93,000 in capital cost, $9,410 in annual operating and utility cost), for instance, can cost up to 5% less in annual total utility operating cost ($364) as compared to using standard gas furnace/AC rooftop units.[25] Partial electrification using a heat pump with gas backup heating ($460,000 in capital cost and $1,775 in annual HVAC operating cost) can also cost up to 9.7% less in annual total utility operating cost ($189) as compared to using packaged terminal air conditioning.[26]

The benchmarking cost associated with implementing the rule is estimated to be $34,654,360.[27] This benchmarking cost, which accrues to building owners and operators, is derived from filing fees and the in-house labor required to report building operational characteristics and performance.

The direct estimated total costs estimated to be incurred by buildings covered under this rule are $1,760,480,593.[28] See cost/benefit table above.

4. Any adverse effects on the economy, consumers, private markets, small businesses, job creation, and economic competitiveness; and

The Division anticipates that the proposed regulation will result in a net benefit for the public based on the associated reductions in GHG emissions and social cost of carbon. However, building owners might pass on some or all of the cost of implementing this rule to their tenants, which could lead to higher rents. In addition to pass-through-rents, implementation of the proposed building performance standards could "harm equity priority communities through gentrification and housing displacement, while benefiting landlords."[29] Other issues may arise with communication and clarity of rule requirements, technological comprehension of reporting and compliance software, and funding for affordable housing and naturally occurring affordable housing.[30]

In contrast, the energy efficiency measures implemented may lead to lower utility bills for the building owners and/or tenants. The net cost to a tenant, which is the difference between the higher rent and the lower utility bill, will depend on considerations such as how much of the cost the building owner pass on to the tenants, if the utility bill was already built into the rent, and the share of the cost that is covered by applicable state and federal programs, among others.

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[20] *See HB21-1286, Final Fiscal Note, July 29, 2021.*
[21] *See APCD Final Economic Impact Analysis at. 3*
[22] *Id. at p. 3*
[23] *See City and County of Denver, The Energize Denver Renewable Heating and Cooling Plan at 30*
[24] *Id. at p. 32*
[25] *Id. at p. 36-37*
[26] *Id. at p. 39*
[27] *See APCD Final Economic Impact Analysis at 3*
[28] *See APCD Final Economic Impact Analysis at 3*
[29] *See CEO_REB_EX_001 at 9*
[30] *See CEO_REB_EX_001 at 9-11*

There are resources and programs for buildings considered affordable housing or under-resourced to ensure that they are equitably taken into consideration during the implementation of this regulation. In addition to this rule, CEO has an online resource hub Building Performance Colorado that provides support and guidance to people impacted by this regulation.[31] The Division provides further details about cost mitigation opportunities in the Division's EIA.[32]

5. At least two alternatives to the proposed rule or amendment that can be identified by the submitting agency or a member of the public, including the costs and benefits of pursuing each of the alternatives identified.

The Commission must adopt rules consistent with HB 21-1286. If the Commission does not adopt the Division's proposed rule, other strategies would need to be identified to meet the statutory directives set forth in Sections 25-7-122, -142, and 24-38.5-112, C.R.S. Additionally, when evaluating alternatives, it is critical to note that the General Assembly specified GHG reduction targets that the rule must accomplish and, in doing so, the Commission must also consider the recommendations of the BPS Task Force. Given these legislative charges, there is no lawful "no action" alternative for the Commission. Furthermore, to the extent that the anticipated reduction in emissions attributable to the proposed rules will reduce statewide GHG pollution, failing to adopt rules with the same or better pollution impacts will require the State to pursue additional strategies in furtherance of the climate goals established in Sections 25-7-102(2) and -105(1)(e), C.R.S.

In addition to the alternatives described below, the Division notes that Denver also provided an alternate proposal to the Division's proposal for consideration by the Commission.[33] The Division appreciates Denver's participation in the rulemaking and has made some revisions to the Division's proposal based on Denver's feedback and suggestions. However, the Division does not propose the adoption of Denver's alternate proposal because Denver's building performance standards were established to meet an overall goal of 30% reduction in energy use, which has not been shown to achieve the statutory GHG reduction goals of HB 21-1286. Also, the targets in Denver's alternate proposal do not align with the Division's statewide weather normalized targets and instead use targets specific for Denver's climate zone. The Division believes that Denver's alternate proposal will not meet the required emission reductions set forth in HB21-1286 and that the Commission should adopt the Division's proposal. The Division's proposed regulation is anticipated to meet the emission reduction goals through benchmarking, compliance pathways, and adjustment provisions that were drafted in response to specific provisions in HB 21-1286 and/or to support implementation of the regulation by CEO.

A. ENERGY STAR score

The Commission could consider elements of building performance standards in other city or state policies, such as using an ENERGY STAR score to measure performance instead of a site-specific energy use intensity (EUI), GHG target, or a fixed percentage target. The Division compiled a list comparing current and proposed building performance standards nationwide to analyze alternative compliance methods and found that while other programs may accomplish similar emission reduction goals they do not necessarily meet the goals specified for the Colorado building performance standards.[34] ENERGY STAR scores compare building energy usage to other building types across the nation and, therefore, may not provide the same level of Colorado-specific data as the proposed site-specific targets.[35] The costs associated with having an ENERGY STAR score as an alternative method could be assumed to be the same as the costs of using the EUI metric; however, the software and reporting could be different and the ENERGY STAR score metrics would be based on a national average instead of a state weather normalized average. Further, the use of an ENERGY STAR score metric would not guarantee that the state meets the specified GHG reduction goals in HB 21-1286 due to the national scope of ENERGY STAR's target scoring. During the drafting of the proposed regulation, the Division focused on providing GHG and energy reduction goals that most accurately matched the climate zones in Colorado to provide more accurate and localized targets for buildings covered under this policy. The Division chose not to use the ENERGY STAR score and instead chose to use a Colorado specific weather normalized EUI metric for target setting to ensure the most equitable targets for buildings covered under the regulation and to meet the statutory GHG reduction goals.

B. Prescriptive Pathway

[31] *See https://www.buildingperformanceco.com/*
[32] *See APCD Final Economic Impact Analysis at 5-8*
[33] *See https://drive.google.com/drive/u/0/folders/1ceFDHUENu-Ms6JXdzpB8wfwb8DtzT-Em*
[34] *See https://drive.google.com/file/d/1D9ncmm82yLLv4EUW5VjXwQ6uQl9v1wsM/view*
[35] *See https://www.energystar.gov/buildings/benchmark/understand_metrics/how_score_calculated*

Another alternative the Commission could consider is a prescriptive pathway to compliance, instead of the proposed multiple compliance pathways, that specifies the measures a covered building owner must achieve in order to meet the GHG emission reduction goals. One potential issue with a prescriptive pathway option is that it may not provide the same level of accountability for covered building owners and could allow building owners to select the most cost-effective measures over efficiency measures for their buildings, therefore not ensuring measures are selected to achieve a greater GHG reduction benefit. Cost-effective implementation does not ensure efficiency and may not be as efficient as other implementations at lowering GHG emissions or energy usage, thereby not ensuring that the program meets the specified GHG reduction goals in HB 21-1286. For example, if building owners were to replace equipment with fossil fuel equipment then emission goals may not be met and costs would increase for the additional emissions. The costs associated with prescriptive pathways when compared to compliance pathways could potentially be the same as the costs associated with the Division's compliance pathways but prescriptive costs may have slightly lesser reporting costs when compared to the Division's proposed compliance pathways. Overall costs for major building upgrades and equipment changes would still be at market rate similar to the costs for the proposed compliance pathways.

The Division notes that, while possibly discussed, these options were not included in the BPS Task Force recommendations.

The Division has in good faith developed this Cost-Benefit Analysis that complies with all requirements of 24-4-103(2.5), C.R.S.

3. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 27, Greenhouse Gas Emissions and Energy Management for Manufacturing, September 8, 2023.

COST-BENEFIT ANALYSIS

In performing a cost-benefit analysis, each rulemaking entity must provide the information requested for the cost-benefit analysis to be considered a good faith effort. The cost-benefit analysis must be submitted to the Office of Policy, Research and Regulatory Reform at least ten (10) days before the administrative hearing on the proposed rule and posted on your agency's web site. For all questions, please attach all underlying data that supports the statements or figures stated in this cost-benefit analysis.

DEPARTMENT: Air Pollution Control Division **AGENCY:** Colorado Department of Public Health and Environment

CCR: 5 CCR 1001-31 **DATE:** September 8, 2023

RULE TITLE OR SUBJECT:

Regulation Number 27, Greenhouse Gas Emissions and Energy Management for Manufacturing

Per the provisions of 24-1-103(2.5)(a), Colorado Revised Statutes, the cost-benefit analysis must include the following:

1. The reason for the rule or amendment;

   The Division is proposing Regulation Number 27 in response to House Bill ("HB") 21-1266 (the "Environmental Justice Act")[1], which amended the Colorado Air Pollution and Prevention Act ("Act") and directed the Commission to adopt rules that reduce GHG emissions from the State's industrial and manufacturing sector.

   The purpose of this regulation is to build on the Commission's previous rules that require manufacturing stationary sources located in Colorado to reduce GHG emissions. Whereas October 2021's GEMM I rulemaking was limited to the energy-intensive, trade-exposed ("EITE") manufacturing stationary sources in the State, the Division's current proposal aims to expand Regulation Number 27 to reduce GHG emissions from manufacturing stationary sources in Colorado with direct GHG emissions equal to or greater than 25,000 mt of CO2e.

   As revised under the proposal, Regulation Number 27 would apply to 18 manufacturing sources in addition to the four EITE sources already covered. The proposal would also adjust the threshold for application of the GEMM I rule (i.e., the portion of Regulation Number 27 applying exclusively to EITE sources) to those with direct GHG emissions of equal to or greater than 25,000 mt of CO2e, to align with the threshold under the proposed revisions to Regulation Number 27.

   Implementing the Division's present proposal is expected to reduce emission by 20% no later than 2030, as compared to the 2015 direct GHG emissions of the covered facilities. By 2050, the anticipated cumulative GHG emissions savings against the 2015 baseline is estimated to be 13,886,100 mt of CO2e.[2] Further discussions about the rule can be found in the Division's request for hearing and rulemaking documents.

2. The anticipated economic benefits of the rule or amendment, which shall include economic growth, the creation of new jobs, and increased economic competitiveness;

[1] House Bill ("HB") 21-1266, 73rd Gen. Assemb., 1st Reg. Sess. (Colo. 2021).
[2] Appendix A at pg. 2.

A. Economic benefit

When calculated against the 2021/2022 baseline, by 2050, the health benefits from limiting co-pollutants and the avoided cost of climate change from reducing GHG emissions are estimated to be worth $460,407,333.[3] Specifically, the avoided cost of climate change resulting from GHG emission reductions is estimated to be worth $395,429,264, and the health benefits of the avoided co-pollutants is estimated to be worth $64,978,069.[4] Based on the methodology used in the Division's EIA to estimate the health benefits of avoided co-pollution reduction, the total benefit estimate has not changed.[5] When calculated against the 2015 baseline, by 2050, the combined health benefits from limiting co-pollutants and the avoided cost of climate change from reducing GHG emissions are estimated to be worth $1,130,405,589.[6]

Whereas the cost per mt of CO2e reduced from the facilities is estimated to be $76.62 in 2023 dollars, by 2050, the benefits of the air pollution reductions proposed by this rule are estimated to be worth over $1,700 per mt of CO2e avoided.[7]

B. Creation of new jobs

Investments made by facilities will have direct, indirect, and induced impacts on the economy. When facilities upgrade their equipment to reduce emissions, that investment creates jobs for individuals installing and operating those equipment as well as for individuals supplying the equipment that are installed, representing direct and indirect impacts, respectively. The wages from these new jobs will lead to additional spending at restaurants, retail malls, and other businesses in the area, creating more jobs at these businesses and representing induced effects.

The multipliers for the 'durables manufacturing' sector, which are the numbers of direct, indirect, and induced jobs created by a $1 million investment are 1.8, 4.9, and 11.6, respectively.[8] Given the estimated cost of compliance and the multipliers for the direct, indirect, and induced effects, this rule is expected to lead to 633 jobs by the end of 2030, with 370 jobs of those jobs created in the year 2030.[9] The number of jobs created is determined by multiplying the number of jobs created per $1 million investment, which are the multipliers described above, with the estimated cost of compliance.

C. **Increased economic competitiveness**

As discussed in the Division's EIA, one of the benefits of this rule is the health benefits that are generated by reducing co-pollutants that have adverse health effects. This increases the economic competitiveness of the state by reducing the health care burden of the state and by contributing to the overall health and wellbeing of the state's workforce. Specifically, by 2050, the rule is expected to reduce mortality, emergency room visits (Asthma), and work loss days by 7.9, 2.67, and 680 days, respectively.[10] These numbers are generated using EPA's Co-Benefits and Risk Analysis (COBRA) tool. These estimates can be generated using this tool after specifying the location, sector and subsectors, as necessary, and inserting the expected yearly emission reduction. The monetary value of these savings involves using the applicable discounting factor for the timeframe under consideration. The Division's EIA contains more information on how the co-pollution levels are estimated and how to access this tool so that parties can verify the analysis as well as run their own scenarios.[11] Health savings that are projected in future years are discounted so as to determine their present value equivalents. A 2.5% discount rate is used for consistency with the analysis quantifying the avoided cost of GHG emissions.

Whereas the decrease in workdays lost contributes to increased productivity, the reduced health cost allows individuals to patronize businesses and contributes to the state's overall economic performance. The health benefits alone, without considering these other additional benefits, is valued at $64,978,069.[12] Given that the co-pollutants considered in this analysis covers only combustion emission and represents a

[3] Appendix A at pg. 1.
[4] *Id.* at pg. 1.
[5] APCD_EIA.pdf, at pg. 12.
[6] Appendix A at pg. 2.
[7] *Id.* at pg. 3.
[8] Economic Policy Institute (available at https://www.epi.org/publication/updated-employment-multipliers-for-the-u-s-economy/).
[9] Appendix A at pg. 4.
[10] COBRA (available at https://www.epa.gov/cobra).
[11] APCD_EIA at pg. 12.
[12] Appendix A at pg. 2.

partial accounting of the overall reduction in co-pollution that is expected to result from implementing this rule, the total health benefit and the resulting contribution to the state's overall economic performance and competitiveness are expected to be higher.[13]

D. Other benefits

The rule is intended to include protections for disproportionately impacted communities (DI Communities) and to prioritize reduction of co-pollutants that adversely affect these communities. Analysis done to assess the distribution of the health benefits across the state's counties shows that the majority of the health savings accrue in DI communities.[14]

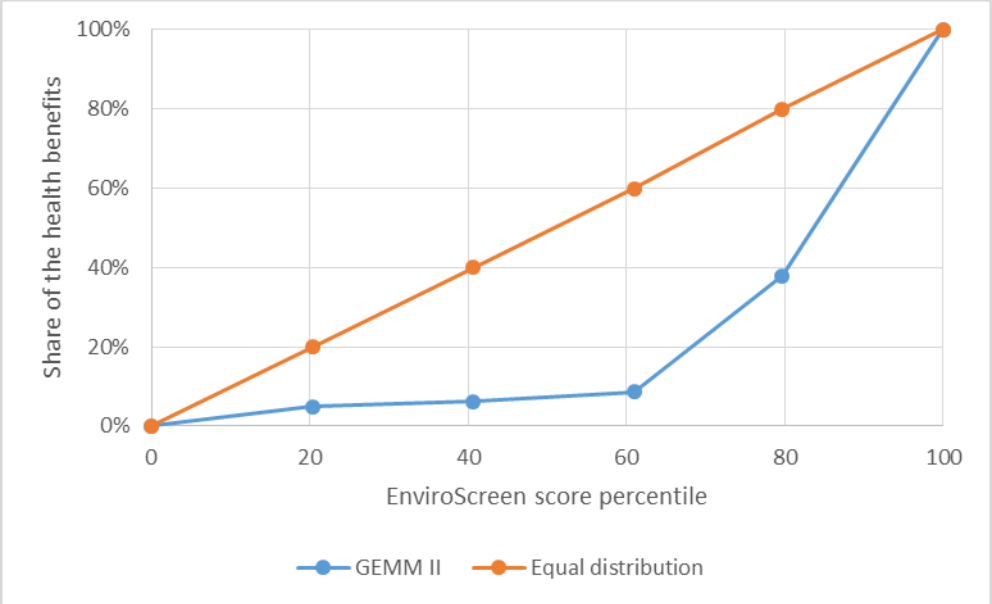


Figure 1: Community health benefit distribution.

Specifically, cross referencing the health savings against the EnviroScreen score of the counties in Colorado shows that 62% of the health benefits accrue to the 20% of the counties that have EnviroScreen score that is equal to higher than the 80th percentile, which are the counties with the highest cumulative environmental burden, as seen in Figure 1. This result shows that the rule contributes to the protection of DI communities and the advancement of environmental justice.

[13] APCD_EIA at pg. 12.
[14] The Gini coefficient, ranging from 0 to 1, measures the distribution of income or other benefits across the affected population, higher values showing that a small section of the affected population gets more than a proportionate share of the income or benefit under consideration. The Gini coefficient of the health benefits for this rule is 0.57. Thus, as envisioned, more than proportionate share of the health benefits from this rule accrue in DI Communities.

3. The anticipated costs of the rule or amendment, which shall include the direct costs to the government to administer the rule or amendment and the direct and indirect costs to business and other entities required to comply with the rule or amendment;

A. Direct costs to the government to administer the rule

Existing funds and full-time employees will be used to administer the rule. The state is not anticipated to incur additional direct costs as a result of administering this rule.

B. Direct and indirect costs to business and other entities

The direct cost of compliance cannot be readily quantified as confirmed by the alternative EIAs submitted by covered facilities. The Cogeneration Group's EIA notes that "Considering the large number of processes and equipment that are found at the covered facilities, each facility would require careful consideration of potential GHG emissions reductions of each approach as well as a detailed cost analysis, estimating specific capital and operating costs at this time is not feasible." Similar points are made by the Chamber Coalition and the Environmental Defense Fund.[15]

Given that the cost of compliance per mt CO2e is assumed to be no more than the 2030 social cost of GHGs, the compliance cost assessed assumes the social cost of GHGs to be the upper bound estimate of compliance cost per mt CO2e. Using the 2030 social cost of GHGs, multiplied by the emissions reductions required for the facilities, and incorporating the total cost of the independent third party reviews, the cumulative cost of achieving GHG reductions required by the Division's proposal from 2024 through 2030 is estimated to be $34,583,981 in 2023 dollars.[16] Given that the social cost of carbon is assumed as the upper bound cost estimate, the Division is not able to break down how much of that cost is for capital and how much is for O&M.

Facilities that have to submit a GHG reduction plan, have to pay an independent third party to review the plan for completeness, accuracy, and compliance with Regulation Number 27. Covered facilities will be responsible for the full cost of this third-party review process, and that cost is estimated to be between $15,000 and $40,000 per facility, with an estimated average cost of $20,000 to $25,000 per facility. This estimated average is based on the average amount of emissions reductions required by the facilities. These estimates accounted for between 15 and 30 hours per review of a GHG reduction plan.

The cost of buying GHG credits will depend on the type/scale of GHG emission reducing measures facilities implement, existing efficiency improvement opportunities, and the emission control technologies that become available and can be cost-effectively implemented in the future, some of which are challenging to accurately predict. If other markets, including Regional Greenhouse Gas Initiative (RGGI) and California Air Resource Board's cap-and-trade program are a guide, the cost of compliance through the use of credits should not be higher than the social cost of carbon. It is important to note that over compliance credit and allowance markets are not the same, and the EIA makes that point. Those numbers are there just to give a frame of reference as we don't have too many other markets we can point to.

Whereas Suncor caveats it, regarding the overall benefit of implementing this rule, it says in its EIA that "If the cost of compliance by purchasing credits is below the social cost of GHGs, and assuming the fact that the reductions will persist well past 2030, the benefits of implementing this rule are expected to be higher than the cost."

Federal and state funding opportunities, including 48(c) Federal Tax Credit and the Colorado Energy Office Clean Air Program (CAP) Grants, among others, will potentially reduce the final cost that facilities incur. The 48(c) Credit and CAP Grants alone will offer over $10,000,000,000 in decarbonization project funding for which industrial facilities may apply.[17]

Facilities might incur additional costs if they have to suspend operations for a considerable amount of time as they implement the emission reduction measures. However, they can minimize or avoid this cost if retrofitting activity is timed with scheduled maintenance.

[15] *See* CCC_ALT_EIA, EDF_ALT - Initial EIA.
[16] Appendix A at pgs. 1, 4.

4. Any adverse effects on the economy, consumers, private markets, small businesses, job creation, and economic competitiveness; and

Compliance with this rule is not expected to cause facilities to reduce production or operation. If that occurred and a job loss results from such reorganization of operations, that loss could have a trickle effect, causing indirect and induced job losses. The Division does not anticipate significant job loss to occur as a result of this rule, especially given the flexibility of facilities' ability to also comply through use of the GHG credit trading system. It is possible that covered facilities might pass on some or all of the compliance costs associated with implementing this rule to their customers. Those costs could include increased consumer costs for products, potential job losses, and reduced economic competitiveness. The Division acknowledges some parties have put forth arguments that the proposed rule could result in regulatory leakage (the movement of facilities to outside the area subject to the regulation; in this case outside Colorado).[18] However, because the Division's proposed rule includes a number of tailored accommodations for the specific operations of the covered facilities, such as adjusted baselines, specific emission obligations, and the ability to trade emission credits with other facilities where lower-cost reductions can be achieved, the Division does not agree such leakage will occur. Similarly, arguments regarding substantial job loss put forth by some parties assumed there will be across-the-board production cuts; this too would be avoided because of the specific flexibilities included in the proposed rules.[19] The Division's rebuttal statement describes in detail why production cuts are not an accurate outcome of the proposed rule as set forth in some parties' rulemaking filings.[20]

While the rule is not structured to require production cuts for facilities, there potentially could be job loss if a facility chooses to comply with its emission reduction targets through reduced production. However, it is uncertain if any facility will take this approach, or if so, what the scale would be, and if it is a temporary adjustment or something more permanent. Because of this, it is not possible to provide a reliable estimate of what that cost is going to be, or if it will be higher than the new jobs created by the investments made as a result of this rule.

The Division acknowledges that some of the retrofitting required for facility upgrades, if not timed with scheduled repair, might require suspension of operations and that this could lead to additional cost. The Division also acknowledges, as included in Section B of the EIA, which products made by these facilities might cost more as a result of this rule.[21] However, given that it is unknown how much of their compliance obligation facilities will meet through the various onsite emission reduction options or the GHG trading program, and what the respective cost of each of these options will be, generating a reliable estimate of what that cost will be is not possible. Facilities might pass on less, equal to, or more than the compliance cost as there is no requirement preventing facilities from doing so. The upper bound estimate of what could potentially be passed on to consumers is equal to the social cost of carbon and considering that the benefit from this rule, including the harmful air pollution reduction, leads to a positive net outcome, the overall impacts of the rule are estimated to outweigh the costs.

5. At least two alternatives to the proposed rule or amendment that can be identified by the submitting agency or a member of the public, including the costs and benefits of pursuing each of the alternatives identified.

Alternative 1: 20% from each individual facility from 2015

In the rule development process, the Division strongly considered requiring each individual GEMM 2 facility to reduce 20% below that specific facility's 2015 reported direct emissions. If this scenario was implemented, it would result in four facilities having no reduction obligation under the rule, while requiring half of the GEMM 2 facilities to reduce well over 20% from current reported emissions, with some of these facilities having reduction obligations upwards of 50%, and in one case, above 175% from their current reported emissions. Many of the GEMM 2 facilities have increased production since 2015 by either taking on new product lines or expanding production capacity at the facility. In some cases this

[17] IRS Additional Guidance for Advanced Energy Projects (available at https://www.irs.gov/newsroom/irs-provides-additional-guidance-for-advanced-energy-projects).
[18] Suncor_REB_EX-001.
[19] Soda_PHS_EX-002.
[20] APCD_REB at pg. 36.
[21] APCD_EIA at pg. 8.

resulted in significant GHG emissions increases between 2015 and today. Requiring each facility to reduce 20% from 2015 individually did not take into consideration any change to operations for any facility after 2015. This was concerning because this approach would 1) require such deep reductions between 2024 and 2030 at certain facilities it could force the facilities to downsize or ultimately close and 2) result in a small number of facilities (four facilities) controlling and monopolizing the GHG credit market, rather than a more equal distribution of supply and demand across facilities which the current proposal has achieved. The cost comparison of the Division's current scenario vs. the alternative is shown in Figure 2. It is clear from the graph that the Division's current approach creates a more equitable share of costs, where the alternative considered has a much larger spread of costs among the facility group.

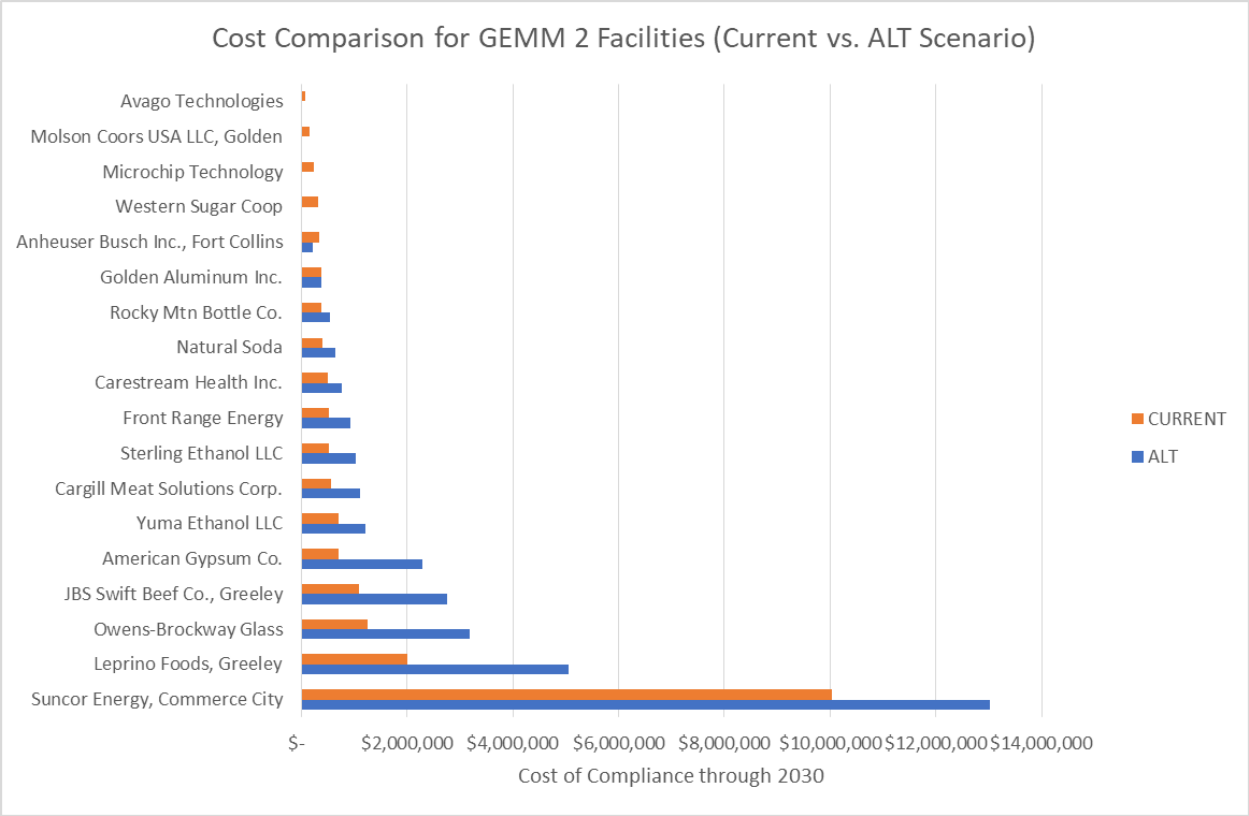


Figure 2: Current Proposal vs. Alternate #1, Cost Comparison for GEMM 2 facilities.[22]

Costs to certain facilities in this scenario would be much higher than the Division's current proposal, where the reduction obligations are distributed more evenly among all GEMM 2 facilities and each facility has at least a small reduction obligation by 2030, requiring every facility to "do their part" by reducing from current operations. In the Division's current proposal, no facility has a reduction obligation over 15.5% from the facility's current emissions.

The overall benefits of pursuing this alternative by 2030 and beyond would be approximately the same as the Division's current proposal, as the alternative would have still required the group of covered facilities to achieve an overall 20% reduction in GHG emissions compared to 2015. Although, when the Division was considering the alternative approach, the near-term reduction targets were not proposed at the time. If no near-term reduction requirements were included in this alternative approach, the benefits of the rule in the near-term, pre-2030, would not occur. Assuming that similar near-term reduction requirements were included in the alternative, the benefits would have been akin to the benefits in the current proposal.

Alternative 2: No action

In a scenario where the rule is not implemented, the emission from the 18 facilities would go unabated and contribute to climate change as well as aggravate air pollution problems and the resulting adverse health impacts. Specifically, compared to the 2015 baseline, direct GHG emissions of the covered facilities would be 13,886,100 mt of CO2e higher than it would be if the rule is not implemented and

[22] Appendix A at pg. 5.

facilities were able to increase emissions to 2015 levels. The economic impact from this emission is estimated to be worth $395,429,264. The health impact from the increased emission of co-pollutants is estimated to be worth $64,978,069.[23] The mortality, emergency room visits (Asthma), and work loss days, which are 7.9, 2.67, and 680 days, respectively, and could have been prevented, would now come to pass. Given that the current social cost of carbon does not capture the entirety of the damages[24] and that the co-pollution considered in this analysis focused only on combustion emission, these costs of inaction can be considered as conservative estimates.[25]

Furthermore, section 25-7-105(1)(e)(XIII), C.R.S. requires that the Commission adopt rules to reduce emissions from the industrial and manufacturing sector 20% as compared to 2015 levels. Absent this rule, or one substantially similar to it, those emissions reductions would be required from other emissions sources in this sector, aside from 18 of the 22 largest sources in the state. Practically speaking, the 567,276 tons of emissions reductions needed from GEMM 2 facilities to help meet Colorado's legislative target could not reasonably come from other sources in this sector. Hence, a "no action" alternative is not legally or practically feasible.

[23] Appendix A at pg. 2.
[24] Supplementary Material for the Regulatory Impact Analysis for the Supplemental Proposed Rulemaking, "Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review" (available at: https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf).
[25] APCD_EIA at pg. 12.

Year	Collective reduction (annual)	Social cost of cargon (2.5% discount rate)	Avoided social cost of carbon (future value) (upper bound cost estimate)	Discounting Factor	Avoided social cost of carbon (present value) (upper bound cost estimate)	Health benefit from co-pollution (present value)	Total ($)
2024	30009	$ 81.65	$ 2,450,085	0.97560976	$ 2,390,327	$ 527,707	$ 2,918,034
2025	30009	$ 82.95	$ 2,489,277	0.9518144	$ 2,369,329	$ 514,836	$ 2,884,165
2026	30009	$ 84.26	$ 2,528,468	0.92859941	$ 2,347,934	$ 502,279	$ 2,850,213
2027	30009	$ 85.56	$ 2,567,660	0.90595064	$ 2,326,173	$ 490,028	$ 2,816,201
2028	30009	$ 86.87	$ 2,606,852	0.88385429	$ 2,304,077	$ 478,076	$ 2,782,153
2029	30009	$ 88.18	$ 2,646,044	0.86229687	$ 2,281,675	$ 466,416	$ 2,748,091
2030	268400	$ 89.48	$ 24,016,700	0.84126524	$ 20,204,415	$ 455,040	$ 20,659,455
2031	268400	90.844	$ 24,382,530	0.82074657	$ 20,011,878	$ 3,851,562	$ 23,863,440
2032	268400	92.207	$ 24,748,359	0.80072836	$ 19,816,713	$ 3,757,621	$ 23,574,334
2033	268400	93.57	$ 25,114,188	0.7811984	$ 19,619,164	$ 3,665,972	$ 23,285,136
2034	268400	94.934	$ 25,480,286	0.76214478	$ 19,419,667	$ 3,576,558	$ 22,996,225
2035	268400	96.297	$ 25,846,115	0.74355589	$ 19,218,031	$ 3,489,325	$ 22,707,356
2036	268400	97.66	$ 26,211,944	0.72542038	$ 19,014,678	$ 3,404,219	$ 22,418,897
2037	268400	99.023	$ 26,577,773	0.7077272	$ 18,809,813	$ 3,321,190	$ 22,131,003
2038	268400	100.387	$ 26,943,871	0.69046556	$ 18,603,815	$ 3,240,185	$ 21,844,000
2039	268400	101.75	$ 27,309,700	0.67362493	$ 18,396,495	$ 3,161,156	$ 21,557,651
2040	268400	103.113	$ 27,675,529	0.65719506	$ 18,188,221	$ 3,084,055	$ 21,272,276
2041	268400	104.449	$ 28,034,112	0.64116591	$ 17,974,517	$ 3,008,834	$ 20,983,351
2042	268400	105.785	$ 28,392,694	0.62552772	$ 17,760,417	$ 2,935,448	$ 20,695,865
2043	268400	107.12	$ 28,751,008	0.61027094	$ 17,545,905	$ 2,863,851	$ 20,409,756
2044	268400	108.456	$ 29,109,590	0.59538629	$ 17,331,451	$ 2,794,001	$ 20,125,452
2045	268400	109.792	$ 29,468,173	0.58086467	$ 17,117,020	$ 2,725,855	$ 19,842,875
2046	268400	111.128	$ 29,826,755	0.56669724	$ 16,902,740	$ 2,659,371	$ 19,562,111
2047	268400	112.464	$ 30,185,338	0.55287535	$ 16,688,729	$ 2,594,508	$ 19,283,237
2048	268400	113.799	$ 30,543,652	0.53939059	$ 16,474,958	$ 2,531,227	$ 19,006,185
2049	268400	115.135	$ 30,902,234	0.52623472	$ 16,261,829	$ 2,469,490	$ 18,731,319
2050	268400	116.471	$ 31,260,816	0.51339973	$ 16,049,295	$ 2,409,259	$ 18,458,554
Total	**5,816,454**				**$ 395,429,264**	**$ 64,978,069**	**$ 460,407,333**

Benefit per ton CO2e reduced and associated copollution in present day USD

$ 1,715.38

Year	Collective reduction (annual)	Social cost of cargon (2.5% discount rate)	Avoided social cost of carbon (future value) (upper bound cost estimate)	Discounting Factor	Avoided social cost of carbon (present value) (upper bound cost estimate)	Health benefit from co-pollution (present value)	Total ($)
2024	328884	$ 81.65	$ 26,851,734	0.97561	$ 26,196,814	$ 5,994,313	$ 32,191,127
2025	328884	$ 82.95	$ 27,281,257	0.951814	$ 25,966,693	$ 5,848,110	$ 31,814,803
2026	328884	$ 84.26	$ 27,710,779	0.928599	$ 25,732,213	$ 5,705,474	$ 31,437,687
2027	328884	$ 85.56	$ 28,140,302	0.905951	$ 25,493,724	$ 5,566,316	$ 31,060,040
2028	328884	$ 86.87	$ 28,569,824	0.883854	$ 25,251,562	$ 5,430,552	$ 30,682,113
2029	328884	$ 88.18	$ 28,999,347	0.862297	$ 25,006,046	$ 5,298,099	$ 30,304,145
2030	567276	$ 89.48	$ 50,760,424	0.841265	$ 42,702,980	$ 5,168,877	$ 47,871,857
2031	567276	90.844	$ 51,533,621	0.820747	$ 42,296,043	$ 5,042,807	$ 47,338,850
2032	567276	92.207	$ 52,306,818	0.800728	$ 41,883,553	$ 8,244,225	$ 50,127,778
2033	567276	93.57	$ 53,080,015	0.781198	$ 41,466,023	$ 8,043,146	$ 49,509,169
2034	567276	94.934	$ 53,853,780	0.762145	$ 41,044,377	$ 7,846,972	$ 48,891,349
2035	567276	96.297	$ 54,626,977	0.743556	$ 40,618,210	$ 7,655,582	$ 48,273,792
2036	567276	97.66	$ 55,400,174	0.72542	$ 40,188,415	$ 7,468,861	$ 47,657,276
2037	567276	99.023	$ 56,173,371	0.707727	$ 39,755,423	$ 7,286,693	$ 47,042,116
2038	567276	100.387	$ 56,947,136	0.690466	$ 39,320,036	$ 7,108,969	$ 46,429,005
2039	567276	101.75	$ 57,720,333	0.673625	$ 38,881,855	$ 6,935,580	$ 45,817,435
2040	567276	103.113	$ 58,493,530	0.657195	$ 38,441,659	$ 6,766,419	$ 45,208,078
2041	567276	104.449	$ 59,251,411	0.641166	$ 37,989,985	$ 6,601,385	$ 44,591,369
2042	567276	105.785	$ 60,009,292	0.625528	$ 37,537,475	$ 6,440,375	$ 43,977,850
2043	567276	107.12	$ 60,766,605	0.610271	$ 37,084,093	$ 6,283,293	$ 43,367,386
2044	567276	108.456	$ 61,524,486	0.595386	$ 36,630,835	$ 6,130,042	$ 42,760,877
2045	567276	109.792	$ 62,282,367	0.580865	$ 36,177,626	$ 5,980,529	$ 42,158,155
2046	567276	111.128	$ 63,040,247	0.566697	$ 35,724,734	$ 5,834,662	$ 41,559,396
2047	567276	112.464	$ 63,798,128	0.552875	$ 35,272,413	$ 5,692,353	$ 40,964,766
2048	567276	113.799	$ 64,555,442	0.539391	$ 34,820,598	$ 5,553,515	$ 40,374,113
2049	567276	115.135	$ 65,313,322	0.526235	$ 34,370,138	$ 5,418,064	$ 39,788,202
2050	567276	116.471	$ 66,071,203	0.5134	$ 33,920,938	$ 5,285,916	$ 39,206,854
Total	**13,886,100**				**$ 959,774,460**	**$ 170,631,129**	**$ 1,130,405,589**

Benefit per ton CO2e reduced and associated copollution in present day USD

$1,992.69

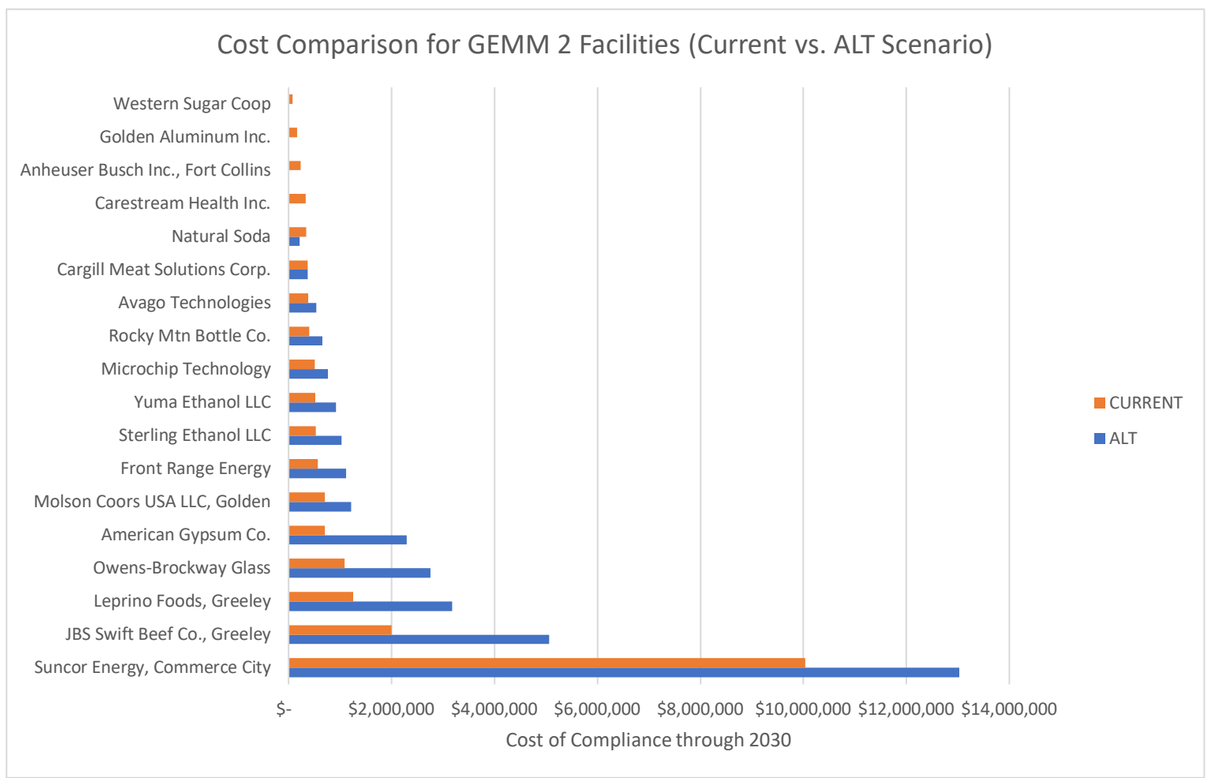
	Required Reduction by 2030	2030 Social Cost of GHGs (PV)	Estimated Cost (PV)
Suncor Energy, Commerce City	133,266	$ 75.28	$ 10,031,904.66
JBS Swift Beef Co., Greeley	26,521	$ 75.28	$ 1,996,429.27
Leprino Foods, Greeley	16,610	$ 75.28	$ 1,250,355.95
Owens-Brockway Glass	14,500	$ 75.28	$ 1,091,520.85
American Gypsum Co.	9,381	$ 75.28	$ 706,176.35
Molson Coors USA LLC, Golden	9,355	$ 75.28	$ 704,219.14
Front Range Energy	7,546	$ 75.28	$ 568,042.51
Sterling Ethanol LLC	7,046	$ 75.28	$ 530,403.86
Yuma Ethanol LLC	6,937	$ 75.28	$ 522,198.63
Microchip Technology	6,756	$ 75.28	$ 508,573.44
Rocky Mtn Bottle Co.	5,368	$ 75.28	$ 404,088.55
Avago Technologies	5,014	$ 75.28	$ 377,440.38
Cargill Meat Solutions Corp.	4,949	$ 75.28	$ 372,547.36
Natural Soda	4,498	$ 75.28	$ 338,597.30
Carestream Health Inc.	4,362	$ 75.28	$ 328,359.58
Anheuser Busch Inc., Fort Collins	3,060	$ 75.28	$ 230,348.54
Golden Aluminum Inc.	2,141	$ 75.28	$ 161,168.70
Western Sugar Coop	1,091	$ 75.28	$ 82,127.53
			$ 20,204,502.60

Cost of Independent Third Party Review (PV)	**$ 360,000.00**
Cost of Independent Third Party Review and GHG emission reductions (PV)	**$ 20,564,502.60**
GHG Emission Reduction (mt CO2e)	**268400**
Cost per mt of CO2e Reduced (PV)	**$ 76.62**

In 2030			
upper bound cost estimate		**multiplier (per $1 million) - direct, indirect, induced**	**jobs created**
$	20,204,415	1.8	36.37
$	20,204,415	4.9	99.00
$	20,204,415	11.6	234.37
			370

2024 - 2030		
upper bound cost estimate	**multiplier (per $1 million) - direct, indirect, induced**	**jobs created**
$34,583,981	1.8	62.25
$34,583,981	4.9	169.46
$34,583,981	11.6	401.17
		633

	2015 Emissions	20% from 2015	2021/2022 Emissions	ALT Reduction Required	Cost (using 2030 SCGHGs in PV)	Current Reduction Required	Cost (using 2030 SCGHG in PV)
Suncor Energy, Commerce City	973,484	778,787	951,898	173,111	$ 13,031,781	133,266	$ 10,032,264
JBS Swift Beef Co., Greeley	38,254	30,603	97,816	67,213	$ 5,059,780	26,521	$ 1,996,501
Leprino Foods, Greeley	92,157	73,726	116,002	42,276	$ 3,182,567	16,610	$ 1,250,401
Owens-Brockway Glass	168,143	134,514	171,101	36,587	$ 2,754,239	14,500	$ 1,091,560
American Gypsum Co.	55,647	44,518	75,047	30,529	$ 2,298,253	9,381	$ 706,202
Molson Coors USA LLC, Golden	49,193	39,354	55,500	16,146	$ 1,215,441	9,355	$ 704,244
Front Range Energy	30,923	24,738	39,588	14,850	$ 1,117,878	7,546	$ 568,063
Sterling Ethanol LLC	53,324	42,659	56,370	13,711	$ 1,032,149	7,046	$ 530,423
Yuma Ethanol LLC	36,282	29,026	41,312	12,286	$ 924,920	6,937	$ 522,217
Microchip Technology	30,998	24,798	34,894	10,096	$ 759,997	6,756	$ 508,592
Rocky Mtn Bottle Co.	50,796	40,637	49,309	8,672	$ 652,843	5,368	$ 404,103
Avago Technologies	86,973	69,578	76,684	7,106	$ 534,910	5,014	$ 377,454
Cargill Meat Solutions Corp.	27,237	21,790	26,759	4,969	$ 374,096	4,949	$ 372,561
Natural Soda	51,002	40,802	43,710	2,908	$ 218,944	4,498	$ 338,609
Carestream Health Inc.	150,657	120,526	81,981	-38,545	-	4,362	$ 328,371
Anheuser Busch Inc., Fort Collins	260,845	208,676	168,907	-39,769	-	3,060	$ 230,357
Golden Aluminum Inc.	387,894	310,315	233,875	-76,440	-	2,141	$ 161,174
Western Sugar Coop	289,356	231,485	125,339	-106,146	-	1,091	$ 82,130



4. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 20, Colorado Clean Cars, October 19-20, 2023.

Cost-Benefit Analysis

In performing a cost-benefit analysis, each rulemaking entity must provide the information requested for the cost-benefit analysis to be considered a good faith effort. The cost-benefit analysis must be submitted to the Office of Policy, Research and Regulatory Reform at least ten (10) days before the administrative hearing on the proposed rule and posted on your agency's web site. For all questions, please attach all underlying data that supports the statements or figures stated in this cost-benefit analysis.

DEPARTMENT:	Air Pollution Control Division	**AGENCY:**	Colorado Department of Public Health and Environment
CCR:	5 CCR 1001-24	**DATE:**	October 19-20, 2023

RULE TITLE OR SUBJECT:

AIR QUALITY CONTROL COMMISSION

REGULATION NUMBER 20

COLORADO CLEAN CARS RULE

…..

Per the provisions of 24-4-103(2.5)(a), Colorado Revised Statutes, the cost-benefit analysis must include the following:

1. **The reason for the rule or amendment.**

   The proposed regulatory revisions establish new emission reduction requirements applicable to manufacturers of new light and medium-duty vehicles sold in Colorado commencing with vehicle model year 2027.

   The federal Clean Air Act establishes a framework for adoption and implementation of emission standards applicable to vehicles. Under this framework, the US Environmental Protection Agency (EPA) is responsible for establishing new vehicle emission standards for vehicles sold across the United States. In general, under the Clean Air Act, states are pre-empted from establishing their own emission standards for new vehicles. However, the act creates an exception to this general pre-emption, allowing California to adopt its own new vehicle emission standards. Pursuant to Section 177 of the Clean Air Act, if California adopts its own new vehicle standards, other states can then adopt the California standards to apply in their states.

Prior to 2018, Colorado relied solely on the federal vehicle standards that EPA adopted. In 2018, the Air Quality Control Commission (AQCC) adopted California's Low Emission Vehicle (LEV) standards applicable to light duty vehicles commencing with model year 2022. These standards established more stringent greenhouse gas emission requirements than those set forth in the federal rules. In 2019, the AQCC adopted requirements for the Zero Emission Vehicle (ZEV) program. Under this program, manufacturers of light duty vehicles sold in Colorado must sell a specified credit percentage of zero emission vehicles commencing with Model Year 2023.

The proposed revisions update and extend those rules. These proposed rule revisions are intended to reduce emissions from light-duty and medium-duty vehicles sold and operated in Colorado. The rules are needed to support the state in reaching its statutorily established greenhouse gas reduction goals, bring the Denver Metro/North Front Range area back into attainment with the federal National Ambient Air Quality Standards for ozone, and accomplish reductions of pollutants in disproportionately impacted communities in support of Colorado's commitment to Environmental Justice.

Over the past several years Colorado has taken a multitude of steps, both regulatory and non-regulatory, to help achieve the broader goal of achieving an inherently lower emitting vehicle fleet including rapidly transitioning to zero emission vehicle technology. These proposed revisions represent an important next step in these efforts and will bring Colorado Clean Cars regulations current with existing California standards.

The proposed revisions consist of two distinct strategies directed at achieving these broader goals. They are:

1) The Low Emission Vehicle program that establishes emission standards for new light and medium-duty vehicles sold in Colorado commencing with model year 2027. The rule incorporates California vehicle emission standards as required under section 177 of the federal Clean Air Act. These standards establish criteria and procedures for the manufacturing, testing, distribution and sale of new on-highway light and medium-duty vehicles in Colorado. This portion of the rule will supersede the current Low Emission Vehicle standards that are now in place.
2) The Zero Emission Vehicle program that requires manufacturers of light-duty vehicles that offer such vehicles for sale in Colorado, to sell a specified percentage of zero emission vehicles (ZEV). Specifically, beginning with the 2027 model year. This updates and replaces the current Zero Emission Vehicle standards that are now in place.

In addition to creating these rule components, the proposed revisions include updating existing incorporations by reference related to Colorado's Low Emission Vehicle and Zero Emission Vehicle programs so that these provisions are aligned with the most recent version of California's regulations. Finally, the proposed revisions reorganize the regulation, clarify existing provisions, and make typographical corrections.

Adoption of the proposed revisions to Regulation 20 serves to advance Colorado's three most critical air quality priorities: 1) reduction of greenhouse gas emissions in support of Colorado's ambitious climate change goals; 2) reduction of ozone precursors in support of efforts to bring the Denver Metro/North Front Range area into attainment with ozone National Ambient Air Quality Standards (NAAQS); and 3) promotion of Environmental Justice through the reduction of harmful pollutants that directly impact Colorado residents living and working in disproportionately impacted communities. While no one set of strategies will solve these critical problems, adopting the proposed revisions would be an important step in addressing all three, bringing both important near term benefits in the form of reduced impact from new light and medium-duty vehicles, and helping Colorado transition to a zero emission vehicle fleet, which is among Colorado's most important long term efforts to fight climate change, significantly reduce ozone concentrations, and ensure that all Coloradoans have clean, healthy air to breathe.

Vehicle emissions are a critical part of Colorado's overall greenhouse gas emissions. Based on the most recent Colorado inventory, vehicles are the second largest source of greenhouse gas emissions in Colorado.[1] Vehicles are projected to remain the second largest sector of GHG emissions in the state through 2035.[2] And while vehicle GHG emissions in Colorado are expected to dramatically decline by 2050, that expectation is premised on the assumption that there will be a rapid transition from fuel burning vehicles to electric and other zero emission vehicles.[3] Colorado has previously taken action to reduce GHG emissions from the light duty fleet through the adoption of its existing LEV and ZEV program (predecessor programs to today's proposal). More recently, at their April 2023 hearing, the Commission adopted new requirements and standards for the heavy-duty fleet. These vehicles emit approximately 22% of the overall fleet emissions, while making up only 9% of the total number of vehicles in the state.[4]

In addition to being an important source of GHG emissions, vehicles play an extremely significant role in the formation of dangerous levels of ozone pollution within the Denver Metro/North Front Range nonattainment area. Based on recent source apportionment modeling, vehicles are the largest in-area contributor to ozone concentrations at ozone monitors that register the highest measured eight-hour ozone concentrations in the nonattainment area. For example, vehicles contribute approximately 31% of the in-area ozone formation at the NREL monitor.[5] This includes important emissions of nitrogen oxides as well as VOC emissions, both of which are a significant contributor to Colorado's summertime ozone issues.

[1] 2021 Colorado Greenhouse Gas Inventory Update at pg. 4.
[2] Id.
[3] Colorado Greenhouse Gas Pollution Reduction Roadmap at pp. 53-62.
[4] Colorado Clean Truck Strategy at pg. 9.
[5] State Implementation Plan for the Denver Metro/North Front Range Nonattainment Area (Ozone SIP) at pg. 5-28

Finally, the adoption of the proposed new vehicle emissions standards and ZEV requirements can play an important role in addressing environmental injustice in Colorado. While a number of source sectors contribute to the disproportionate impacts from pollution that certain communities face, vehicle pollution is a key contributor to this injustice. A myriad of health studies show that communities that are located near busy roadways face significant negative health consequences from exposure to vehicle pollution in general[6],[7],[8],[9]. If Colorado wants to truly address these direct exposure problems, it must move forward with strategies to reduce emissions from the light and medium-duty vehicle sector.

The rule implements manufacturer fleet emissions averages that while maintaining the standards that will be implanted under the LEV III rules in MY2025, will phase-out the manufacturer's use of zero emission BEVs and emissions adjusted plug-in hybrids to lower overall manufacturer's fleet emissions. Currently, manufacturers are permitted to incorporate these vehicles into their corporate fleet averages which lowers the overall averages. Average fleet emissions by MY2029 will only represent conventional vehicles subject to the LEV IV standards, representing true (non-ZEV) fleet emissions.

Along with this, the rule implements new lower emitting vehicle "bins" that motor vehicles may be certified to allowing these cleaner vehicles to be used to lower fleet emission averages, as well as the elimination of higher emission "bins" that will disallow vehicles to be certified to those high emission standards. Table 1 gives the emission standards used for each emission "bin". Table 2 gives the actual manufacturer's light-duty fleet NMOG+NOx emissions standards that each manufacturer must meet when averaging the emissions from all their vehicles produced from all the emissions bins. Table 3 is the manufacturer's fleet average NMOG+NOx emissions standards for medium-duty vehicles. Figure 4 shows the required minimum sales requirements for electric vehicles.

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[6] Kim, et al., *Traffic-related Air Pollution near Busy Roads*
The East Bay Children's Respiratory Health Study, American Journal of Respiratory Critical Care Medicine, May 31, 2004. https://doi.org/10.1164/rccm.200403-281OC

[7] Kim, et al., *Residential Traffic and Children's Respiratory Health*, Environmental Health Perspectives, September 1, 2008. https://doi.org/10.1289/ehp.10735

[8] HSU, et al., *The effects of traffic-related air pollutants on chronic obstructive pulmonary disease in the community-based general population*, - PMC, Respiratory Research, 2021. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8336021/pdf/12931_2021_Article_1812.pdf

[9] CHANG, et al., *Electric vehicle fleet penetration helps address inequalities in air quality and improves Environmental Justice*, Communications, Earth and the Environment, 2023https://www.nature.com/articles/s43247-023-00799-1

Table 1. New Vehicle Emissions "Bin" Standards

Vehicle Type	Bin/ Emissions Std	NMOG+NOx (low/high alt) g/mi	CO g/mi	PM* mg/mi	HCHO mg/mi
cars, light-duty trucks, and medium-duty passenger vehicles	ULEV125	0.125/0.160	4.2	1	4
	ULEV70	0.070/0.105	2.1	1	4
	ULEV60	0.060/0.090	1.7	1	4
	ULEV50	0.050/0.070	1.7	1	4
	ULEV40	0.040/0.060	1.7	1	4
	SULEV30	0.030/0.050	1.0	1	4
	SULEV25	0.025/0.050	1.0	1	4
	SULEV20	0.020/0.030	1.0	1	4
	SULEV15	0.015/0.030	1.0	1	4
medium-duty vehicles 8,501 -10,000 lbs GVW	ULEV250	0.250	6.4	8	6
	ULEV200	0.200	4.2	8	6
	SULEV170	0.170	4.2	8	6
	SULEV150	0.150	3.2	8	6
	SULEV125	0.125	3.2	8	6
	SULEV100	0.100	3.2	8	6
	SULEV85	0.085	3.2	8	6
	SULEV75	0.075	3.2	8	6
medium-duty vehicles 10,001 - 14,000 lbs GVW	ULEV400	0.400	7.3	10	6
	ULEV270	0.270	4.2	10	6
	SULEV230	0.230	4.2	10	6
	SULEV200	0.200	3.7	10	6
	SULEV175	0.175	3.7	10	6
	SULEV150	0.150	3.7	10	6
	SULEV125	0.125	3.7	10	6
	SULEV100	0.100	3.7	10	6

* For PM, all cars, light-duty trucks, and medium-duty passenger vehicles must meet a phased-in standard of 1 mg/mi, with the exception that during the phase-in period, 25% of MY2027 vehicles may be certified to 3 mg/mi. Commencing with the 2028 model year, all of these category vehicles must meet the 1 mg/mi standard.

Table 2. Fleet Average NMOG+NOx Standards for Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles

Model Year	NMOG+NOx g/mi	Incl. Max Amount of ZEVs
2027	0.030	30%
2028	0.030	15%
2029-2032	0.030	0%

Table 3. Fleet Average NMOG+NOx Standards for Medium-Duty Passenger Vehicles

Model Year	NMOG+NOx g/mi	
	Medium-Duty Vehicles 8,501-10,000 lbs. GVW	Medium-Duty Vehicles 10,001-14,000 lbs. GVW
2027	0.174	0.232
2028	0.166	0.212
2029	0.158	0.193
2030-2032	0.150	0.175

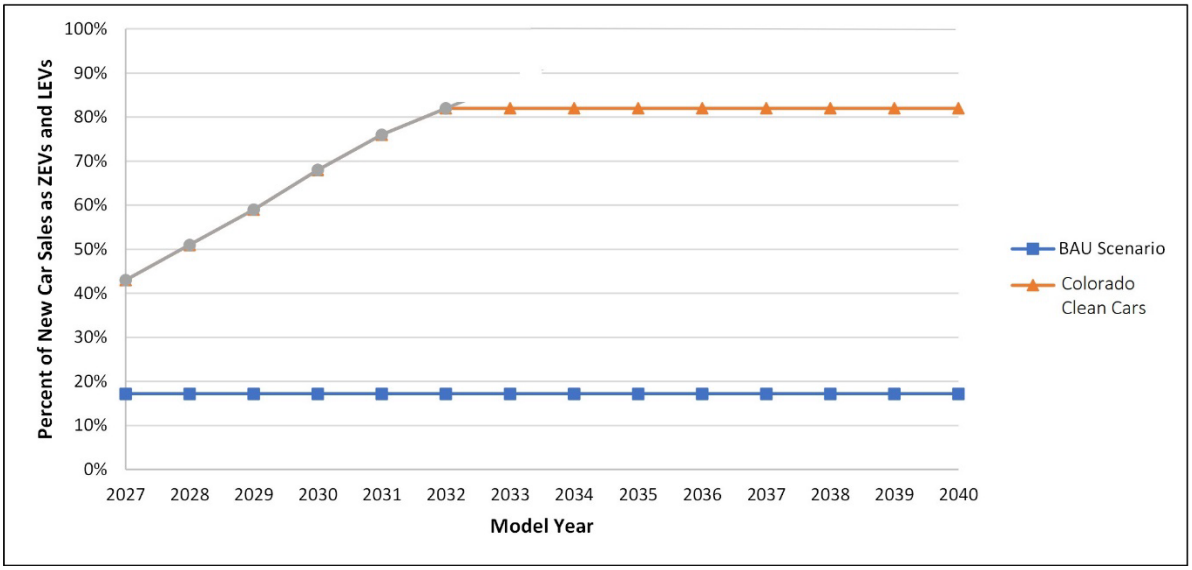
Table 4. Percent of BEV and PHEV New Vehicle Sales (2027-2040)

Colorado Clean Cars versus No Program

Calendar Year	Business as Usual (existing rule)		Colorado Clean Cars (as adopted)	
	BEV	PHEV	BEV	PHEV
2027	16.6%	0.6%	38.8%	4.2%
2028	16.6%	0.6%	46.9%	4.1%
2029	16.6%	0.6%	55.1%	3.9%
2030	16.6%	0.6%	64.1%	3.9%
2031	16.6%	0.6%	72.6%	3.4%
2032	16.6%	0.6%	78.6%	3.4%
2033	16.6%	0.6%	78.6%	3.4%
2034	16.6%	0.6%	78.6%	3.4%
2035	16.6%	0.6%	78.6%	3.4%
2036	16.6%	0.6%	78.6%	3.4%
2037	16.6%	0.6%	78.6%	3.4%
2038	16.6%	0.6%	78.6%	3.4%
2039	16.6%	0.6%	78.6%	3.4%
2040	16.6%	0.6%	78.6%	3.4%

Figure 1 below, follows Table 4 in a graphical form.

Figure 1. Forecasted Percent of New Car Sales as ZEVs in Colorado's Vehicle Fleet (2027 to 2040)



2. The anticipated economic benefits of the rule or amendment, which shall include economic growth, the creation of new jobs, and increased economic competitiveness.

The adoption of the proposed Colorado Clean Cars rule will have a substantial overall positive economic benefit for Colorado. It will generate new opportunities and prospects in the state. The rule will result in economic growth, the creation of new jobs, and increased economic competitiveness.

For each $1 in spending, implementing this rule will generate a benefit worth $6.5 for the motorist and people of Colorado, though this entails reduced revenue for affected businesses. The benefits result from lower vehicle costs, lower fuel and maintenance costs, reduced GHG emissions, and avoided adverse health incidences. The subsections below describe each of these specific benefits in detail.

Job Creation

The employment impact from this rule results from two distinct effects that follow from the rule. First, customers spend less on new cars, fuel costs, and maintenance costs. Whereas that represents savings for consumers, who then spend that money elsewhere, it represents decreased revenues to affected industries, such as car dealers, petroleum producers, gas stations, and vehicle service centers. Measuring the net effect of this effect requires quantifying the potential job gain in businesses that are now patronized by the money the car buyers saved by paying less on new cars, fuel costs, and maintenance costs versus the potential job loss expected in petroleum producers and others seeing their revenue decrease.

Second, considerable investment is made on charging infrastructure in terms of direct spending on different types of chargers as well as grid upgrades. Expenditure is also made on operating and maintaining the chargers. The cost per charger is multiplied by the number of chargers needed over the years to determine the total amount of spending that will be made on chargers. The employment impact resulting from this and other investments made is determined by multiplying the expected total spending by the corresponding multipliers, which are the number of jobs expected to result from a $1 million investment in a given sector. The jobs resulting from this investment can be classified as direct, indirect, and induced effects.

Direct jobs (gained/lost) are those jobs in industries supplying goods and services such as EV manufacturing jobs. Indirect jobs are created in industries that supply goods and services to EV manufacturers and include such jobs as refining raw metals from which EVs are built. Induced jobs represent those jobs supported through broader economic activity stimulated by the creation of direct and indirect jobs, including grocery store workers and health care providers.

Table 5. Employment impact of the rule, including direct, indirect, and induced effects.

Calendar Year	Loss	Gain		Net change (Gain – Loss)
	Car manufacturers, and dealers, petroleum producers and marketers, maintenance facilities, related businesses receiving lower revenue.	Re-investment of monies saved on new cars, fuel, and maintenance.	Investment on charger installation/O&M, grid upgrade.	
2027	-3,958	7,996	1,885	5,923
2028	-6,440	11,413	2,576	7,549
2029	-9,340	15,087	3,309	9,056
2030	-12,644	19,450	4,156	10,962
2031	-16,047	23,880	5,102	12,935
2032	-18,874	27,120	5,955	14,201
2033	-19,887	19,686	6,426	6,225
2034	-20,797	20,466	6,899	6,568
2035	-21,615	21,151	7,322	6,858
2036	-22,234	21,776	7,890	7,432
2037	-22,860	22,410	8,266	7,816
2038	-23,474	23,028	8,576	8,130
2039	-24,229	23,792	8,587	8,150
2040	-25,012	24,588	8,795	8,371
2027-2040	-247,411	281,843	85,744	120,176

The figures estimated are quoted in "job-year" or FTE (Full-time Equivalent), which is equivalent to employing one person for one full year, or two employees for six months each, or any other combination of employees that adds up to one year's worth of labor. The results show that the rule will generate a considerable number of jobs that outstrip the number of jobs that will be lost. Between 2027 and 2040, a total of 120,176 job years are expected to occur as a result of the rule.

Moreover, a considerable share of the revenue and job loss that will be experienced by petroleum producers and car makers will take place outside of Colorado as the state does not have a car making industry and imports two-thirds of the petroleum it consumes. On the other hand, the job creation, which will occur as a result of the reinvestment of the monies car buyers saved, including their spending at local restaurants and other businesses, will occur in the state. Thus, in addition to creating net job gain, taken from the state's perspective, the job gain is that much larger than the job loss.

The skillset necessary to maintain a zero-emission vehicle is different from those required to maintain conventional vehicles. Nonprofits, government agencies, post-secondary education institutions and public workforce development agencies are working with employers and labor unions to create training programs for workers in this and other declining occupations. Such measures will help to mitigate adverse impacts resulting from the shift to zero-emission vehicles.

Under CDOT's ZEV Workforce Development Group, training and skill set needs of technicians involved in electric vehicle repair and maintenance as well as infrastructure development, are being met. This group is identifying and determining the type and kind of programmatic and financial support needed to develop a robust electric vehicle workforce in the state. The group is actively working with parties such as automotive dealerships, repair facilities, fleet managers, as well as involving the cooperation of other government agencies such as CEO and CDPHE[10].

Current cross-cutting initiatives across Departments and Divisions, including CDOT, CEO, and CDPHE are underway. Efforts are being taken to conduct ZEV workforce needs analysis to determine the number of community colleges/technical schools offering ZEV training, identifying gaps in the workforce training system, and supporting community colleges in launching the first EV automotive technology programs[11]. Future plans include taking steps to ensure EV automotive training is available at every community college. Such an effort will help to accelerate the transition to zero emission vehicles, support a broad and resilient ZEV workforce while also offering job opportunities to all Coloradans.

Health Benefits

The rule will result in health benefits that improve the well-being of people in Colorado. As stated previously, light and medium-duty vehicles comprise the largest source of mobile source emissions. Through this rule, harmful vehicle emissions of nitrogen oxides and fine particulate matter will be reduced from these vehicles. The Department estimates that implementation of these rules through 2040 will reduce NOx by 18,657 tons and PM2.5 by 1,317 tons. The below table provides a breakdown of the emission savings by type and by year.

[10] https://drive.google.com/file/d/1R2WEarx6n2_pXXtd68tGV8ou6yrYoPMV/view.
[11] https://drive.google.com/file/d/1R2WEarx6n2_pXXtd68tGV8ou6yrYoPMV/view.

Table 6. Emission savings resulting from this rule

Year	PM2.5	SO2	NOx	NH3	VOC
2027	10	12	222	82	239
2028	17	19	359	139	462
2029	26	29	520	209	753
2030	37	39	682	291	1,089
2031	51	51	895	386	1,568
2032	67	63	1,116	487	2,091
2033	83	73	1,294	575	2,590
2034	98	81	1,427	653	3,072
2035	112	88	1,506	718	3,488
2036	129	94	1,719	792	3,953
2037	146	99	1,929	858	4,398
2038	163	103	2,134	921	4,850
2039	181	107	2,334	978	5,309
2040	198	110	2,522	1,031	5,781
2027-2040	**1,317**	**967**	**18,657**	**8,121**	**39,641**

Note: SO2 and NH3 are tailpipe emission levels whereas NOx, PM2.5 and VOC are well-to-wheel figures.

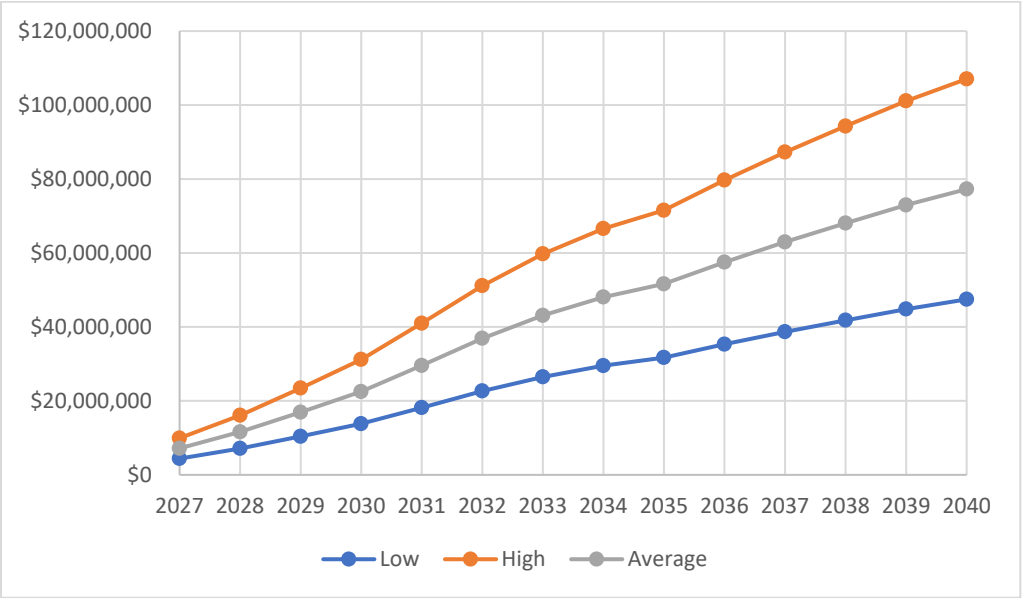
The health benefits from this rule will include avoided premature deaths, avoided hospitalizations for cardiovascular illness, and avoided hospitalizations for respiratory illness. The table below presents the expected reductions by endpoint.

Table 7. Expected reduction in mortality and other health endpoints by 2040

Health Endpoints	Expected reduction (2027-2040)
Mortality	68.67
Nonfatal Heart Attacks	23.63
Infant Mortality	0.275
Hospital Admits, All Respiratory	9.69
Hospital Admits, Cardiovascular	9.08
Acute Bronchitis	70.34
Upper Respiratory Symptoms	1267.32
Lower Respiratory Symptoms	893.12
Emergency Room Visits, Asthma	24.75
Asthma Exacerbation	1325.77
Minor Restricted Activity Days	38,022
Work Loss Days	6,494

Using concentration response functions to link the changes in particulate matter to epidemiological studies along with cost of illness and other statistics, the state determined the economic value of illnesses and deaths avoided resulting from this rule. Between 2027 and 2040, the rule is expected to generate health benefits worth $606,230,198.

Figure 2. Expected health benefits, by year.

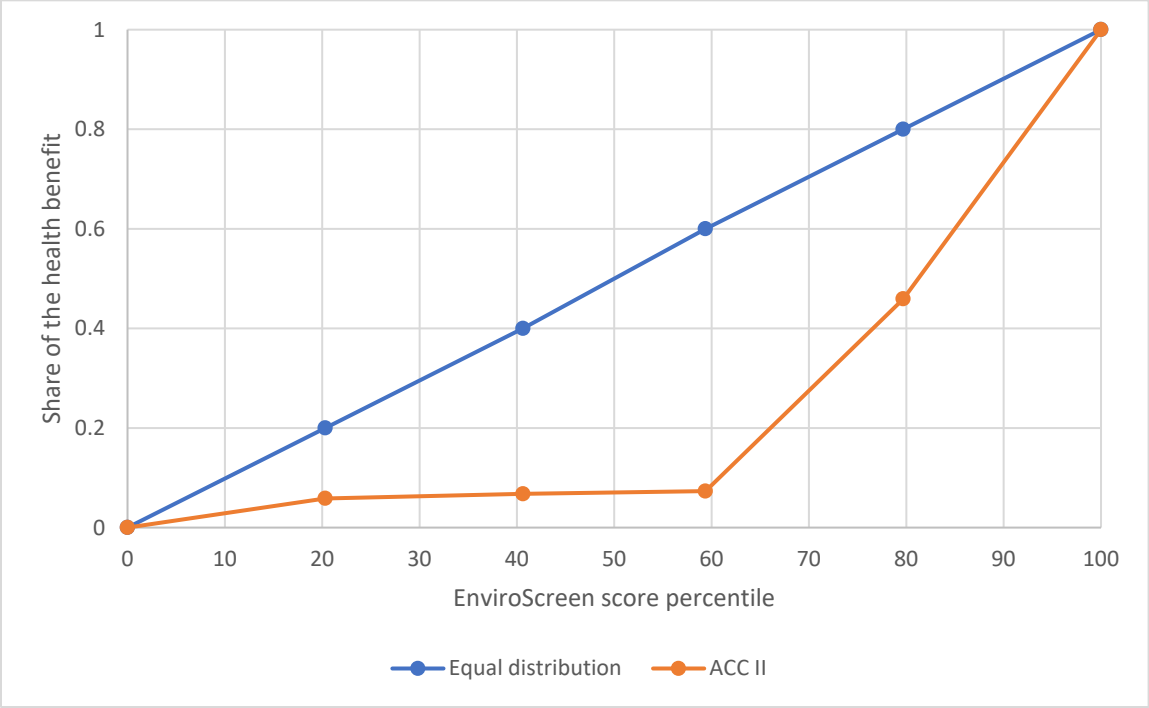


<u>Health benefits accruing to disproportionately impacted communities.</u>

The health benefits from this rule will be distributed statewide, affecting all of Colorado, but especially disproportionally impacted communities, including communities located near major highways and roadways and motor vehicle traffic. The Division's analysis shows that a considerable share of the health benefits will accrue to DI communities. Specifically, it shows that 54% of the health benefits accrue to the 20% of the counties that have EnviroScreen score that is equal to or higher than the 80th percentile, which is used to define disproportionately impacted communities experiencing cumulative impacts[12]. As such, the rule contributes to the protection of DI communities and the advancement of environmental justice.

[12] § 24-4-109(5)(a)(I), C.R.S. (2023).

Figure 3. Distribution of the health benefits of this rule with respect to the EnviroScreen score percentile of the counties in the State.



Greenhouse Gas Reductions and the Social Cost of Carbon

Reductions in greenhouse gas emissions will impact climate change. These implications may be quantified in terms of the social cost of carbon, as derived from the Interagency Working Group on Social Cost of Greenhouse Gases, dated February 2021. The social cost of carbon includes the value of all climate change impacts, including changes in net agricultural productivity, human health effects, property damage from increased flood risk, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services.

Table 8: Social Cost of Carbon per ton of Carbon

Year	Social Cost of Carbon/mtCO2 (2.5% discount rate)
2027	$ 85.56
2028	$ 86.87
2029	$ 88.18
2030	$ 89.48
2031	$ 90.84
2032	$ 92.21
2033	$ 93.57
2034	$ 94.93
2035	$ 96.30
2036	$ 97.66
2037	$ 99.02
2038	$ 100.39
2039	$ 101.75
2040	$ 103.11

Adoption of this rule will result in considerable reductions in GHG emissions. The Department estimates that implementation of the rules through 2040 will reduce GHG emissions by 109,096,948 metric tons. Using the social cost of carbon detailed in Table 9, the monetary value of this reduction in GHG emissions is $8.72 billion.

Table 9. Yearly breakdown of the emission savings and the corresponding avoided cost of climate change (in million dollars).

Calendar Year	Colorado Clean Cars (in million dollars)	Avoided social cost of climate change (in million dollars)
2027	1,122,015	$102.0
2028	1,930,776	$172.8
2029	2,866,650	$252.8
2030	3,937,092	$341.2
2031	5,204,250	$444.8
2032	6,571,025	$553.8
2033	7,766,565	$645.5
2034	8,871,865	$727.2
2035	9,819,473	$791.8
2036	10,766,362	$855.2
2037	11,578,182	$905.9
2038	12,290,154	$947.2
2039	12,913,874	$980.4
2040	13,458,665	$1,004.5
2027-2040	109,096,948	**$8,725.2**

Sources: Colorado Legislature (2021), Houk et al. (2023), IWG (2021), and BLS (2023)

Incremental Vehicle Cost Savings

Electric vehicles are expected to reach price parity with conventionally fueled vehicles by 2028, with some longer-range (bigger battery pack) vehicles and pickup trucks reaching parity by 2030. The exception to this is the longest ranged pickup trucks that reach cost parity by 2033. As stated earlier, plug-in electric hybrid vehicles continue to show a cost disadvantage of a few thousand dollars throughout the analysis period. Light-duty conventionally fueled vehicles under this proposal are expected to be similar in price as current models under the business-as-usual case, and so a minimal cost difference is reflected in this analysis, less than $3 per vehicle[13],[14]. There is a cost associated for medium-duty conventionally fueled vehicles that is included. CARB estimates that this cost is less than $500 per vehicle for all gasoline and diesel-powered vehicles averaged together[15].

When all vehicles are averaged together as an aggregate combined fleet cost, there is an overall cost savings after calendar year 2028 (the second year of the program). Under this proposal, there will be a continued availability of conventionally fueled cars and trucks for sale to the motoring public.

Table 10 lists the consumer vehicle cost impacts for the program from its start in 2027 past full implementation through 2040. Both discount rates of 3% and 7% are given to reflect the time value of money. Under the 3% discount rate scenario, a total vehicle cost savings of $8.77 billion is reached through 2040. Only calendar years 2027 and 2028 show a net new vehicle cost impact (negative numbers shown).

[13] CARB Staff, *Advanced Clean Cars II Proposed Amendments to the Low Emission, Zero Emission, and Associated Vehicle Regulations - Standardized Regulatory Impact Assessment (SRIA)*, CARB, January 26, 2022.

[14] CARB Staff Report, *Appendix E. Final Environmental Analysis for the Proposed Advanced Clean Cars II Program*, CARB, August 24 2022.

[15] CARB Staff, *Advanced Clean Cars II Proposed Amendments to the Low Emission, Zero Emission, and Associated Vehicle Regulations - Standardized Regulatory Impact Assessment (SRIA)*, CARB, January 26, 2022.

Table 10. Estimated Consumer Savings on New Vehicle Sales in Colorado (Millions of 2022$)

Calendar Year	Colorado Clean Cars	
	3% discount rate	7% discount rate
2027	-$157.1	-$145.5
2028	-$37.0	-$33.0
2029	$133.6	$114.7
2030	$331.6	$274.1
2031	$533.6	$424.6
2032	$707.3	$541.7
2033	$799.3	$589.3
2034	$876.0	$621.7
2035	$938.4	$641.1
2036	$936.0	$615.6
2037	$933.1	$590.7
2038	$929.5	$566.4
2039	$925.5	$542.9
2040	$921.1	$520.1
2027-2040	**$8,770.9**	**$5,864.3**

To be conservative, the impacts of state or federal tax credits were not included in the analysis. If federal EV tax credits, which were extended in the Inflation Reduction Act, were included, it is estimated Colorado consumers would see an additional cumulative benefit over the analysis time frame of $4.1-$4.9 billion depending on the discount rate used. While the Colorado legislature recently extended and increased the state ZEV tax credit through HB23-1272 for this analysis the impact is assumed to be neutral since the credits are a benefit to consumers but a cost to the state.

Fuel Cost Savings

Electric vehicles are fundamentally more efficient than internal combustion powered motor vehicles. This increased efficiency directly translates into improved fuel economy. The net effect of this increased fuel efficiency allows electric vehicles to travel further on the same amount of energy as conventionally fueled vehicles. Moreover, electricity costs can be significantly lower priced than gasoline or diesel fuel, especially at home, where the vast majority of charging is estimated to take place.

Direct current fast charging (DCFC) stations tend to be higher in cost than residential charging stations utilizing simple Level 1 or Level 2 chargers, negating some of the cost advantages of operating an electric vehicle. However, the continuing fuel efficiency of electric operation will still result in overall fuel cost savings. Additionally, DCFC stations have the operational advantages of fast charging electric vehicles away from home, or for motorists that do not have access to home or business charging.

Plug-in hybrids have similar advantages to that of battery-electric vehicles when operated on their electric motor only. And, with plug-in hybrid vehicles required to go 43 miles between charges through MY2028 for partial credit, and 70 miles thereafter, for full credit, most in-town travel can be made strictly on electric operation. Table 11 lists the fuel prices used in this analysis in 2022 dollars.

Table 11[16],[17] Annual Fuel Costs for ICE Vehicles and EVs

Calendar Year	Fuel Type		
	ICE- $/gal[18]	EV - $/kW[19]	DCFC - $/kW[20]
2027	$2.94	$0.12	$0.38
2028	$2.93	$0.12	$0.37
2029	$2.93	$0.12	$0.37
2030	$2.94	$0.12	$0.36
2031	$2.95	$0.12	$0.35
2032	$2.94	$0.12	$0.35
2033	$2.96	$0.12	$0.34
2034	$2.97	$0.12	$0.34
2035	$2.99	$0.12	$0.33
2036	$3.00	$0.12	$0.33
2037	$3.04	$0.13	$0.32
2038	$3.04	$0.13	$0.32
2039	$3.06	$0.13	$0.31
2040	$3.07	$0.13	$0.31

[16] *Annual Energy Outlook 2023*, Table: Table 3. Energy Prices by Sector and Source, Case: Reference case | Region: Mountain, EIA, March 16, 2023.
[17] EVgo. 2023. Discover pricing on the go. Colorado region.
[18] https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2023&region=1-8&cases=ref2023&start=2021&end=2050&f=A&linechart=ref2023-d020623a.28-3-AEO2023.1-8&map=&ctype=linechart&sourcekey=0
[19] electricity: https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2023&region=1-8&cases=ref2023&start=2021&end=2050&f=A&linechart=~ref2023-d020623a.6-3-AEO2023.1-8&map=&ctype=linechart&sourcekey=0
[20] https://www.evgo.com/pricing/

Vehicle miles traveled (VMT) assumptions used are based on EPA data of population and activity of on-road vehicles from the Motor Vehicle Emissions Simulator (MOVES3) model. These are the same assumptions described and utilized in the emissions analysis. It assumes a 15-year vehicle ownership period for consumer spending on fuel and other operational costs.

The analysis utilizes the inputs documented in ICCT 2022 for home versus public charging, the share of electric versus gasoline driving for PHEVs, and the estimated operational efficiency and cost impacts of towing. Their report assumes that about 95 percent of charging for a 300-mile range BEV is assumed to be completed at home, with the remainder at public Direct Current Fast Charger (DCFC). For 50-mile range PHEVs, the assumed fraction of annual miles traveled on electricity is in the range of 69 percent. The report also accounts for additional DC fast charging to support a proportion of towing miles associated with longer-distance trips, including the efficiency losses anticipated during towing.

The fuel cost savings resulting from this rule is expected to be worth $12.7 billion with a 3% discount rate and $9.2 billion with a 7% discount rate. Table 12 lists these cost savings by calendar year.

Table 12. Estimated Consumer Savings on Fuel in Colorado (Millions of 2022$)

Calendar Year	Colorado Clean Cars	
	3% discount rate	7% discount rate
2027	$544.7	$504.7
2028	$690.7	$616.1
2029	$822.9	$706.6
2030	$948.8	$784.2
2031	$1,049.2	$834.8
2032	$1,096.2	$839.6
2033	$1,036.6	$764.3
2034	$976.7	$693.2
2035	$918.4	$627.4
2036	$921.5	$606.0
2037	$924.6	$585.3
2038	$925.0	$563.7
2039	$925.9	$543.1
2040	$927.6	$523.8
2027–2040	**$12,708.7**	**$9,192.8**

Maintenance Savings

As well as being more fuel efficient, battery electric vehicles are also much simpler mechanically than conventional vehicles with far fewer moving parts to wear out or that need to be serviced or adjusted. Due to this, maintenance costs will be lower on these vehicles.

For conventional gasoline or diesel fueled vehicles sold under this proposal, costs are expected to remain comparable to current vehicles. They are assumed to have similar maintenance costs to the business-as-usual fleet, fundamentally being the same as current vehicles, though because of the increased engine/vehicle life and extended warranty requirements, these vehicles may be more durable than existing vehicles with savings from that. On the other hand, there may be certain minor increased costs associated with their more robust warranties, parts, and electronics[21].

Plug-in hybrid electric vehicles will have higher maintenance costs than battery electric vehicles since they have both an electrical as well as mechanical internal combustion system. Table 13 lists the values in terms of cost per mile utilized in this analysis.

Table 13. Per-Mile Vehicle Maintenance Costs[22]

Vehicle Model	Vehicle Type		
	ICE	BEV	PHEV
Car	$0.07	$0.036	$0.05
Crossover	$0.07	$0.036	$0.05
SUV	7	$0.036	$0.05
Pickup	$0.09	$0.036	$0.05

Assuming driving patterns do not change between vehicle types, there will be a net benefit or costs savings of $10.1 billion for this program when assuming a 3% discount rate, $7.2 billion cost saving at the 7% discount rate. Table 14 summarizes the projected maintenance savings/benefits of the program by calendar year through 2040.

[21] *Advanced Clean Cars II Proposed Amendments to the Low Emission, Zero Emission, and Associated Vehicle Regulations, Standardized Regulatory Impact Assessment (SRIA)*, California Air Resources Board, Updated: March 29, 2022.

[22] Peter Slowik, et., al., *Assessment of Light-Duty Electric Vehicle Costs and Consumer Benefits in the United States in the 2022-2035 Time Frame*, ICCT, October 2022.

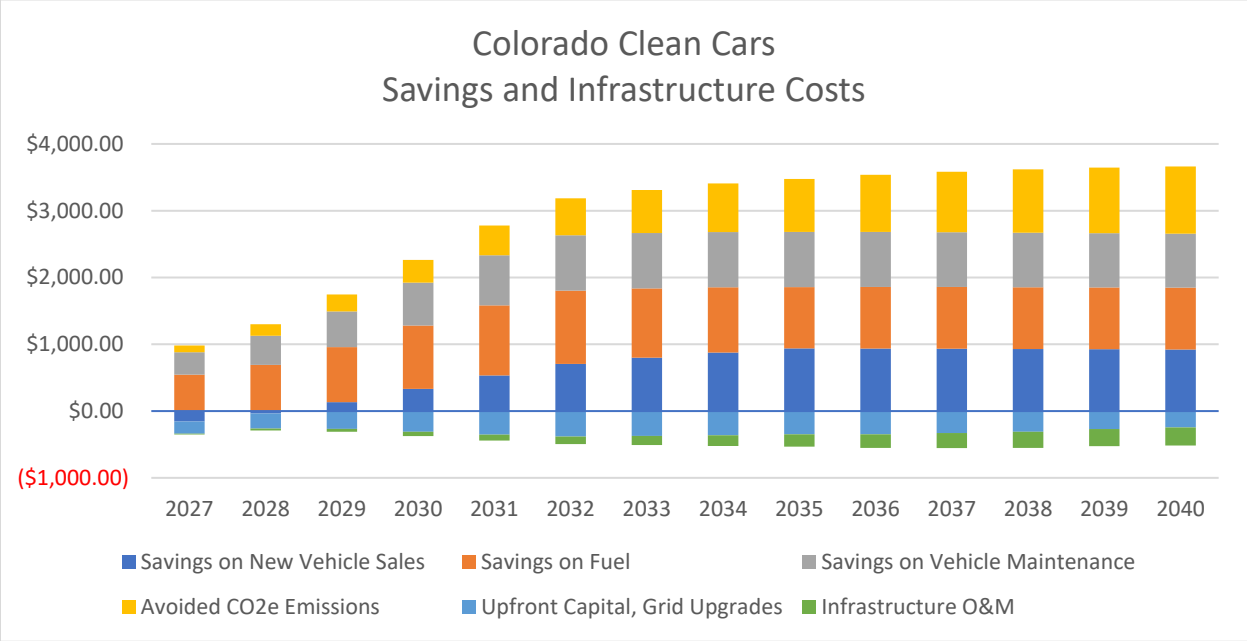
Table 14. Estimated Consumer Savings on Vehicle Maintenance in Colorado (Millions of 2022$)

Calendar Year	Colorado Clean Cars	
	3% discount rate	7% discount rate
2027	$335.3	$310.7
2028	$437.7	$390.4
2029	$535.8	$460.1
2030	$641.7	$530.4
2031	$750.1	$596.8
2032	$829.3	$635.2
2033	$829.4	$611.5
2034	$828.7	$588.1
2035	$827.0	$565.0
2036	$824.2	$542.0
2037	$820.9	$519.7
2038	$817.1	$497.9
2039	$812.8	$476.8
2040	$808.1	$456.3
2027–2040	$10,098.2	$7,181.0

Summary of Savings

The savings from this rule include savings on new vehicle sales, fuel, vehicle maintenance, health savings, and the avoided cost of climate change from CO2e Emissions. These savings add up to $41 billion. The cost that impact these savings include charging infrastructure upfront capital and grid upgrades as well as infrastructure O&M, adding up to $6.3 billion. Taken together, the rule has a benefit-to-cost ratio of 6.5, meaning that for each dollar in cost, there will be at least $6.5 in benefits when comparing program savings to infrastructure costs. These figures do not include other potential benefits of the rule, such as the utilization of federal tax credits, and the potential for reduced electric utility rates due to increased utilization of the electric grid. State fees and taxes are also not included.

Figure 4. Savings and Infrastructure Costs, 3% discount rate (figures in million $)



3. **The anticipated costs of the rule or amendment, which shall include the direct costs to the government to administer the rule or amendment and the direct and indirect costs to business and other entities required to comply with the rule or amendment.**

Direct Costs to Government

Direct costs to the government are reduced since Colorado is incorporating through reference California's Clean Cars requirements. This permits Colorado to share general administration and enforcement of the program with the State of California, much like states do with federal new car standards. This lessens the regulatory burden on the state.

The Division will require an additional 1.0 FTE to assist in administering the Colorado Clean Cars Rule. The additional staff will be necessary to monitor environmental justice (EJ) requirements, coordinate with dealers for the financial assistance program, and oversee the community-based clean mobility program, as well as other duties as assigned. The cost to the state is expected to be approximately $105,250 for the first year, of which $87,600 would be for staff salary and benefits. Associated support equipment and administrative costs will be $18,150 in computer equipment and office supplies.

Infrastructure Costs

To support the growing population of battery electric vehicles and plug-in electric hybrids, additional charging and infrastructure is necessary. While there has been tremendous growth in support infrastructure in the recent past due to the continued adoption of electric vehicles and investments by the federal government, State of Colorado, electric utilities, and private entities, such infrastructure will need to be expanded to even a larger extent than under this rule. For the conventionally fueled portion of the fleet subject to this rule, it is expected that the existing infrastructure already in place will be adequate for any new production conventionally fueled vehicles produced under this rule.

It is projected that infrastructure costs under this rule are expected to be between $3.1 and $4.3 billion with operational and maintenance costs of between $1.4 and $2.0 billion through 2040, depending on discount rates utilized. In deriving these costs, the analysis looked at the number of needed recharging installations, their average cost, attendant maintenance costs, and grid upgrade per recharging installation.

Charging Infrastructure

A study commissioned by the Colorado Energy Office in 2021 that estimated the type, number, and cost of various types of chargers needed to meet the state's 2030 EV sales goals was updated to reflect the EV adoption scenarios examined for this rule[23]. Data from this updated analysis was then used to determine the capital and grid upgrade costs as well as the operation & maintenance cost.

The number of new charger installations required by the proposal is estimated to be 1.6 million by 2040. This compares to 315,000 new installations under the business-as-usual scenario.

[23] Chih-Wei Hsu, et. Al., *Colorado Charging Infrastructure Needs to Reach Electric Vehicle Goals*, ICCT, February 25, 2021

Table 15. Number of New Charger Installations

Calendar Year	BAU	Colorado Clean Cars
2027	26,815	68,721
2028	26,291	81,033
2029	25,747	93,357
2030	25,118	107,220
2031	25,039	122,347
2032	24,627	134,369
2033	23,963	136,155
2034	23,055	137,109
2035	21,984	136,399
2036	20,909	135,295
2037	19,589	131,892
2038	18,432	126,919
2039	17,407	114,702
2040	16,412	108,319
2027-2040	**315,388**	**1,633,837**

Source: ICCT (2023)

Home chargers are estimated to cost between $1,082 to $4,084 per unit depending on the charger level (1 or 2). Large direct current fast charging (DCFC) units are projected to cost an average of $125,962 over the study period. The following table lists these costs for the different level chargers by calendar year.

Table 16. Cost of Charging Infrastructure Upfront Capital and Grid Upgrade Costs by Charger Type* (2022$, undiscounted)

Calendar Year	Home Level 1	Home Level 2	Workplace	Public Level 2	DCFC**
2027	$1,111	$4,096	$5,208	$8,068	$116,587
2028	$1,105	$4,090	$5,188	$7,983	$119,245
2029	$1,100	$4,085	$5,169	$7,901	$121,965
2030	$1,095	$4,081	$5,152	$7,823	$123,943
2031	$1,090	$4,078	$5,137	$7,748	$125,221
2032	$1,085	$4,076	$5,122	$7,676	$126,355
2033	$1,081	$4,075	$5,110	$7,607	$127,585
2034	$1,077	$4,075	$5,098	$7,542	$128,180
2035	$1,074	$4,077	$5,088	$7,479	$128,687
2036	$1,071	$4,079	$5,080	$7,420	$129,294
2037	$1,068	$4,083	$5,073	$7,364	$129,907
2038	$1,066	$4,087	$5,067	$7,310	$129,882
2039	$1,064	$4,093	$5,063	$7,259	$128,816
2040	$1,062	$4,100	$5,060	$7,211	$127,806
Average	**$1,082**	**$4,084**	**$5,115**	**$7,599**	**$125,962**

Source: ICCT (2023)
*These estimates include costs for installation, hardware, and grid upgrades.
**The cost for DCFCs represents a mix of 50-, 150-, and 350-kW chargers that changes over time based on the assumed mix of these three different types of fast chargers. For example, in 2025, the DCFC upfront capital and grid upgrade cost represents a mix of 61 percent 50-kW, 37 percent 150-kW, and 2 percent 350-kW DCFCs. In 2030, the DCFC O&M cost represents a mix of 40 percent 50-kW, 57 percent 150-kW, and 3 percent 350-kW DCFCs.

Operation and Maintenance (O&M) costs for electric vehicle charging units are a necessary component in determining total infrastructure costs. They range from $6 annually for a simple Level 1 home charging unit to $8,175 annually for a large DCFC charging unit.

Operational and maintenance costs were provided by ICCT and include data on costs from Avista[24] that include planned and unplanned charger maintenance, network fees, connection restoration, testing, site maintenance, and land use. The costs also include estimates of demand charges based on Xcel Energy (2023)[25] and are about $3.50 per kilowatt per month in 2027. The analysis assumes chargers have a 10-year lifetime. Network fees are included for home Level 2 chargers for multi-family housing to allow for individual billing, as well as for all public chargers. Networking costs as well as site maintenance, land use, and demand charges do not apply to single-family home charging. The following table lists these costs for the different level chargers by calendar year.

[24] Rendall Farley, P.E, et. al., *Electric Vehicle Supply Equipment Pilot Final Report,* Avista, October 18, 2019.
[25] *January 2023 Colorado Business Rate Brochure*, Xcel Energy, 2023.

Table 17. Cost of Charging Infrastructure Operation and Maintenance by Charger Type* (2022$, undiscounted)

Calendar Year	Home Level 1	Home Level 2	Workplace	Public Level 2	DCFC*
2027	$6	$228	$470	$975	$5,813
2028	$6	$228	$476	$982	$6,207
2029	$6	$228	$483	$988	$6,656
2030	$6	$228	$490	$995	$7,059
2031	$6	$228	$497	$1,002	$7,415
2032	$6	$228	$504	$1,009	$7,743
2033	$6	$228	$512	$1,017	$8,122
2034	$6	$228	$519	$1,025	$8,450
2035	$6	$228	$527	$1,032	$8,748
2036	$6	$228	$535	$1,040	$9,097
2037	$6	$228	$543	$1,049	$9,458
2038	$6	$228	$552	$1,057	$9,721
2039	$6	$228	$561	$1,066	$9,892
2040	$6	$228	$569	$1,075	$10,068
Average	**$6**	**$228**	**$517**	**$1,022**	**$8,175**

Source: ICCT (2023)
*The DCFC category represents a mix of 50-, 150-, and 350-kW DCFCs that change over time, as described above in Table 2.

Based upon the number of recharger units needed to meet the proposed rule and the costs associated with these units and their maintenance, a total cost for upfront capital and grid upgrades may be calculated, as shown in Table 18.

Table 18. Estimated Expenditures on Charging Infrastructure Upfront Capital and Grid Upgrades (Millions of 2022$)

Calendar Year	Colorado Clean Cars	
	3% discount rate	7% discount rate
2027	$181.9	$168.6
2028	$225.6	$201.2
2029	$265.9	$228.3
2030	$309.0	$255.4
2031	$352.8	$280.7
2032	$380.8	$291.7
2033	$371.9	$274.2
2034	$362.5	$257.2
2035	$349.1	$238.5
2036	$347.3	$228.4
2037	$329.8	$208.8
2038	$308.5	$188.0
2039	$268.6	$157.6
2040	$245.9	$138.9
2027-2040	**$4,299.5**	**$3,117.3**

Sources: ICCT (2021), ICCT (2023), and BLS (2023)

Ongoing maintenance of necessary charging units need to meet this proposal (above and beyond those needed in a business-as-usual case), are listed in Table19.

Table 19. Estimated Expenditures on Charging Infrastructure Operation and Maintenance (Millions of 2022$)

Calendar Year	Colorado Clean Cars	
	3% discount rate	7% discount rate
2027	$11.9	$11.1
2028	$26.8	$23.9
2029	$44.2	$38.0
2030	$64.7	$53.4
2031	$87.9	$69.9
2032	$112.9	$86.4
2033	$137.2	$101.1
2034	$160.7	$114.1
2035	$182.7	$124.8
2036	$204.0	$134.2
2037	$223.9	$141.7
2038	$242.1	$147.5
2039	$257.3	$150.9
2040	$270.7	$152.9
2027-2040	**$2,026.9**	**$1,350.0**

Sources: ICCT (2021), ICCT (2023), and BLS (2023)

For public chargers it is hard to determine how much charging providers will pass on both capital and operation and maintenance costs to consumers through their fees for public charging. As a result, this analysis does not attempt to quantify the proportion of capital or operation and maintenance costs that may be passed on to consumers and reflected in the price of charging. This analysis thus represents a conservative approach, as some of the costs to consumers for public charging may also be represented in the capital and operating costs summarized in this section.

The primary costs to consumers of this rule is anticipated to primarily be for the installation of home chargers (Home Level 1 and 2), which represent a large proportion of the anticipated infrastructure costs. Nevertheless, this analysis takes a conservative approach and estimates the cost of the full network of different types of chargers needed to support the transition to ZEVs, though other state, utility, and federal policies and programs are driving much of the investment, particularly for public charging, independently of this proposed rule.

Direct and Indirect Costs to Businesses and Other Entities to Comply

There are certain direct and indirect costs to businesses that are associated with this rule. Though the rule will result in overall total health and cost savings to the public and society, businesses reliant on the production, repair and maintenance, and services that include providing gasoline and diesel fuel to conventional vehicles will be impacted. Businesses expected to be impacted by this rule include automobile manufacturers and parts suppliers, car dealers and dealerships, vehicle repair facilities, fuel providers, distributors and jobbers, as well as retail fuel and service stations.

Electric vehicles are projected to become less expensive than conventionally fueled vehicles. This will translate into reduced income for new vehicle dealerships, as well as potentially also affecting used vehicle dealers in the longer term. As the bulk of revenues received from the purchasing of new motor vehicles pass to the vehicle manufacturers, much of this reduction in lost vehicle revenue will be borne by out-of-state vehicle manufactures who may be able to adjust their business practices to compensate for this.

Reduced maintenance costs will result from the adoption of battery electric vehicles as well as plug-in hybrid electric vehicles. This will reduce the income seen by dealership maintenance departments as well as independent repair facilities.

A decline in gasoline and diesel fuel demand will result as battery electric and plug-in hybrid vehicles make up a greater proportion of the automotive fleet. It must be noted that this decrease in demand from electric vehicles is just one of several factors that will depress future fuel sales. Increasing fuel efficiency of new vehicles is already impacting fuel demand.

Overall, the loss of business, and/or income, for car dealers and dealerships, repair shops, and refiners and producers, and fuel suppliers, including retail refueling stations, will translate in the reduction in the number of jobs that are dependent on the sale, maintenance and servicing of those vehicles. While businesses may modify their business operations such as convenience store/refueling outlets adding quick charging stations as part of their business, the number of positions needed to produce, sell, and service conventional vehicles will decline. Switching a business' emphasis to catering to electric vehicles could shift some of these jobs to new positions prevalent with the switch to electric vehicles. Already, certain large oil companies, such as BP have been divesting into other energy fields such as renewable energy (*Top Oil Companies Investing in Renewable Energy*, The Motley Fool, May 12, 2023).

As shown in Table 20, depending on the discount rate, the total decrease in spending non affected parities range from $20.1 to $28.7 billion, depending on the discount rate chosen.

Table 20. Total Decrease in Spending on Vehicle Sales and Ownership in Affected Industries in Colorado (Millions of 2022$).

Calendar Year	Colorado Clean Cars	
	3% discount rate	7% discount rate
2027	-$601.5	-$557.4
2028	-$940.8	-$839.2
2029	-$1,316.2	-$1,130.1
2030	-$1,719.2	-$1,421.0
2031	-$2,102.8	-$1,673.1
2032	-$2,385.4	-$1,827.0
2033	-$2,425.6	-$1,788.3
2034	-$2,448.3	-$1,737.6
2035	-$2,456.5	-$1,678.2
2036	-$2,455.4	-$1,614.8
2037	-$2,453.3	-$1,553.1
2038	-$2,447.5	-$1,491.5
2039	-$2,455.0	-$1,440.2
2040	-$2,463.3	-$1,391.0
2027-2040	**-$28,670.7**	**-$20,142.2**

Sources: ICCT (2022), ICCT (2023), EIA (2023), and BLS (2023)

The result of decrease vehicle spending on conventional vehicles does reduce the number of corresponding job positions in support of the vehicles, along with job creation in supporting and servicing electric vehicles. As discussed above, many of the business impacts will be felt by out-of-state vehicle manufacturers and fuel producers and providers, whose operational flexibility could shift vehicles and products to other more profitable regions. Similarly, job positions affected will be felt out-of-state. Affected in-state staffing would occur in vehicle dealerships and other car outlets, local vehicle maintenance facilities, and retail fuel outlets, among other businesses. Table 5 above details these job changes.

4. **Any adverse effects on the economy, consumer, private markets, small businesses, job creation, and economic competitiveness.**

The rule will have overall health and environmental cost benefits, as well as significant economic savings for vehicle owners. As with any new technology, the introduction of electric vehicles will create disruptions in current vehicle sales and usage practices. This rule will speed up these disruptions, but given current manufacturing trends, these disruptions will occur absent the rules. In fact, the adoption of proposed Regulation No. 20 may smooth out the transition to the introduction of electric vehicles into the vehicle fleet through early adoption and prevent more lasting adverse effects later by encouraging the development of vehicle markets, infrastructure, and operational awareness of these vehicles in the near term. This may improve Colorado's economic competitiveness in the future.

The introduction, operation and maintenance of battery electric and plug-in hybrid vehicles will experience certain economic impacts, detailed earlier, when purchasing, operating, and maintaining a vehicle. Necessary infrastructure to support these vehicles will have to be put into place, from recharging units to electrical distribution upgrades. Electric providers will have to expand and upgrade their energy generation and distribution network. Of note is that these changes will occur over an extended period of time, lessening their immediate impacts.

For some owners, the entry into battery electric vehicles may be more burdensome than to others. Under this proposal, owners will still be free to choose traditionally fueled vehicles that meet the more stringent emissions standard averages being proposed. Conventionally fueled vehicles will remain available under this proposal.

Vehicle technicians that are involved in vehicle maintenance may be impacted, though it will take a period of time for fleet turn over to affect a transition to a predominately electric vehicle fleet. While not quantified, additional training may be necessary for those technicians working on electric vehicles. Reduction in the need for maintenance of these vehicles may also have an impact. There will be a motorist savings of $10.09 billion dollars in maintenance costs through 2040, which will translate into a loss of income of roughly the same amount.

Fuel providers, distributors, and marketers will be impacted by the loss of business with the introduction of battery electric vehicles and plug-in hybrid vehicles. As stated above, there will be a motorist savings of $12.7 billion dollars of business through 2040, which will translate into a loss of income of roughly the same amount. Much of this loss will be incurred from products imported into the state, so the localized impact for Colorado may be mitigated to a certain extent.

5. At least two alternatives to the proposed rule or amendment that can be identified by the submitting agency or a member of the public, including the costs and benefits of pursuing each of the alternatives identified.

No action:

Section 177 of the federal Clean Air Act (CAA) allows states to adopt California standards for vehicles sold within their borders.[26] Under the identicality requirements of section 177, states are not allowed to develop their own standards. This identicality standard was adopted to create a very narrow exception to the Federal government's broad jurisdictional preemption of new motor vehicle emission standards.[27]

[26] 42 U.S.C § 7507.

[27] *Id. See also* Washington v. General Motors Corp., 406 U.S. 109 (1972).

The CAA is clear, however, that states must utilize either Federal or California vehicle standards. Given this jurisdictional preemption, Colorado's alternatives with respect to light and medium-duty vehicle standards are very limited. The most obvious alternative is the no-action alternative whereby the Commission would not adopt any new program and instead allow Colorado to be subject to federal vehicle standards. Alternatively, the Commission could adopt pieces of the Division's proposal. While Colorado cannot create its own vehicle standards, it is not prohibited from adopting portions of the California program.

By definition, the no-action alternative will not result in any additional costs or benefits relative to the current state. However, because the package of proposed rules is projected to result in both significant emission reduction benefits and significant cost-savings, the no-action alternative will result in a lost opportunity to achieve the projected benefits and savings. As detailed above, the package of proposed rules is projected to reduce GHG emissions by 109,096,948 metric tons of CO2e, NOx emissions by 18,657 tons, and PM2.5 by 1,317 tons. Overall financial savings from the proposed rules are estimated at approximately $41 billion dollars. These benefits and savings will not be achieved under the no-action alternative.

Adoption of the rule through 2035:

A second alternative would be to adopt California's new vehicle standards through the model year 2035 and beyond.[28] Under this scenario, savings in direct spending by consumers on vehicle sales and ownership in this scenario would range from $25.2 billion to $35.0 billion for the 3% and 7% discount rates. The indirect and induced impacts on economic output would range from $32.6 billion to $45.3 billion for the 3% and 7% discount rates, although this figure would decrease if consumers chose to just save the money not spent on vehicle sales and ownership instead of spending it on other goods and services. Employment impacts would increase annually to a total in 2032 of 27,120 FTEs gains and then decrease in future years due to the projected end of the federal and state tax credits in 2032.

Expenditures on charging infrastructure, including upfront capital, grid upgrades, and ongoing O&M would result in a total economic impact of $9.9 billion to $14.1 billion for the 3% and 7% discount rates. The employment impact from this investment would result in a high number of jobs, peaking at 9,724 FTEs in 2039.

The total economic benefits of avoided GHG emissions of this scenario (2035) range from $6.7 billion to $10.0 billion for the 3% and 7% discount rates. The health benefits from this rule are estimated to be worth $687,997,075.

[28] One of the parties to the rulemaking (Environmental Advocates) has proposed this as an alternative proposal and submitted a Final Economic Impact Analysis (EA_REB_EX-005) in support of that alternative proposal which is incorporated here by reference and linked here.
https://drive.google.com/drive/u/0/folders/13RMiq8d2gxl1-RKyGb8Xipc7Ni9Hetx2

5. Cost-Benefit Analysis: Air Quality Control Commission Regulation Number 3 - Stationary Source Permitting and Air Pollutant Emission Notice Requirements, May 16-19, 2023

Cost-Benefit Analysis

In performing a cost-benefit analysis, each rulemaking entity must provide the information requested for the cost-benefit analysis to be considered a good faith effort. The cost-benefit analysis must be submitted to the Office of Policy, Research and Regulatory Reform at least ten (10) days before the administrative hearing on the proposed rule and posted on your agency's web site. For all questions, please attach all underlying data that supports the statements or figures stated in this cost-benefit analysis.

DEPARTMENT:	Colorado Department of Public Health & Environment	**AGENCY**:	Air Quality Control Commission
CCR:	5 CCR 1001-5	**DATE:**	May 5, 2023

Rule Title or Subject:

Regulation Number 3 - Stationary Source Permitting and Air Pollutant Emission Notice Requirements

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Per the provisions of § 24-4-103(2.5)(a), Colorado Revised Statutes, the Colorado Department of Public Health and Environment, Air Pollution Control Division ("Division") has prepared the following cost-benefit analysis.

1. The reason for the rule or amendment

During the 2021 legislative session, Colorado's General Assembly adopted House Bill 21-1266 (HB 21-1266), otherwise known as the Environmental Justice Act, revising 25-7-114.4, C.R.S. HB 21-1266 directs the Air Quality Control Commission (Commission) to adopt rules that "must provide for enhanced modeling and monitoring requirements for new and modified sources of affected pollutants in disproportionately impacted communities that are identified or approved at the time of permit application." HB 21-1266 further directs the Commission that "In adopting the rules, the Commission shall also consider requiring enhanced monitoring for existing sources of affected pollutants."

The Division is proposing revisions to Regulation Number 3 (Regulation 3) to meet both the letter and spirit of the statutory requirements of HB 21-1266. Specifically, the Division is proposing the following revisions: (1) in Part A, Section I.B to include definitions for "Air Quality Enterprise", "Affected Pollutants," "Affected Construction Source," "Cumulatively Impacted Community," Disproportionately Impacted Community," "Occupied Areas," "Significant," "Significant Emissions Increase," and "Socioeconomically Vulnerable Community"; (2) in Part B, Section II.A.6 to ensure all permitting actions that may have an adverse impact on already burdened communities are assessed through the enhanced permitting framework; (3) in Part B, Section III.B to revise permit application requirements for sources to include an environmental justice summary and to provide for enhanced modeling requirements; (4) in Part B, Section III.D to include an expansion of Reasonably Available Control Technology (RACT) requirements; (5) in Part B, Section III.J to include enhanced monitoring requirements for new and modified sources in disproportionately impacted communities; and (6) in Part C, Section V.C to allow for enhanced monitoring requirements in renewed operating permits for facilities located in Disproportionately Impacted Communities (DI Communities).

2. The anticipated economic benefits of the rule or amendment, which shall include economic growth, the creation of new jobs, and increased economic competitiveness

These revisions will aid Colorado's efforts to address environmental injustice experienced in communities of color, low-income communities, communities experiencing housing burdens, and communities that are disproportionately harmed by the cumulative impacts of pollution. The proposed revisions are designed both to provide meaningful information on impacts being experienced by communities and reduce emissions in Disproportionately Impacted Communities (DI Communities) thereby reducing local health and environmental burdens.

Disproportionate health burdens from air pollution results in an economic burden for those communities, who face more missed days of school and work from associated health impacts, as well as additional economic strains from increased medical costs. The proposed revisions aim to mitigate air pollution impacts in the most burdened communities, and therefore aims to reduce the economic strains associated with disparate air pollution impacts.

Requiring sources to address environmental justice concerns early in the permitting process may help businesses and other entities avoid public and/or legal concerns raised late in the permitting process, resulting in cost savings and increased operational efficiency.

The proposed revisions may result in positive economic impact to supporting businesses that contractually conduct modeling analyses, as some owners and operators may choose to contract a company to conduct the proposed modeling requirements. The proposed revisions may also result in positive economic impact to equipment suppliers or monitoring companies, as some owners and operators may have to purchase and install equipment in order to comply with the proposed monitoring revisions. The Division anticipates that some companies may have to hire additional staff or engage contracting support to accommodate the additional permitting, modeling, and monitoring requirements.

3. The anticipated costs of the rule or amendment, which shall include the direct costs to the government to administer the rule or amendment and the direct and indirect costs to business and other entities required to comply with the rule or amendment

The Division's assessment of the costs and benefits for each of the proposed revisions is set forth below. For each component of the proposed revisions, these assessments identify the potential costs of the proposed revisions for affected industries. The Division also assessed whether any of the proposed strategies would impose a direct cost on the general public to comply, and determined that based on the available data there will be no direct costs on the general public for any of the proposed requirements.

Definition Revisions

The Division's proposal to revise definitions in Part A, Section I, may result in costs to businesses and other entities that will use the new definitions to determine applicability of the proposed Regulation 3 requirements. There are little to no costs resulting from the inclusion of the definitions themselves. However, there may be costs incurred due to enhanced modeling, monitoring, or permitting requirements (detailed below) which will be determined using the proposed definitions (among several other factors). The industrial and business sectors potentially impacted by the proposed definitions may include sources of emissions from: the oil and gas industry; electric utilities; manufacturing sources; mining operations; hospitals; university and college campuses; and all other entities with emissions of Affected Pollutants above applicable thresholds.

The Division requested additional information from stakeholders, but none was provided. The Administrative Procedures Act and the Air Pollution Prevention and Control Act require the Division only to use reasonably available data.

Permitting Revisions

Minor Modification Permitting Process

The Division's proposal includes revisions to Regulation 3, Part B, Section II.A to clarify that sources in DI Communities are not able to qualify for a minor modification for projects that would otherwise qualify as minor New Source Review (NSR) permitting actions under Part B. The revision to the minor modification process may impact timing of project implementation as it would require sources to have an approved construction permit prior to the commencement of operations, potentially resulting in increased costs for businesses and other entities. The Division, however, has tailored the rule to account for this concern by proposing a future effective date that would allow businesses to plan appropriately for the implementation of this change and take action to ensure permit applications are submitted with enough lead time so as not to delay operations.

In the past 5 years, the Division has processed 176 minor modifications, and based on this analysis it is anticipated that this proposal would impact approximately 35 permitting actions per year statewide. However, as this is a forward-looking proposed program and the proposed change is limited to sources located in DI Communities, the Division cannot estimate the precise number of permits that would be impacted by this change.

The Division estimates this proposed revision would lower implementation costs for the Division in the processing of minor modifications. This revision removes burdensome processing and review requirements necessitated by minor modification timelines. There will no longer be the need for the repeated and resource intensive rework in response to submittal of minor modifications for facilities where permit renewals have already been drafted. Permit processing costs may increase for applicants as they may be subject to the costs incurred due to enhanced modeling, monitoring, or permitting requirements (detailed below).

Additionally, the Division is proposing to revise Part C, III.B.2 to clarify significant modifications are subject to requirements of Part B. This proposal does not change any existing practices or create new requirements, rather, it clarifies the existing requirement and, as such, will not result in costs to affected sources.

Environmental Justice Summary

The Division's proposal to revise Regulation 3, Part B, Section III.B. to require the development of environmental justice summaries for all sources should result in no costs to businesses or other entities, as the environmental justice summary will be compiled from information readily available in the free, open-source, and publicly-available Colorado EnviroScreen tool. However, stakeholders have noted that preparing the environmental justice summary may result in costs to sources, including time and labor costs to engage with community members, and to consider or make changes to the permit application. The Division requested additional information on the potential costs but no economic figures have been provided by stakeholders. The Administrative Procedures Act and the Air Pollution Prevention and Control Act require the Division only to use reasonably available data. The Division further notes that though public engagement is encouraged by Regulation 3 to promote fair treatment and meaningful involvement of disproportionately impacted community members, it is not a substantive application requirement.

The Division will spend additional time reviewing environmental justice summaries with permit applications, and is actively hiring an Environmental Justice in Permitting Specialist who will focus specifically on the review of environmental justice summaries and assessment of appropriate enhanced requirements. Regulation 3, Part A, Section VI.D.2 establishes a permit processing fee of $119 per hour. Parties to this rulemaking have noted that this cost will be incurred by the source and will depend on the length of time that the Division spends reviewing, which is anticipated to take approximately 1 to 2 hours per review of each environmental justice summary. As such, the environmental justice summary may result in $119-$238 per permit of increased costs for permit processing.

Enhanced Modeling

The Division's proposal to revise Regulation 3, Part B, Section III.B to require enhanced modeling may result in additional costs to new or modified sources of affected pollutants located in cumulatively impacted communities, as the affected sources may have to conduct additional modeling to evaluate the impact of the source's emissions. Affected businesses will be charged $119 per hour for each permit's modeling review, and the modeling review is anticipated to require an average of 2 weeks per permit, resulting in an increased costs of $9,520 when additional modeling is required. However, the Division has designed the proposed rules to leverage existing modeling requirements so additional modeling requirements would apply only to certain sources of benzene, toluene, ethyl benzene and xylenes in Cumulatively Impacted Communities.

Affected businesses may choose to hire contract modelers to complete the required modeling analysis, the cost of which will vary depending on the level of complexity and type of source. The Division estimates that cost to conduct modeling through contract modelers may range from $140-$180 per hour depending on consulting services used, with the hours of consulting services needed dependent on the complexity of the source operations, pollutants to be modeled, and level of modeling analyses required.[1] Stakeholders have noted that the Division's range of modeling costs may be low. The Division requested that stakeholders provide additional information to better inform this value, however, none was provided. The Division again notes that requirements were structured to leverage existing modeling requirements, minimizing the additional modeling, and associated costs, that would be required.

There will be increased workload for the Division as a result of increased modeling submissions. The workload resulting from the proposed revisions will be absorbed by additional staff, including six additional staff recently hired by the Division to support the efforts of the Permit Modeling Unit. The Division may also enlist third party contractors to support modeling review efforts.

Reasonably Available Control Technology Analysis

The Division's proposal to revise Regulation 3, Part B, Section III.D to require new or modified sources in Cumulatively Impacted Communities to conduct RACT analysis, for volatile organic compounds, nitrogen oxides, and fine particulate matter may result in additional costs to affected businesses as the RACT analysis may determine that additional emission reduction measures should be utilized by the source. Additionally, each RACT analysis submitted by an affected business will require, on average, 1 hour for review by Division staff. This review may increase to 5–10 hours for more rare equipment types. At a rate of $119 per hour for Division staff time, a typical RACT analysis review may result in $119 in increased costs to affected businesses, with potential costs of $595-$1,119 in rare circumstances.

RACT has been defined as "the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility."[2] RACT may include control technology for a facility or distinct piece of equipment, work practices, emission standards, or some combination of these. The Division understands that given the heightened need to mitigate the disparate burden being experienced in DI communities, control technologies needed to meet RACT requirements may result in higher cost-effectiveness figures compared to cost-effectiveness figures in communities not experiencing a greater environmental burden. Technological and economic feasibility will be determined on a case-by-case basis through permitting in accordance with well-established practices.

EPA provides an Air Pollution Control Cost Manual as guidance for the development of accurate and consistent costs for air pollution controls for VOC, NO_x, and PM.[3] Though not inclusive of potential costs related to associated work practices, EPA's Control Cost Manual includes cost estimates for:

- VOC controls such as permanent total enclosures, carbon adsorbers, refrigerated condensers, flares, and incinerators;

- NO_x controls such a fuel switching, low NO_x burners, steam/water injection, natural gas reburn, selective non-catalytic reduction, selective catalytic reduction, and non-selective catalytic reduction; and

- PM controls such as baghouses, wet scrubbers, electrostatic precipitators, and inertial impactors.

EPA's Control Cost Manual estimates that the total costs associated with controls range from approximately $34,000 to $9,700,000. EPA continues to evaluate and update these cost estimates.

[1] Consultant rates for specialized dispersion modeling work provided to Division at time of EIA.
[2] See 44 Fed. Reg. 53762 (Sept. 17, 1979).
[3] See EPA Air Pollution Control Cost Manual webpage at https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution.

EPA has also provided a Menu of Control Measures (2012), listing of potential emissions reduction measures for direct $PM_{2.5}$ and precursors of ozone and $PM_{2.5}$ (NO_X, VOC, SO_2, and ammonia).[4] EPA's Menu of Control Measures includes cost per ton of emissions reduced estimates ranging from approximately $80 to $44,000 for emission reduction measures such as air to fuel ratio controller, flue gas recirculation, work practices, coating reformulations, adsorbers, catalytic oxidizers, and more. These reference documents highlight the wide variability in emission reduction control costs.

Parties to this rulemaking have noted that RACT analysis will result in increased time and labor costs to affected businesses to evaluate various RACT controls. However, though requested, no costs were provided by stakeholders. The Administrative Procedures Act and the Air Pollution Prevention and Control Act require the Division only to use reasonably available data.

Enhanced Monitoring

Source-Specific Monitoring

The Division's proposal to revise Regulation 3, Part B, Section III.J and Part C, Section V.C to allow for enhanced monitoring requirements for new, modified, and existing sources in disproportionately impacted communities will result in increased costs to affected businesses. Costs will differ between sources depending on the affected pollutant to be monitored and the monitoring technology required, and approximate costs of various monitoring technologies are detailed below. The Division is proposing sources operate a community monitor, fenceline monitoring, or leverage existing monitoring practices and modeling to comply with enhanced monitoring requirements.

Each monitoring plan submitted to the Division will require approximately 2-7 days for review by Division staff, depending on the complexity of operations, which is charged at a rate of $119 per hour. As such, each source-specific monitoring review may result in $1,904-$6,664 in increased costs to affected businesses.

Due to potential options for air quality monitoring sensors and programs that an owner or operator could select to meet their enhanced monitoring requirement, costs of the proposed revisions may vary and may range from $100s to $10,000s per sensor and system. Low-cost sensors are typically those considered to be less than $2,500 per sensor.[5]

Examples of different monitoring networks and associated costs include:

- California's South Coast AQMD Air Quality Sensor Performance Evaluation Center (AQ-SPEC) program gas-phase sensor evaluations summary table lists twenty-two gas-phase (O_3, NO_2, CO, SO_2) sensors that ranging from $200 to $10,000.[6] AQ-SPEC's PM sensor evaluations summary table lists 50 PM sensors ranging in estimated costs from $100 to $7,000.[7]

- Methane Observation Networks with Innovation Technology to Obtain Reductions (MONITOR) projects on Advanced Research Projects Agency-Energy's (ARPA-E) website list monitoring systems ranging from $300 to $3,000.[8]

[4] See EPA's Menu of Control Measures at https://www.epa.gov/air-quality-implementation-plans/menu-control-measures-naaqs-implementation.
[5] See Low-Cost Air Quality Monitoring Tools: From Research to Practice (A Workshop Summary), https://www.mdpi.com/1424-8220/17/11/2478 (published October 2017).
[6] See AQ-SPEC air Quality Sensor Performance Evaluation Center, at http://www.aqmd.gov/aq-spec/evaluations/summary-gas.
[7] See AQ-SPEC, at http://www.aqmd.gov/aq-spec/evaluations/summary-pm.
[8] See ARPA-E at https://arpa-e.energy.gov/?q=program-projects/MONITOR.

- EPA revised its National Emission Standard for Hazardous Air Pollutants (NESHAP) from Petroleum Refineries, 40 CFR Part 63 Subpart CC, in 2015 to include a fenceline monitoring work practice standard to improve the management of fugitive emissions. EPA evaluated a fenceline passive diffusive tube monitoring requirement and estimated the annualized costs for three model plants at $41,000 (18 monitoring sites), $47,600 (26 monitoring sites), and $52,500 (32 monitoring sites) per year.[9]

- Based on information readily available to the Division, cost estimates for monitors, including continuous emissions monitoring systems (CEMS), entail capital costs at approximately $215,000 and annual costs at approximately $20,000-$50,000, and parametric monitoring, entail capital costs ranging from approximately $1,100 to $32,000.[10]

- While not inclusive of cost estimates, EPA has created an Air Sensor Toolbox to provide information on air sensor performance, operation, and use for PM and gas phase (e.g. NO_x, benzene, ozone) sensors.[11]

In contrast to the lower-cost sensors described above, the cost of a trailer-based laboratory such as the Division's Colorado Air Monitoring Mobile Lab (CAMML) or Mobile Oil/Gas Optical Sensor of Emissions (MOOSE) used for community monitoring are approximately $500,000 and $800,000, respectively, not including the ongoing costs related to deployment or data processing. Other non-regulatory, community monitoring technologies vary in costs depending on pollutant(s) monitored and detection specifications, with sensors capable of monitoring one pollutant costing $200 - $300 per sensor and more sophisticated monitoring stations capable of monitoring multiple pollutants at $80,000 per monitoring station.

Fenceline monitoring can take on many different forms depending on the measurement needs of a given emission source. For example, on the simpler side of the spectrum, a small sensor specific to a compound of interest can be placed at four fixed locations surrounding the facility. On the more complex side, an optical open-path measurement system can be used to measure emissions across the entire perimeter of the facility. These two examples represent the extremes of fenceline monitoring systems, and many different permutations exist in between depending on the specific needs of the monitoring requirements. Similarly, the economic impact of these fenceline monitoring systems are equally variable depending on the complexity of the monitoring systems needed. As a guideline, the small sensor scenario described above would cost on the order of $20,000 to $30,000, whereas the more complex open-path monitoring system could cost upwards of several million dollars depending on the complexity of the facility's perimeter, the specific compounds needed to measure, and the type of instrumentation needed.

The additional monitoring would also result in increased costs to businesses and other entities for increased recordkeeping requirements. The EPA estimates these costs to be approximately $2,000-$10,000 per year.[12]

For sources utilizing the parametric monitoring and modeling option to demonstrate compliance, the cost will be minimal as sources will leverage existing monitoring, and associated recordkeeping and reporting, to inform the impact demonstration.

While the above costs data is informative, the Division is not proposing to specify a particular monitoring technology or method that sources must use at this time and, therefore, cannot estimate precisely the potential costs related to the proposed requirements for sources to conduct air monitoring.

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[9] See EPA's Fenceline Monitoring Impact Estimates for Final Rule, EPA-HQ-OAR-2010-0682 (June 4, 2015). For the small model plant, purchased equipment total capital costs were $86,650 ($89,270 for the medium model plant, $90,880 for the large model plant) and included a meteorological station, instillation, ancillary planning/selecting costs, and shipping. Annualized operating costs were $28,680 ($34,910 for the medium model plant, $39,550 for the large model plant) and included equipment maintenance/insurance, sampling collection, sampling analysis, recordkeeping, and reporting.

[10] See EPA's Publication No. 325-N-20-001 at https://www.epa.gov/sites/default/files/2021-01/documents/ap42-enforcementalert.pdf.

[11] See EPA's Air Sensor Toolbox at https://www.epa.gov/air-sensor-toolbox. EPA recently updated the Air Sensor Guidebook (2022) to incorporate best practices, current knowledge, and recommendations on sensors.

[12] Environmental Protection Agency, *Enforcement Alert – EPA Reminder About Inappropriate Use of AP-42 Emission Factors* (Nov 2020), *available at* https://www.epa.gov/sites/default/files/2021-01/documents/ap42-enforcementalert.pdf

Community Monitoring

The Division's proposal to revise Regulation Number 3, Part B, Section III.J to require sources of affected pollutants located in DI Communities which are not subject to source-specific monitoring to participate in community monitoring will result in direct costs to affected sources. Sources will be required to pay community monitoring fees upon issuance of a permit per Table 1 – Disproportionately Impacted Community Monitoring Fees. The Disproportionately Impacted Community Monitoring Fees will be assessed as a one-time fee, on a per pollutant basis. This fee schedule will be re-evaluated every three years with consideration of the number of affected sources required to pay into the community monitoring fund and changes in monitoring technology and costs.

Table 1 - Disproportionately Impacted Community Monitoring Fees			
	Socioeconomically Vulnerable Community	Cumulatively Impacted Community	
Pollutant Increases Above APEN Reporting Thresholds and Less than Affected Construction Source Threshold	$50.00	$100.00	*per Affected Pollutant in this Tier*
Pollutant Increases Greater than or Equal to Affected Construction Source Threshold	$200.00	$400.00	*per Affected Pollutant in this Tier*
Pollutant Increases Above APEN Reporting Threshold at a Major Source of Affected Pollutant	$500.00	$750.00	*per Affected Pollutant in this Tier*

Cost for Division implementation of community monitoring will be covered by fees collected.

Well-Production Monitoring

The Division's proposal to revise Regulation Number 3, Part B, Section III.J to require extended monitoring for well-production facilities will result in direct costs to the well-production facilities located in cumulatively impacted communities. Extended monitoring at well-production facilities requires affected sources to continue monitoring conducted under Part D, Section V.I. of Regulation Number 7. In discussions with the Division, stakeholders have noted that monitoring conducted under Part D, Section V.I. of Regulation Number 7 results in approximately $5,000-$7,000 in costs per month.

4. Any adverse effects on the economy, consumers, private markets, small businesses, job creation, and economic competitiveness

Finally, it does not appear that the costs associated with the Division's proposal will have any adverse effects on the economy, consumers, private markets, small businesses, job creation, and/or economic competitiveness.

5. At least two alternatives to the proposed rule or amendment that can be identified by the submitting agency or a member of the public, including the costs and benefits of pursuing each of the alternatives identified

Community and Environmental Partners Alternate Proposal

The Community and Environmental Partners (CEP) asked the Commission to consider an alternate proposal to: reduce applicability thresholds, include 17 additional hazardous air pollutants (HAPs) in its definition of "Affected Pollutants," require cumulative impact assessment modeling for each of the Affected Pollutants, require each source of Affected Pollutants to conduct additional emission unit specific monitoring, and allow the Division to reopen construction permits to include enhanced monitoring requirements.

CEP's proposal requires full-facility modeling for each of the twenty-four (24) Affected Pollutants for every non-administrative permitting action in a DI Community, irrespective of whether or not those permitting actions increase emissions of those affected pollutants. Again, the Division estimates that costs to conduct modeling through contract modelers may range from $140-$180 per hour depending on consulting services used.[13] CEP's proposal does not leverage existing modeling requirements, and as such its proposal to conduct modeling for each additional HAP would result in additional costs to sources for additional modeling contractor services. Further, affected businesses will be charged $119 per hour for each permit's modeling review. In considering that the modeling review would be encompassing of all 24 affected pollutants, and would not be limited to the project being permitted, it is anticipated that the modeling review would require more than 2 weeks per permit. Sources would not only incur additional costs for contract modeler services, but may also incur increased costs in excess of $9,520 for each permit's modeling review.

The modeling requirements proposed by CEP would also place a tremendous burden on finite Division resources. As previously stated, the Division processes an average of 1,471 general permit actions and 2,089 individual permit actions per year.[14] Conservatively assuming only 30% of these permitting actions occur in a DI Community, this would equate to the Division reviewing 1,068 modeling actions per year. It currently takes a permit modeler 2-3 weeks on average to review a permit model submission for one pollutant, and for many sources this review can take 1-2 months. Assuming a 40-hour work week at two weeks per review, this would equate to 85,440 hours[15] of Division staff time per year to implement, assuming each facility only has one pollutant above construction permitting thresholds. Assuming the average Division employee works 50 weeks per year at 40 hours per week, this workload would require 42 additional full time employees per year to manage.[16] Again, this is a low-end estimate.

CEP's proposal expands the RACT requirements to sources in all DI Communities. The Division's proposal limits RACT requirements to sources located within approximately 79 census block groups identified as cumulatively impacted, while CEP's proposal expands these requirements to sources located within approximately 707 census block groups identified as DI communities. In comparison to the costs associated with the Division's proposal (detailed above), CEP's proposed expansion of RACT to all DI communities may increase the time and labor costs nine-fold for sources required to comply with these requirements. Additionally, sources would incur costs resulting from Division staff review of RACT analyses, as detailed previously in this analysis.

CEP proposed that their Best Available Monitoring Technology ("BAMT") framework be applied on a case-by-case basis to assess monitoring technology requirements for all sources seeking a construction permit or with HAPs emitted above non-criteria pollutant reporting thresholds. The Division reiterates that, at the thresholds proposed by CEP, Division staff would, conservatively, be expected to conduct 1,068 monitoring reviews per year. Given that CEP is proposing this assessment be done for each affected pollutant for each emission unit at a source, the Division assumes it would, at a minimum, take one Division employee one week to complete the BAMT analysis. Assuming a 40-hour work week at one week per review, this would equate to 42,720 hours of Division staff time per year to implement. Assuming the average Division employee works 50 weeks per year at 40 hours per week, this workload would require 21 full-time employees per year to manage. CEP's proposal would also result in increased costs to affected businesses for monitoring plan review by Division staff, which will require approximately 7 days per review utilizing CEP's proposed framework. Charged at a rate of $119 per hour, each monitoring review may result in $6,664 in increased costs to affected businesses.

[13] Consultant rates for specialized dispersion modeling work provided to Division at time of EIA.
[14] See APCD_REB_EX-013 (Air Pollution Control Division, Colorado APCD Permitting Dashboard).
[15] 2 weeks/review * 40 hours/week * 1,068 review.
[16] 8,544 hours/year * 1 employee/50 weeks * 1 week/40 hours.

CEP proposed Continuous Emissions Monitoring Systems (CEMS) be operated for every emission unit that is a major source of a criteria pollutant and/or 1 ton per year of any HAP identified as an Affected Pollutant. The installation and operation of CEMS is incredibly resource intensive. CEMS cost $215,000 to install and $20,000-$50,000 annually to operate.[17] An installation inspection is required for every CEMS upon installation, and a Relative Accuracy Test Assessment (RATA) is completed annually. RATA requires an on-site technician to compare CEMS data to reference monitors to validate data created by CEMS. Cylinder gas audits are performed and submitted quarterly (except when RATA is performed during a quarter), which can cost approximately $100,000. The operation of CEMS requires personnel to maintain, operate, and repair the CEMS. Most facilities with existing CEMS have full-time technicians whose sole job is to operate equipment and check validity of data, as well as an environmental consultant who reviews data and submits reports to the state at required intervals. CEMS require ongoing Quality Assurance or Quality Control requirements including daily calibrations, quarterly audits, and annual testing. The necessary inspection of CEMS and review of CEMS data by Division staff is also resource intensive. Each CEMS installation inspection requires 11-16 hours of Division staff time to review CEMS protocol, conduct field observation of the RATA, review the report and additional certification documents, and complete data entry and archival tasks. Additionally, each RATA conducted annually requires Division staff time for field observation, which requires approximately 5-10 hours of Division staff time per assessment.

CEP proposed that sources utilize material balance calculations as a monitoring technique. This would result in increased costs to businesses and other entities for increased recordkeeping requirements. The EPA estimates these costs to be approximately $2,000-$10,000 per year.[18]

CEP also proposes optical remote sensor technologies as a monitoring technique. Open Path Optical/Laser Absorption Spectroscopy ranges in capital costs from $15,000 to $445,000, and Extractive Optical/ Laser Absorption Spectroscopy ranges in capital costs from $1,000 to $150,000.[19] These costs do not account for maintenance and operation costs, or recordkeeping and reporting costs, which would result in additional costs to businesses of $2,000-$10,000 per year based on EPA estimates.

CEP proposes sources subject to enhanced monitoring must routinely report monitoring results in terms of emission rates and supplemental data, and that the Division make these reports available to the public within 30 days. CEP proposes major sources submit reports every 30 days and minor sources submit reports quarterly. CEP does not propose a reporting frequency for synthetic minor sources. There are currently 46 major sources in DI Communities. The Division assumes it would, at a minimum, take one compliance and enforcement staff person eight hours to review one compliance report. Considering the 46 major sources in DI Communities and again assuming a 40 hour work week, it would take 368 staff hours per month to complete these reviews.[20] With four weeks per month, it would take three full-time employees solely to complete reviews of the monthly major source reports.[21] Conservatively assuming that there would be an additional 1,068 permitting actions that would subsequently trigger this requirement, at eight hours per review, this would require an additional 8,544 staff hours per quarter, or 34,176 staff hours per year, to complete.[22] Assuming the average Division employee works 50 weeks per year at 40 hours per week this workload would require 17 additional full time staff to manage.[23]

CEP proposes that every construction permit application be made available for public comment. CEP's Economic Impact Analysis inaccurately states that this would not impose costs on the applicant, as this would require increased time and labor costs for sources to engage with community members. Further, each permit application made available for public comment would require one hour for Division staff to prepare and publicly post each permit. Permits that receive public comments require approximately 10 hours of Division staff time to respond to public comments. While it is difficult to predict how many permit applications this proposal would affect as this is a forward looking program, the Division estimates that approximately 10 percent of permits posted for public comment receive comments.

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[17] See APCD_PHS_EIA.

[18] Environmental Protection Agency, *Enforcement Alert – EPA Reminder About Inappropriate Use of AP-42 Emission Factors* (Nov 2020), *available at* https://www.epa.gov/sites/default/files/2021-01/documents/ap42-enforcementalert.pdf

[19] Environmental Defense Fund, *Technology Assessment Report: Air Monitoring Technology Near Upstream Oil And Gas Operations* (Dec. 2017) at 18-19, *available at* https://www.edf.org/sites/default/files/Ramboll-report.pdf

[20] 8 hours/review* 46 review.

[21] 368 hours/month* 1 employee/160 hours.

[22] 8 hours/review * 1068 reviews (*4 quarters/year).

[23] 8,544 hours /quarter * 1 quarter/1 weeks * 1 week/40 hours.

Again, however, over the past three years, the Division has processed an average of 1,471 general permit actions and 2,089 individual permit actions each year. Assuming 200 permits receive public comment, requiring 2,200 staff hours, and the average Division employee works 50 weeks per year at 40 hours per week, the public comment component of CEP's proposal would require approximately 1-2 additional full time staff to manage.[24]

No Action Alternative

The Division also considered a "no action" alternative to the Regulation Number 3 revisions. The obvious benefit of this approach would be the cost savings by the affected industries that would not have to conduct additional modeling analyses, implement enhanced monitoring requirements, and analyze and install Reasonably Available Control Technology, if applicable. However, a potential negative consequence of the no action alternative is potential litigation costs if the state fails to comply with statutory obligations. Further, and more importantly, the no action alternative will be disadvantageous for health and environmental impacts on residents in DI Communities.

The Division opposes the two alternatives identified above, and believes that the current proposal, reflecting consensus amongst diverse parties, including entities with private property and economic interests, properly reflects a balanced consideration of environmental and economic costs and benefits.

The Division has in good faith developed this Cost-Benefit Analysis that complies with all requirements of 24-4-103(2.5), C.R.S.

[24] 2,200 hours/year * 1 employee/50 weeks * 1 week/40 hours.

Appendix B: 2022 and 2023 Regulatory Analyses

1. Regulatory Analysis: Air Quality Control Commission Regulation Number 28, Building Benchmarking and Performance Standards, August 4, 2023.
2. Regulatory Analysis: Air Quality Control Commission Regulation Number 27, Greenhouse Gas Emissions and Energy Management for Manufacturing, September 8, 2023.

1. Regulatory Analysis: Air Quality Control Commission Regulation Number 28, Building Benchmarking and Performance Standards, August 4, 2023.

REGULATORY ANALYSIS

In performing a regulatory analysis, each rulemaking entity must provide the information requested for the regulatory analysis to be considered a good faith effort. Each regulatory analysis shall include quantification of the data to the extent practicable and shall take account of both short-term and long-term consequences. The regulatory analysis must be submitted to the Air Quality Control Commission Office at least five (5) days before the administrative hearing on the proposed rule and posted on your agency's web site. For all questions, please attach all underlying data that supports the statements stated in this regulatory analysis.

DEPARTMENT: Colorado Department of Public Health and Environment

AGENCY: Air Pollution Control Division

CCR: 5 CCR 1001-32

DATE: August 10, 2023

RULE TITLE OR SUBJECT:

REGULATION NUMBER 28: Building Benchmarking and Performance Standards

Per the provisions of 24-1-103(4.5)(a), Colorado Revised Statutes, the regulatory analysis must include the following:

I. A description of the classes of persons who will be affected by the proposed rule, including classes that will bear the costs of the proposed rule and classes that will benefit from the proposed rule;

Enacting a building performance regulation to increase energy efficiency and reduce greenhouse gas (GHG) emissions ensures that building owners participate in the reduction of emissions from the built environment. Consistent with statutory direction in sections 25-7-142(8)(a)(I), and 24-38.5-112, C.R.S., and the recommendations of the statutorily constituted Building Performance Standards Task Force, the Division is proposing building performance standards that will require covered buildings to implement measures that, taken together, are expected to achieve GHG emission reductions from this sector of 7% by 2026 and 20% by 2030, as compared to 2021 levels.

The principal classes of persons who may be affected by the proposed rule include owners, tenants, and customers of buildings subject to the proposed regulations — "covered buildings." Per statute, buildings covered under this rule are buildings with a gross floor area of fifty thousand (50,000) square feet or more that are occupied by a single occupant or a group of tenants. Building types not covered under this rule are a storage facility, stand-alone parking garage, or an airplane hangar that lacks heating and cooling; a building in which more than half of the gross floor area is used for manufacturing, industrial, or agricultural purposes as defined in the rule; and a single-family home, duplex, or triplex. The Division estimates that approximately 8000 buildings may be subject to the proposed regulation.

As discussed in greater detail below, the principal costs of the proposed regulations will come from implementing energy efficiency and/or GHG reduction measures at the covered buildings. The principal benefits will result from energy savings from these efficiency measures. Owners, tenants, and customers of covered buildings may all bear the costs and reap the benefits of the proposed regulations depending on the private business decisions and contractual relationships between affected classes (i.e., lease agreements). Owners will also be required to submit annual benchmarking reporting, which will create certain direct costs.

II. To the extent practicable, a description of the probable quantitative and qualitative impact of the proposed rule, economic or otherwise, upon affected classes of persons;

Based on the Division's analysis of the current rule proposal, with revised information from the Cost-Benefit Analysis, one of the benefits of this rule is the utility cost savings that may be realized by the building owner or payer of the building's natural gas and electricity. The electricity and natural gas savings resulting from this rule are estimated to be $4,577,040,161 and $577,557,481, respectively.[1]

[1] *See APCD Cost-Benefit Analysis at p. 3*

Predicting the precise allocation of costs and benefits as between affected classes presents extreme challenges given the discretion and private decisions outside the State's purview. For instance, covered building owners might pass on some or all of the cost of complying with this rule to tenants, which could lead to higher rents. Additionally, it is speculated that building performance standard (BPS) and benchmarking programs could "harm equity priority communities through gentrification and housing displacement, while benefiting landlords."[2] Other issues may arise with communication and clarity of rule requirements, technological comprehension of reporting and compliance software, and funding for affordable housing and naturally occurring affordable housing.[3] In contrast, the energy efficiency measures implemented may lead to lower utility bills for the tenants. The net cost to the tenant, which is the difference between the higher rent and the lower utility bill, will depend on considerations such as how much of the cost the building owner pass on to the tenants, if the utility bill was already built into the rent, and the share of the cost that is covered by applicable state and federal programs, among others.

It is likely that the new rule will create new jobs in Colorado. According to the International Energy Agency, six to fifteen jobs are created for every $1 million USD spent on building efficiency[4], meaning approximately 10,616 to 26,540 additional building efficiency jobs could be created in Colorado from 2024 to 2050. The Division anticipates that future job growth will be closer to the scenario where six jobs are created for every $1 million.

Additionally, measures implemented to reduce GHG emissions will result in decreased pollution burden for the entire State of Colorado. A detailed analysis of the probable quantitative and qualitative impacts of the proposed rule can be found in the Division's Final Economic Impact Analysis and updated in the Cost Benefit Analysis.[5]

Lawrence Berkeley National Laboratory (LBNL) and Pacific Northwest National Laboratory (PNNL) provided the Division and CEO an analysis estimating the cost and savings resulting from implementing Colorado's proposed BPS regulation, see attached Colorado BPS Impact Analysis. The estimates from LBNL and PNNL show that there are considerable savings at the building stock level. The analysis identified the type and cost of various compliance measures available to building owners and applied those options to buildings according to their individual energy mix, showing not only economic but also technical feasibility. The methodology of the analysis does not include discounting analysis or the use of cost curves that could have applied to a greater number of buildings, did not consider the avoided cost of climate change, and used a different modeling tool from the one used in the EIA submitted by the Division. LBNL and PNNL determined that 71% of the buildings, representing 75% of the floor area, will see net savings or at least break even. At the sector level, one can expect that for each $1 in cost, building owners will see benefits worth $2.1 in energy savings. Although this analysis has not yet found a common theme across buildings that are not seeing savings, such buildings could see savings when other compliance options and the cost cutting impact of the various incentive programs are considered.

III. The probable costs to the agency and to any other agency of the implementation and enforcement of the proposed rule and any anticipated effect on state revenues;

Sections 24-38.5-112(1) and 24-38.5-112(1)(a) require the Colorado Energy Office (CEO) to implement a building performance program and to use "county assessor records and other available sources of information" to administer the building performance program. CEO must create a database of covered buildings and of owners required to comply with the building performance program; track compliance with the building performance program; maintain a list of noncompliant owners; and provide the Division a list of noncompliant owners. The Division will enforce the building performance program.

The current direct costs estimated to be incurred by the State from this rule come from the anticipated governmental program administration costs. These costs are attributed to the implementation and maintenance of the rule and are expected to be $8,855,599.[6] The direct estimated total costs expected to be incurred by the government and buildings covered under this rule are $1,769,336,191.[7] Recognizing the potential increase in compliance assurance work to implement this program, the General Assembly approved expenditures for additional personnel beginning in Fiscal Year 2022-23. More information about future State full time employee cost expenditures can be found in the Energy Performance for Buildings Final Fiscal Note.[8]

Additional costs to the government may occur as public buildings begin to fall under applicability of the building performance standards; these costs were estimated and accounted for in the direct costs to buildings and not specifically addressed in the direct cost analysis to the government.

The proposal may result in a small increase in State revenues because of potential additional compliance and enforcement actions. The Division has not estimated the increase in revenues because it expects all affected businesses to comply with the proposed regulation. Additionally, the State will also gain revenue through the annual $100 benchmarking data submission fee that is required for all covered buildings who submitted their building's data or received a benchmarking waiver, unless the building is a public building, then the building is not required to pay the $100 fee.

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[2] *See CEO_REB_EX_001 at p. 9*
[3] *See CEO_REB_EX_001 at p. 9-11*
[4] *See https://www.iea.org/reports/energy-efficiency-2020/energy-efficiency-jobs-and-the-recovery*
[5] *See APCD Cost-Benefit Analysis*
[6] *See APCD Final Economic Impact Analysis at p. 3*
[7] *Id.*
[8] *See HB21-1286, Final Fiscal Note, July 29, 2021*

IV. A comparison of the probable costs and benefits of the proposed rule to the probable costs and benefits of inaction;

The legislature has acknowledged that climate change impacts Colorado's economy and directed that GHG emissions be reduced across the many sectors of our economy.[9] Further, the legislature has also realized significant economic benefits from reducing statewide GHG pollution, including "creat[ing] new markets, spur[ring] innovation, driv[ing] investments in low-carbon technologies, and put[ting] Colorado squarely on the path to a modern, resilient, one-hundred percent clean economy."[10] Delaying these reductions will prevent Colorado from realizing the full benefit of these advantages and lead to further environmental and economic harms from climate impacts.[11]

After completing the Cost-Benefit Analysis, the Division found that over the timeframe of 2024-2050, the electricity and natural gas savings from the implementation this rule are estimated to be $4,577,040,161 and $577,557,481 and the reduction costs from the inclusion of the social cost of carbon account for $1,239,234,731.[12] The energy savings along with the avoided social cost of GHG emissions is estimated at $6,393,832,373, creating a benefit of $3.60 for each $1 in cost.[13]

Given the statutory directives in Section 25-7-142, C.R.S. to adopt building performance standards rules, there is no lawful option of inaction. Further, in the absence of the proposed rule, the potential energy savings that would have accrued to ratepayers may never materialize. The GHG emission reductions attributable to the proposed rule may also not materialize and the global economic cost of those emissions, which is estimated through the social cost of carbon, would be incurred instead.

The costs and benefits of the proposed rule are further detailed in the Division's Final EIA and updated in the Cost Benefit Analysis.

V. A determination of whether there are less costly methods or less intrusive methods for achieving the purpose of the proposed rule; and

Per statute, the building performance standards must achieve sector-wide emission reduction goals of 7% by 2026 and 20% by 2030 from covered buildings. Accordingly, the Division has set targets for all covered buildings based on property type or standard percent reductions designed to accomplish these statutory objectives. Covered buildings will have to determine and implement individual building plans to meet these targets or seek adjustments as provided for in the rules. When developing the building benchmarking and reporting requirements, major attention was focused towards creating straightforward and flexible pathways for building owners/operators to implement and follow.

The proposed building performance standards were selected to provide the building owner a variety of pathways to comply while assuring that the emission reduction goals in HB21-1286 are met. The primary compliance pathway is meeting a State assigned energy use intensity (EUI) target based on property type of the building and achieved by reducing a building's overall energy consumption. The second compliance pathway assigns buildings a greenhouse gas intensity (GHGi) target by property type and allows a building owner the ability to use a singular method or combination of energy efficient implementation to reduce their building's energy use, efficient electrification of space and water heating, and/or the option to install or acquire renewable energy under certain circumstances. Importantly, these targets were set such that 40% of covered buildings are already expected to meet the 2026 targets and 20% expected to already meet the 2030 targets. For these "high performing" buildings and those close to these targets, this pathway is expected to be extremely cost-effective.

Further, buildings unable to meet the property type EUI or GHGi target can use a standard percent reduction target by reducing EUI or GHGi 13% in 2026 and 29% in 2030 relative to the building's 2021 baseline benchmarking data. Buildings utilizing this pathway may include older buildings or those with abnormally high energy use. This pathway will be most cost-efficient for owners of buildings able to make impactful modifications to their buildings or operations but for which the EUI or GHGi targets are more than 13% and 29% away in 2026 and 2030, respectively. These diverse compliance pathways allow building owners the ability to use a variety of options to meet their building performance standards.

Additionally, covered buildings may apply for a timeline or a target adjustment if the building owner demonstrates that the building's target or timeline is not feasible for the building. All adjustments will be reviewed and approved by CEO.

Other approaches taken by different states and cities follow similar building performance pathways and metrics but may differ slightly.[14] The major differences between the Division's proposal and the building standards of other cities and states might be

[9] *See* § 25-7-102(2)(b), C.R.S. ("Colorado is already experiencing harmful climate impacts, including declining snowpack, prolonged drought, more extreme heat, elevated wildfire risk and risk to first responders, widespread beetle infestation decimating forests, increased risk of vector-borne diseases, more frequent and severe flooding, more severe ground-level ozone pollution causing respiratory damage and loss of life, decreased economic activity from outdoor recreation and agriculture, and diminished quality of life. Many of these impacts disproportionately affect rural communities, communities of color, youth and the elderly, and working families.").
[10] *See* § 25-7-102(2)(e), C.R.S.
[11] *Id.*
[12] *See APCD Cost-Benefit Analysis at p. 3*
[13] *Id. at p. 2*
[14] *See* APCD_REB_EX-007 (Nationwide Comparison of BPS Programs)

the goals of the building performance standards, the requirements for buildings, or what buildings are covered. However, all of the different building performance standards follow similar pathways towards energy reduction through some combination of energy efficient implementation, electrification, or substitution with renewables to meet emission or energy reduction goals. One common trend among building performance standards implementation is the phasing out of fossil fuel infrastructure for efficient electric infrastructure. This is also an important consideration for Colorado in meeting the GHG emission reduction goals.

VI. A description of any alternative methods for achieving the purpose of the proposed rule that were seriously considered by the agency and the reasons why they were rejected in favor of the proposed rule.

To achieve the required emission reduction targets, the statute directed the AQCC to adopt building performance standards. It also directed CEO to appoint a Task Force to develop recommendations for the AQCC to consider when promulgating the rules for the State's building performance standards. CEO convened a Task Force of 18 members that represented diverse interests from across Colorado and the building sector including building owners, building operators, architects, engineers, building trades, utilities, local government representatives, and environmental groups.[15] The Task Force met monthly for a year to create the recommendations and considered many different methods to achieve the greenhouse gas emission reductions set forth in HB21-1286. Before choosing site EUI, beneficial electrification, renewable energy crediting, or a combination of the mix to be the pathways for compliance, the Task Force discussed other pathways for compliance. The Task Force recommended that EUI would be the best method given greater ease of understanding and implementation for covered building owners. The Division used this recommendation as a starting place and developed additional flexibilities for covered building owners while also ensuring that the proposed rules are designed to meet the statutory GHG reduction targets.

In the initial rulemaking proposal, the Division included electrification of fossil fuel powered equipment as a standalone compliance pathway. During the rulemaking process, the Division met with the Environmental Protection Agency (EPA) and the Department of Energy (DOE) to seek guidance on developing building performance standards and discussed the proposed electrification pathway. It was during this time that the Division was informed that EPA's ENERGY STAR Portfolio Manager had created a Building Emissions Calculator that could be used to measure a benchmarking building's greenhouse gas emissions by assessing type of energy used (electricity v. gas v. qualifying renewables). The Building Emissions Calculator allowed the Division to create a more expansive and inclusive GHGi compliance pathway than the standalone electrification pathway that would allow buildings to implement energy efficiency, replace fossil fuel equipment with high-efficiency electric equipment, and/or employ qualifying renewable energy generation and storage. The GHGi pathway allows buildings unable to meet the EUI pathway targets the option to implement other emission reducing strategies to meet compliance with the building performance standards that might be more beneficial or cost-effective. Therefore, the Division removed the electrification compliance pathway as a standalone compliance pathway in the proposed building performance standards.

The numerical changes in the performance targets stem from updates to three different factors: additional and cleaned benchmarking data; changes to future or new building energy metrics; and a correction of a miscalculation in the 2030 Greenhouse Gas Intensity (GHGi) targets. After the submission of the initial EIA, additional benchmarking data was submitted to the State that allowed the EUI and GHGi targets to be refined for better representation of Colorado-specific emission targets. After the submission of the final EIA, CEO and the Division were informed by CEO's consulting agency, Group 14, that the 2030 GHGi targets incorrectly used the 2026 emission factors, which resulted in revised targets once the correct 2030 emission factors were applied. Lastly, the new building energy use was adjusted in the analysis for the current targets based on information obtained from the U.S. Department of Energy's Pacific Northwest National Laboratory regarding projected EUI reductions for new buildings, as well as the City and County of Denver's Energize Denver requirements for new buildings. Future building energy demand must be accounted for in order to reduce sector-wide building emissions to meet the future emission reduction goals. The updates and revisions to these factors and metrics resulted in revised performance standards targets, as last provided in the Division's Rebuttal Proposal.[16]

In addition to the alternatives described above, the Division notes that Denver also provided an alternate proposal to the Division's proposal for consideration by the Commission.[17] The Division appreciates Denver's participation in the rulemaking and has made some revisions to the Division's proposal based on Denver's feedback and suggestions. However, the Division does not propose the adoption of Denver's alternate proposal because Denver's building performance standards were established to meet an overall goal of 30% reduction in energy use, which has not been shown to achieve the statutory GHG reduction goals of HB 21-1286. Also, the targets in Denver's alternate proposal do not align with the Division's statewide weather normalized targets and instead use targets specific for Denver's climate zone. The Division believes that Denver's alternate proposal will not meet the required emission reductions set forth in HB21-1286 and that the Commission should adopt the Division's proposal. The Division's proposed regulation is anticipated to meet the emission reduction goals through benchmarking, compliance pathways, and adjustment provisions that were drafted in response to specific provisions in HB 21-1286 and/or to support implementation of the regulation by CEO.

Additional alternative methods for achieving the purpose of the proposed rule are discussed in the Division's Cost Benefit Analysis.

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[15] *See COLORADO'S BUILDING PERFORMANCE STANDARDS (BPS) TASK FORCE RECOMMENDATIONS at 23-24*

[16] See APCD Rebuttal Proposal

[17] See City and County of Denver Alternate Proposal

Colorado BPS Impact Analysis

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August 8, 2023

Overview

This memo describes the methodologies used by Lawrence Berkeley National Laboratory (LBNL) and Pacific Northwest National Laboratory (PNNL) for estimating the impacts of Colorado's proposed Building Performance Standard (BPS) regulation. We first describe our data preparation procedure, then the estimation of costs of implementing measures. Next, we describe the model that estimates BPS impacts and conclude with a brief discussion of the results.

1. Data Preparation

The analysis started with the covered buildings list (CBL) provided by the Colorado Energy Office in cooperation with Group 14, which contains data on building type, floor area, and energy consumption for 8,002 buildings. Building types correspond to ENERGY STAR Portfolio Manager (ESPM) property types [1]. We assigned each building a broader category using ESPM's definitions (e.g., the adult education, K-12 school, and pre-school/daycare types are all mapped to the education category). We removed 5% of the buildings that have exempt buildings type (e.g., manufacturing, industrial), or do not have targets (data centers, mixed use properties, and parking), or have floor area < 50k ft^2. In order to simplify the analysis, we treated all energy use as either electricity or natural gas use. Since only a small proportion of buildings use non-gas fuels (1.8% use district steam and 1.3% use district chilled water), we believe this simplifying assumption has a small impact on overall results. We manually inspected site energy use intensity (EUI) histograms for each building type and removed energy data for 1% of buildings with abnormally high or low site EUI. The resulting dataset contains 7,629 buildings, but due to incomplete benchmarking data collection, 39% of these buildings do not have building type or floor area data, and an additional 2% do not have energy use data. We filled in the missing building types by sampling from the 61% of buildings that do have building type, according to their prevalence (e.g., if 25% of the buildings with type data are offices, then each of the buildings with missing types has a 25% chance of being assigned the office building type, and likewise for the other buildings types). We filled in missing floor area data by sampling from the floor area distribution for buildings of the same type (or the same category, if there were fewer than 20 buildings with the same type). Similarly, for buildings without energy data, we sampled site EUI and electric/site ratio (i.e., the proportion of site

energy use that is electricity) from the distribution for buildings with the same type (or category).

Next, we used data from the Commercial Buildings Energy Consumption Survey (CBECS) [2] and the Residential Energy Consumption Survey (RECS) [3] to get the proportion of gas used for space heating, water heating, and everything else. We used the subsect of CBECS corresponding to the Mountain division and the "Cool" or "Cold or very cold" climates. We used the subset of RECS corresponding to the state of Colorado and apartment buildings with 5 or more units. For both CBECS and RECS, we used only buildings whose primary space and water heating fuels are natural gas. We used these subsets of CBECS and RECS to compute the proportion of total gas consumption that is used for space heating and for water heating. We mapped the building types and categories from the CBL to the corresponding CBECS types (i.e., the PBAPLUS column in the CBECS microdata) or CBECS categories (i.e., the PBA column) first using EPA's suggested mapping [4], but sometimes including more types when there wasn't enough CBECS data (at least 1 record). For each building on the CBL, if its electric/site ratio is > 0.9, we assumed the building does not use gas for space or water heating, and assigned all gas use to the other category. For buildings with electric/site ratio < 0.9, we sampled space and water heating proportions from the subset of CBECS or RECS with the corresponding type, then used these proportions to split each building's total gas use into the amount of gas used for space heating, water heating, and all other end uses combined.

The resulting dataset contains 7,629 buildings with 1.13 billion ft^2 of floor area, 50.1 billion kBtu electricity consumption, 37.1 billion kBtu natural gas consumption (80% for space heating, 15% for water heating, and 5% for everything else), and 8.64 billion kg of CO2 equivalent (kgCO2e) greenhouse gas (GHG) emissions.

We used projected GHG emissions factors for electricity and natural gas (provided by Group 14) in our analysis. Figure 1 shows the electric grid getting dramatically cleaner (especially between 2024 and 2030), nearly reaching zero by 2050.

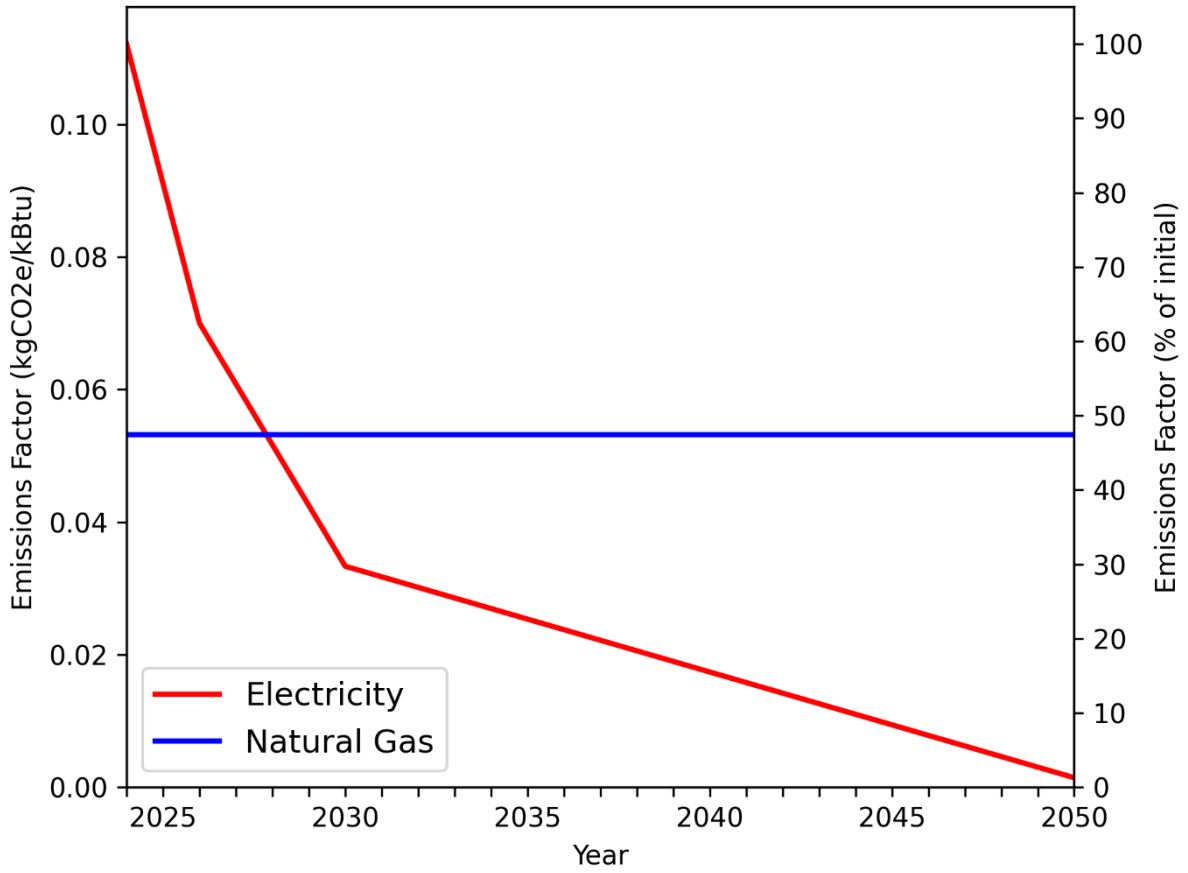

Figure 1: Projected GHG emissions factors.

For energy use rates (i.e., the cost of purchasing energy from a utility), we started with the actual rates for Colorado, then projected them into the future using annual scaling factors based on projections from the U.S. Energy Information Administration's (EIA) Annual Energy Outlook 2022 energy rate projections through 2050. Figure 2 shows that neither electricity nor natural gas use rates change significantly over time. Note that the energy use rates are not adjusted for inflation.

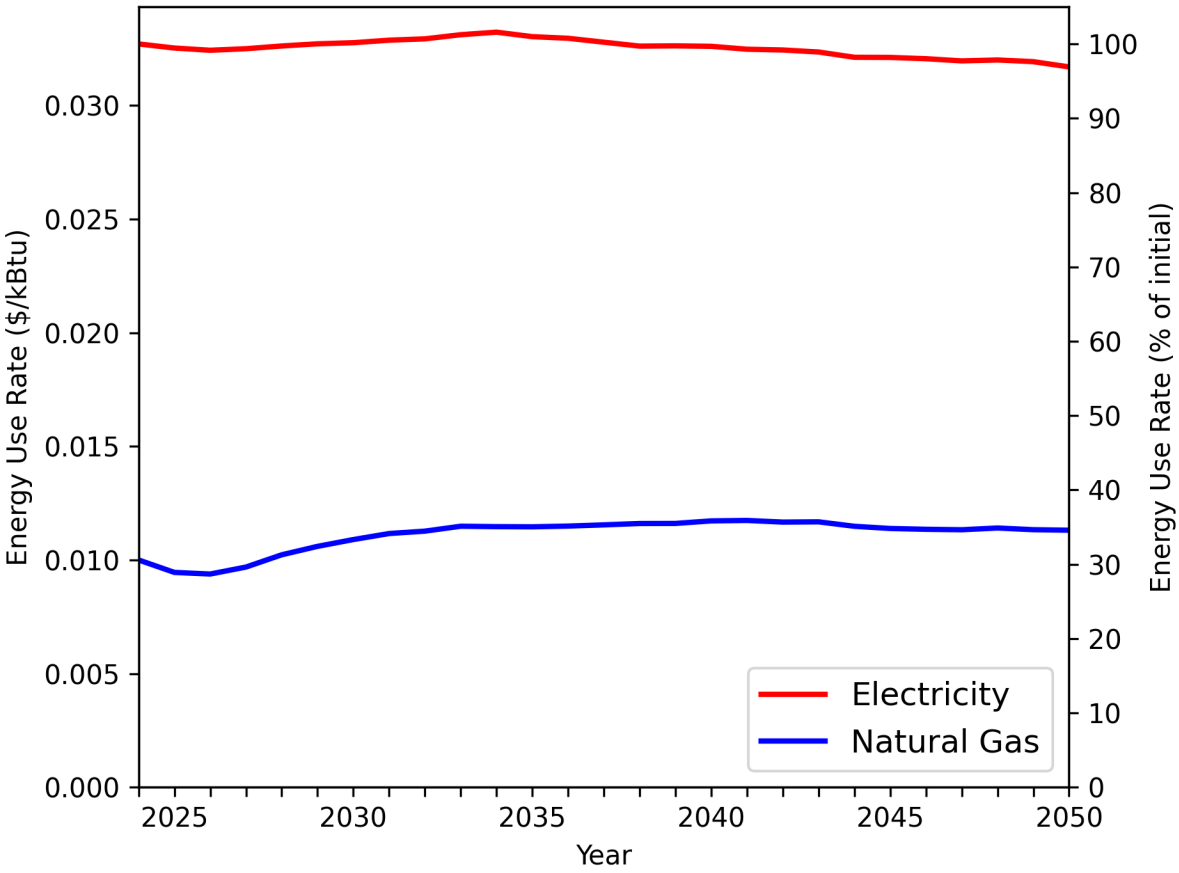

Figure 2: Projected energy use rates.

2. Measure Costs

PNNL used the following methodology for estimating the costs of implementing building modifications in four different categories: 1) energy efficiency measures (EEMs) for electric efficiency, 2) EEMs for gas efficiency, 3) electrification of gas equipment, and 4) like-for-like replacement of gas equipment.

EEMs for electric efficiency: These are measures that reduce electricity consumption without electrification or a change of fuel source. We performed a literature search to compile a list of potential EEMs with associated costs and savings. The literature search included studies performed for the implementation of building performance standards across the U.S. as well as research from the latest model energy code development, which include advanced efficiency measures and energy credit measures. This resulted in the following list of measures:

- Add Plug Load Control
- Add programmable, provide instructions to occupants on use
- Add R-10 Roof Insulation

- Add R-5.0ci Wall Insulation
- Add vestibule
- Adjust existing HVAC schedules to align with occupancy
- Central Temperature Controls
- Close Shaft Vents
- Commissioning: Stage 1: 1-month payback
- Commissioning: Stage 2: 1-year payback
- Commissioning: Stage 3: 3-year payback
- DOAS/fan control
- Efficient Elevator
- Envelope Leakage Reduction
- Fault Detection and Diagnosis
- Heat pump clothes dryer
- Improve Fenestration
- Increase daylight area
- Increase occupancy sensor
- Install an exhaust recovery ventilation unit
- Install low flow aerators in faucets and showers
- Install primary chilled water pump variable frequency drives
- Install smart plug load management tools
- Install submeters to incentivize tenants to reduce their energy use
- Install variable frequency drives on central distribution pumps
- Install variable frequency drives on condenser water pumps
- Install variable frequency drives on domestic water booster pumps
- Install variable frequency drives on heating hot water pumps
- LED conversion
- LED conversion for parking garage
- Light power reduction
- Residential HVAC control
- Residential light control
- SHW pipe insulation
- SHW shower drain heat recovery
- Thermostatic balancing valves
- Upgrade Exhaust Fans
- Upgrade In-Unit Appliances

This list of measures was reviewed and sorted by the building types in which they would be appropriate. For example, 27 measures were considered for multifamily buildings. Following an initial step of analyzing the range of energy savings expected for different building types based on the BPS impact analysis conducted by LBNL, we evaluated combining these measures into

packages that could achieve different saving ranges. However, given the wide range of energy savings necessary for buildings to meet BPS targets, we determined that developing a cost curve using the EEMs identified would be a more effective way to apply costs to buildings in the impact analysis rather than using discrete packages. The cost curves were developed by sorting the measures from low to high cost per unit of EUI savings, which is a measure of cost-effectiveness, and by developing a regression curve that could represent the cost for deeper levels of savings. The intent is to consider that building owners will likely implement energy efficiency improvements starting with the most cost-effective measures and following the curve upward with decreasing cost-effectiveness. Figure 3 shows the cost curve for multifamily buildings and shows increasing costs per unit energy saved as the total EUI savings increases. Similar cost curves were also developed for office and non-refrigerated warehouse building types. We used the warehouse cost curve for all buildings other than multifamily and office buildings.

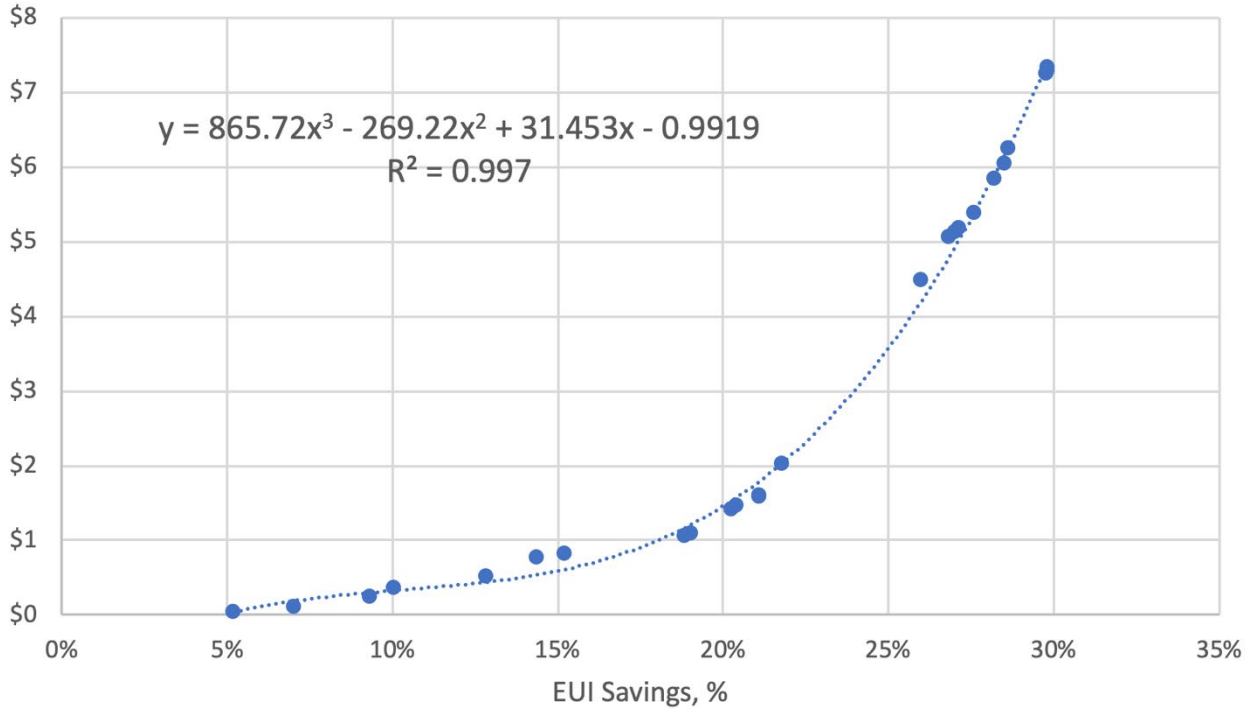

Figure 3: Electric efficiency cost curve showing cumulative cost ($/ft^2) vs. EUI savings (%).

EEMs for gas efficiency: For gas consumption reductions due to efficiency, we assume building retro-commissioning with an estimated cost of $0.34/ft^2.

Electrification of gas equipment: These are measures where natural gas-fired equipment is replaced with electric equipment, typically reverse cycle refrigeration equipment and heat pumps for space and water heating and other electric technologies for other gas-fired equipment such as food service equipment and clothes dryers. These costs are averages from a pilot analysis of strategies that would, over time, meet the BPS targets in Montgomery County, Maryland [5], but are adjusted to reflect costs in Colorado by applying regional scaling factors.

Due to the limited number of building investigations, costs can only be provided per square foot of floor area. For space heating electrification, we estimate a cost of $\$8.27/ft^2$ for residential buildings and $\$12.24/ft^2$ for commercial buildings. For water heating, we estimate $\$5.02/ft^2$ for both residential and commercial. For all other end uses, we estimate $\$0.82/ft^2$ for residential and $\$0.11/ft^2$ for commercial.

Like-for-like replacement of gas equipment: These are costs associated with replacing gas-fired space and water heating equipment with new gas-equipment when the equipment reaches the end of its useful life. When considering electrification at the same point in time, replacement with gas-fired equipment is likely the lowest capital cost alternative. For this reason, it is important to consider the marginal cost of electrification, i.e., the additional cost that would be required to replace equipment at its end-of-life with electric equipment rather than doing a like-for-like gas-fired replacement.

Replacement costs were developed from tools used to develop the state-level cost effectiveness for ASHRAE Standard 90.1-2019 [6]. These costs are the most representative since they reflect the most recent research of typical costs for equipment that would comply with Colorado energy codes currently in effect. Costs were normalized by site EUI so they could be applied to buildings with higher energy use, which is expected for most, older, existing buildings. Table 1 shows replacement costs for office, multifamily, and non-refrigerated warehouse building types. We used the warehouse costs for all buildings other than office and multifamily buildings.

Building Type	End Use	Heating Type	Cost ($/kBtu)
Office	Space heating	Boiler gas-fired	0.14
Multifamily	Space heating	Split A/C with gas heating	1.23
Warehouse	Space heating	PSZ with gas heating	0.01
Office	Water heating	Commercial gas storage	0.05
Multifamily	Water heating	Residential gas storage	0.11
Warehouse	Water heating	Commercial gas storage	0.10

Table 1: Like-for-like replacement costs for gas space and water heating equipment.

3. Impacts Modeling

We constructed a model that predicts the behavior of each building from 2024 through 2050 under two different hypothetical scenarios: 1) a baseline scenario representing business as usual, and 2) a scenario in which the proposed BPS regulation is implemented. For each year, and for each building, the model predicts the building's energy reductions (for electricity and each gas end use) as the building implements efficiency, electrification, and/or like-for-like replacement measures. The model uses the GHG factors and energy use rates from Section 1, and the measure costs from Section 2.

1) In the baseline scenario, buildings are not subject to any BPS regulation and only make like-for-like replacements of gas systems and the end of their useful life. Each building replaces both their space heating and water heating systems (but no other gas systems) in one randomly selected year from 2024 to 2050 (i.e., we assumed that, on average, these systems have useful lifetimes of roughly 25 years, but we made no assumptions about how old the currently-installed systems are). We assumed the current space heating systems are 79% efficient, and are replaced with new systems that are 85% efficient. We assumed the current water heating systems are 85% efficient, and are replaced with new systems that are 93% efficient.

2) In the BPS scenario, buildings are subject to Colorado's proposed BPS regulation and implement measures to meet the site EUI or GHG intensity (GHGI) targets specified in the regulation. Each building is assigned four targets, according to its building type: a site EUI target to be met (or exceeded) by 2026, a GHGI target for 2026, a site EUI target for 2030, and a GHGI target for 2030. Alternatively, each building is also assigned a standard reduction for each metric (site EUI and GHGI) and for each compliance year (2026 and 2030). In 2026, the standard reduction is a 13% reduction from the initial value (both for site EUI and GHGI), and in 2030, the standard reduction is 29%. If the standard reduction is smaller than the reduction needed to hit the target, buildings are allowed to make the standard reduction instead of meeting the target.

In order to meet the targets (or make the standard reductions), we assume buildings will make reductions according to the following logic:

1. Reduce electricity use up to 10% (of the initial value) by implementing EEMs.
2. Reduce gas space heating use (not water heating or other) up to 20% (of the initial value) by implementing EEMs.
3. Reduce electricity use up to an additional 15% (of the initial value), i.e., 25% total, by implementing additional EEMs not implemented in step 1.
4. Reduce gas use (and increase electricity use) by electrifying gas equipment (space heating, water heating, and/or other).
5. Reduce electricity use as much as necessary by implementing additional EEMs not implemented in steps 1 or 3.

A building will complete as many of these steps (in order) as necessary, stopping when either of the targets (or standard reductions) are met. The reduction maximums in steps 1 through 3 apply cumulative to meeting both the 2026 and 2030 targets (i.e., if a building meets its 2026 targets by reducing electricity use 10% and gas use 12% via EEMs, that building may only reduce gas use an additional 8% and electricity use an additional 15% to meet its 2030 targets). We assumed each building will meet its 2026 targets by making all necessary reductions in a single randomly selected year between 2024 and 2026, and will meet its 2030 targets by making reductions in a single randomly selected year between 2027 and 2030 (i.e., buildings do not spread the reductions needed for meeting a particular target across multiple years).

When electrifying gas equipment, we assumed the same efficiencies as in the baseline scenario for the current systems (i.e., 79% for space heating and 85% for water heating). We assumed the new electric space heating systems will have a coefficient of performance (COP) of 2.5, new water heating systems will have a COP of 2.2, and other systems will have a COP of 1.0. When

deciding which gas equipment to electrify (space heating, water heating, and/or other), buildings choose whichever individual end use (or combination of multiple end uses) that meets the target at the lowest implementation cost (see Section 2). If electrifying all three end uses does not meet the target, the building electrifies all three, then proceeds to step 5.

For both scenarios, the model results include, for each building and each year: energy reductions (due to electricity EEMs, gas EEMs, electrification, and/or like-for-like replacement), the resulting energy consumption (for electricity, gas space heating, gas water heating, and other gas end uses), and GHG emissions.

4. Results

In the baseline scenario, annual energy consumption from all buildings on the CBL decreases 3% from initial levels by 2050, with all reductions coming from replacing gas equipment at the end of useful life with new (and more efficient) gas equipment. Annual GHG emissions decrease 75% during the same time period, with essentially all of the decrease due to the electric grid getting cleaner.

In the BPS scenario, annual energy consumption decreases 29% from initial levels by 2030 (with the majority coming from gas), then stays constant through 2050. Figure 4 shows annual energy consumption from each fuel. Annual GHG emissions decrease 87% by 2050, with 73% of the decrease due to the electric grid getting cleaner. Figure 5 shows annual GHG emissions due to each fuel.

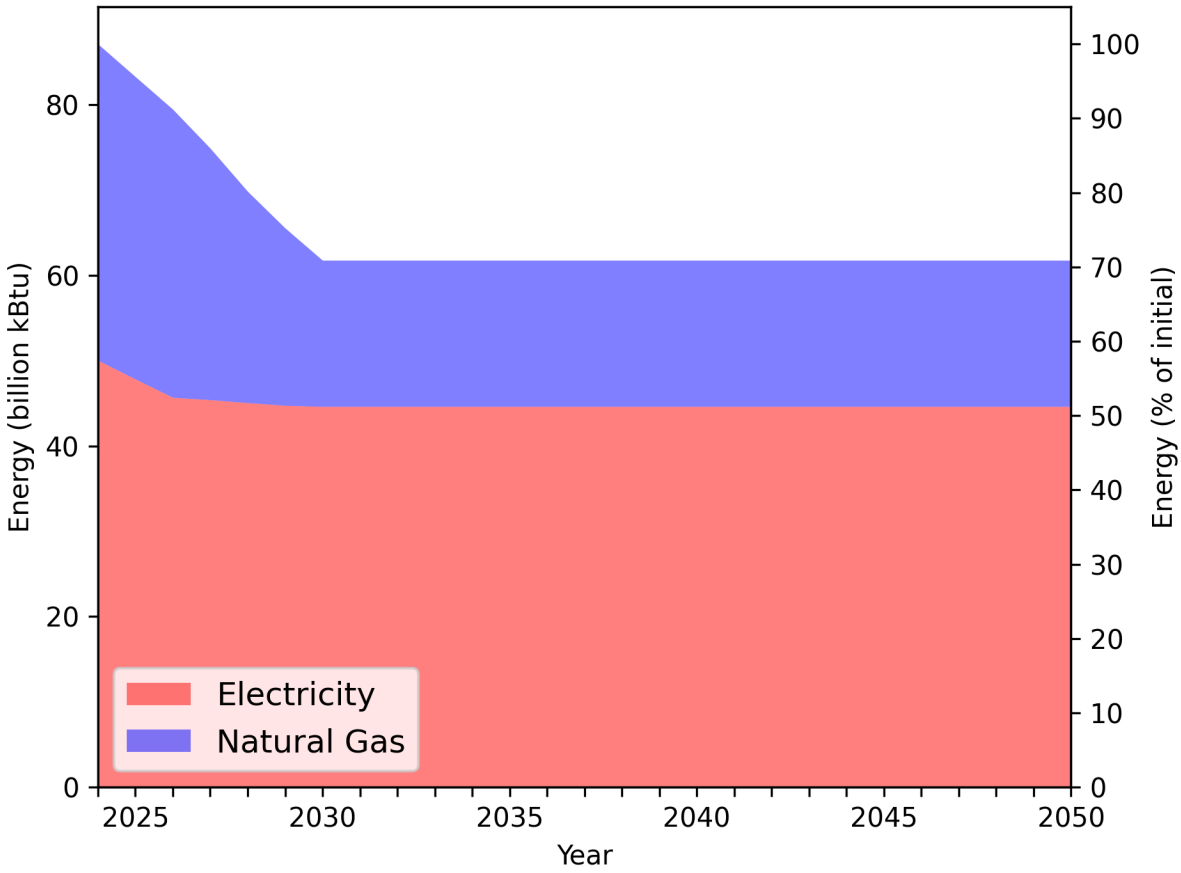

Figure 4: Annual energy consumption from electricity and natural gas in the BPS scenario.

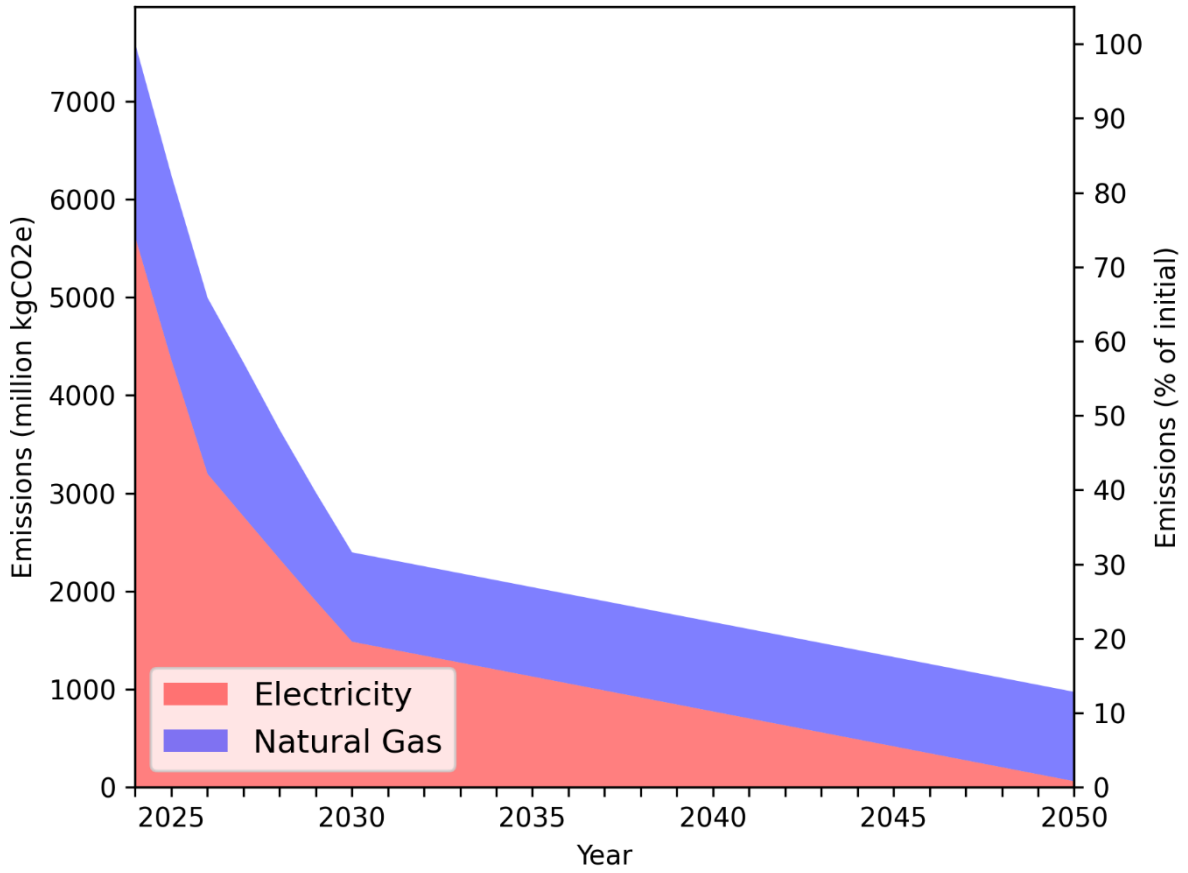

Figure 5: Annual GHG emissions from electricity and natural gas in the BPS scenario.

When considering the costs and benefits of the BPS scenario relative to the baseline scenario, the BPS reduces 2024-2050 cumulative energy consumption by 24% (560 billion kBtu) and reduces 2024-2050 cumulative GHG emissions by 28% (25.8 billion kgCO2e). In the baseline scenario, buildings spend $5.56 billion on like-for-like equipment replacement and spend $54.7 billion on energy costs, for a total cost of $60.2 billion. In the BPS scenario, buildings spend $1.92 billion on EEMs, $5.29 billion on electrifying gas equipment, and $45.5 billion on energy costs, for a total cost of $52.7 billion. Thus, the BPS scenario reduces cumulative energy use by 24% and cumulative emissions by 28%, at a net savings of $7.55 billion. At the building stock level, the BPS scenario has net cost savings, but this varies significantly by building: on average, buildings save $5.34/ft^2, but 68% of buildings (72% of total floor area) have net savings, 2.8% of buildings (2.9% of area) break even, and 29% of buildings (25% of area) have net costs. Of the buildings with net savings, average savings are $9.66/sqft. Of the buildings with net costs, average costs are $4.37/sqft.

References

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[2] U.S. Energy Information Administration. “Commercial Buildings Energy Consumption Survey”. 2018. https://www.eia.gov/consumption/commercial/data/2018/.

[3] U.S. Energy Information Administration. “Residential Energy Consumption Survey”. 2020. https://www.eia.gov/consumption/residential/data/2020/.

[4] U.S. Environmental Protection Agency. “U.S. Energy Intensity by Property Type”. April 2021. https://portfoliomanager.energystar.gov/pdf/reference/US%20National%20Median%20Table.pdf.

[5] Steven Winter Associates. “Building Energy Performance Standards Development – Technical Analysis”. February 2022. https://www.montgomerycountymd.gov/green/Resources/Files/energy/Montgomery%20County%20Performance%20Ordinance%20-%20Building%20Energy%20Performance%20Standards%20Report%20-%20final.pdf.

[6] Tyler, Xie, Poehlman, and Rosenberg. “Cost-Effectiveness of ANSI/ASHRAE/IES Standard 90.1-2019 for Maryland”. Pacific Northwest National Laboratory. July 2021.

2. Regulatory Analysis: Air Quality Control Commission Regulation Number 27, Greenhouse Gas Emissions and Energy Management for Manufacturing, September 8, 2023.

REGULATORY ANALYSIS

In performing a regulatory analysis, each rulemaking entity must provide the information requested for the regulatory analysis to be considered a good faith effort. Each regulatory analysis shall include quantification of the data to the extent practicable and shall take account of both short-term and long-term consequences. The regulatory analysis must be submitted to the Air Quality Control Commission Office at least five (5) days before the administrative hearing on the proposed rule and posted on your agency's web site. For all questions, please attach all underlying data that supports the statements stated in this regulatory analysis.

DEPARTMENT: AIR POLLUTION CONTROL DIVISION **AGENCY:** CO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

CCR: 5 CCR 1001-31 **DATE:** September 14, 2023

RULE TITLE OR SUBJECT:

Regulation Number 27, Greenhouse Gas Emissions and Energy Management for Manufacturing

Per the provisions of 24-1-103(4.5)(a), Colorado Revised Statutes, the regulatory analysis must include the following:

I. A description of the classes of persons who will be affected by the proposed rule, including classes that will bear the costs of the proposed rule and classes that will benefit from the proposed rule;

The Air Pollution Control Division's (Division) proposed Regulation Number 27 principally requires certain covered manufacturing facilities to reduce greenhouse gas (GHG) emissions. Compared to the 2015 statutory baseline, adopting the Division's proposed Regulation Number 27 will reduce the covered facilities' GHG emissions by 20% no later than 2030. Against the 2015 baseline, by 2050, the anticipated cumulative GHG emissions savings resulting from this rule are estimated to be 13,886,100 mt of CO2e.[1]

The principal classes of persons who may be affected by the proposed rule include covered facilities, customers of those facilities, individuals living close to the facilities who experience impacts from co-pollution emissions, individuals working for the covered facilities, and Coloradans in general who bear the cost of climate change resulting from the covered facilities' GHG emissions.

The principal costs of the Division's proposal will come from implementing GHG reduction measures at the covered facilities. Customers buying products made by these facilities might see the price of those products increase on account of the increased cost of production. If job losses result from facilities having to reduce or restructure their operations as a result of this rule, employees at these facilities might be affected. Depending on the scale and permanence of this restructuring, the job loss might result in indirect and induced effects, affecting affiliated industries and businesses.[2] However, given the flexibility built into the rule, these results are not anticipated to occur.

[1] Appendix A at pg. 2.

[2] Every economic activity, whether it is an investment or a loss, has direct, indirect, and induced effects. When facilities upgrade their equipment to reduce emissions, that investment creates jobs for individuals operating those equipment as well as for individuals supplying the equipment that are installed, representing direct and indirect impacts, respectively. The wages from these new jobs will lead to additional spending at restaurants, retail malls, and other businesses in the area, creating more jobs at these businesses and

The principal benefits of the Division's proposal will come from the avoided health impacts of co-pollutants and the avoided impacts of climate change that are caused by the release of GHGs. Reducing co-pollutants will reduce the health care burden of the state by reducing emergency room visits (Asthma), and work loss days, among others, and contribute to the overall health and wellbeing of the state's workforce, productivity, and competitiveness.[3] To the extent this emission reduction limits the impacts of climate change and to the extent those impacts are experienced in Colorado, the state's residents will be able to avoid considerable economic damages from climate change.[4]

As described further below, disproportionately impacted communities are also expected to get more than a proportionate share of the health benefits from implementing this rule. As such, the rule is expected to contribute to the advancement of environmental justice.

Another class of people benefiting from this rule includes individuals hired to complete the jobs generated as a result of the facilities' effort to comply with this rule. This includes the individuals hired to complete installation and maintenance of equipment that facilities will use to reduce emissions as well as the independent third-party auditors contracted to review the GHG reduction plans submitted by facilities. The wages generated from these jobs will also be used to patronize local businesses and add to the state's economy and tax revenue.[5]

Facilities will also have the opportunity to generate tradeable GHG credits. If a facility reduces emissions below the facility's 2030 emission requirement, it will generate credits and, in turn, could benefit by selling those credits to facilities that need credits to meet their compliance obligations.

II. To the extent practicable, a description of the probable quantitative and qualitative impact of the proposed rule, economic or otherwise, upon affected classes of persons;

When calculated against the rule's 2021/2022 baseline,[6] by 2050, the health benefits from limiting co-pollutants and the avoided cost of climate change from reducing GHG emissions are estimated to be worth $460,407,333.[7] Specifically, the avoided cost of climate change resulting from GHG emission reductions is estimated to be worth $395,429,264, and the health benefits of the avoided co-pollutants is estimated to be worth $64,978,069.[8] When calculated against the 2015 statutory baseline, by 2050, the combined health benefits from limiting co-pollutants and the avoided cost of climate change from reducing GHG emissions are estimated to be worth $1,130,405,589.[9] These impacts are calculated by multiplying a given year's emission savings by that year's social cost of carbon. The present value version of that result is determined by using a discounting analysis, where a 2.5% discount rate is used.

Whereas the cost per mt of CO2e reduced from the facilities is estimated to be $76.62 in 2023 dollars, by 2050, the benefits of the air pollution reductions proposed by this rule are estimated to be worth over $1,700 per mt of CO2e avoided.[10]

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representing induced effects. The inverse is also true: Job loss results in less economic activity. See Economic Policy Institute (available at https://www.epi.org/publication/updated-employment-multipliers-for-the-u-s-economy/).

[3] APCD_EIA at pg. 12-14.

[4] *Id.* at pg. 8-12.

[5] Economic Policy Institute (available at https://www.epi.org/publication/updated-employment-multipliers-for-the-u-s-economy/).

[6] APCD_REG_27_and_SBAP_ERRATA_CLEAN, Part A, Section II.X.

[7] Appendix A at pg. 1.

[8] *Id.* at pg. 1.

[9] *Id.* at pg. 2.

[10] *Id.* at pg. 1.

As noted above, the health benefits from reducing co-pollution is estimated to be worth $64,978,069. Specifically, by 2050, the rule is expected to reduce mortality, emergency room visits (Asthma), and work loss days by 7.9, 2.67, and 680 days, respectively. For a given location and expected co-pollution reduction, the health benefits and their monetary value can be determined by using EPA's Co-Benefits and Risk Assessment (COBRA) tool.[11] The monetary value of the health savings that are projected to occur in the future are discounted so as to determine their present value equivalents. A 2.5% discount rate is used for consistency with the analysis quantifying the avoided cost of GHG emissions. These health benefits are expected to contribute to the states overall productivity and competitiveness by reducing the cost of health care and loss of workday. Thus, when calculated against the rule's 2021/2022 baseline, by 2050, the total benefits of this rule (including the avoided cost of climate change) is estimated to be worth $460,407,333.

The investment that facilities make to comply with this rule is also expected to create jobs in producing, installing, operating, and maintaining the equipment that will allow the facilities to reduce their emission. Through the direct, indirect, and induced effects, the investment made by facilities is expected to generate up to 633 jobs by the end of 2030, with 370 jobs of those jobs created in the year 2030.[12] The number of jobs created is determined by multiplying the number of jobs created per $1 million investment, which are called multipliers, with the estimated cost of compliance.[13]

The rule also contributes to the protection of DI communities and the advancement of environmental justice. Cross referencing the health savings against the EnviroScreen score of the counties in Colorado shows that 62% of the health benefits accrue to the 20% of the counties in the state that have EnviroScreen score that is equal to or higher than the 80th percentile, which are the counties with the highest cumulative environmental burden.[14] The Gini coefficient for the health benefits, measuring the distribution of income or other benefits across the affected population, is 0.57, showing that the DI communities will get more than a proportionate share of the health benefits.

Figure 1

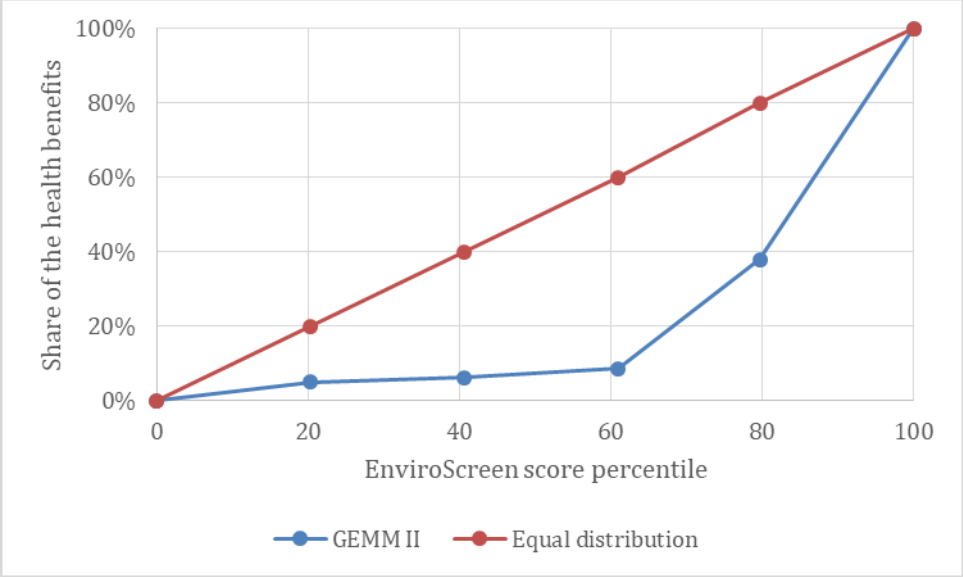


Figure 1: Community health benefit distribution.

[11] COBRA (available at https://www.epa.gov/cobra).
[12] Appendix A at pg. 4.
[13] Economic Policy Institute (available at https://www.epi.org/publication/updated-employment-multipliers-for-the-u-s-economy/).
[14] Colorado EnviroScreen (available at teeo-cdphe.shinyapps.io/COEnviroScreen_English/).

Although the price customers pay for the products made by these facilities might increase on account of the overall increase in cost of operation, predicting the amount by which the price of the products produced by the covered facilities' is challenging as facilities could possibly pass on more than the compliance cost to customers. Further, whether facilities take advantage of the state and federal incentives available to them and how that affects the price they pass on to their customers are not fully known.

While the rule is not structured to require production cuts for facilities to comply with GHG emission requirements, the potential for this effect exists. The extent of corresponding job loss, however, cannot be estimated readily given the uncertainty regarding whether or not any facility will make this decision and what the extent of this adjustment in terms of scale and permanence. Given the number of new jobs created as a result of the investments made by the facilities to comply with this rule, it is possible that the net effect from implementing this rule on the number of jobs is positive. The flexibilities in the Division's proposal, including the ability to trade emission credits with other facilities, along with the number of tailored accommodations for facilities are also expected to prevent the likelihood of leakage and job loss. This consideration is in fact the reason that partly drove the decision to abandon a plan requiring each facility to reduce its mission 20% from its individual 2015 target. Given the high emission reduction obligation for some facilities, that plan would have required deeper reduction from certain facilities and would have resulted in a higher chance of reduced production or closure. The current rule is less likely to cause these adverse effects. The Division further disagrees with the concerns raised by some parties regarding the possibility of a regulatory leakage, which is the movement of facilities outside of Colorado as a result of a regulation, on the grounds of the number of tailored accommodations made for the specific operations of the covered facilities, such as adjusted baselines, specific emission obligations, and the ability to trade emission credits with other facilities, where lower-cost reductions can be achieved.

III. The probable costs to the agency and to any other agency of the implementation and enforcement of the proposed rule and any anticipated effect on state revenues;

The Division will enforce the rule using existing funds and full-time employees. Thus, the state is not expected to incur additional direct costs as a result of administering this rule.

Regarding the rule's effect on the state's revenues, the spending by facilities on equipment is expected to generate revenues to the state in terms of sales tax.

Although the wages generated by the new jobs created as a rest of this rule are yet not known, commensurate with the applicable tax laws, considerable income and sales tax are expected to accrue to the state as a result of these new jobs. If facilities have to cut production and the net effect of this rule in terms of jobs is negative, however, that could lead to lost revenue for the state.

If facilities fail to comply with the rule, the penalty assessed for non-compliance will also add to the state's revenue. That amount will be determined by the Compliance and Enforcement program and will not exceed $47,357 per day for each day of the violation.

IV. A comparison of the probable costs and benefits of the proposed rule to the probable costs and benefits of inaction;

Reducing statewide GHG pollution contributes to innovation, investments in low-carbon technologies, and helps the state to build a resilient economy.[15] Delaying or curtailing the rule and allowing GHG emissions to go

[15] *See* § 25-7-102(2)(e), C.R.S.

unabated will prevent Colorado from realizing these benefits, and instead lead to environmental and economic harms from climate impacts.[16]

Given that the benefit from avoiding the emission of GHGs was calculated using the social cost of carbon, these figures can be interpreted as the cost of inaction. Accordingly, by 2050, the costs of inaction are $395,429,264 in overall damages from climate change and $64,978,069 in co-pollutant related health costs. The preventable mortality, emergency room visits (Asthma), and work loss days, which are 7.9, 2.67, and 680 days, respectively, would also now come to pass.

Given that the current social cost of carbon does not capture the entirety of the damages and that the co-pollution estimate focuses only on combustion emission, these cost estimates can be considered as conservative estimates of the cost of inaction.[17]

Implementing this rule would prevent the stated impacts of climate change along with the health impacts resulting from the co-pollution emitted by the covered facilities. As noted earlier, it would also create jobs for individuals operating and maintaining the equipment upgrade that facilities will make, along with the indirect and induced effects that result from that investment. By generating revenue for the state and by reducing co-pollution related health care burden, it will also contribute to the states overall productivity and competitiveness.

Inaction would benefit the covered facilities as they would not have to make the investment required to reduce their emissions. Consumers would also be able to avoid the increase in the price of the products made by the covered facilities.

Implementing this rule would require facilities to make investments. To the extent that they pass on the cost to consumers, however, facilities might not ultimately bear the cost of this rule in terms of lost profits.

V. A determination of whether there are less costly methods or less intrusive methods for achieving the purpose of the proposed rule; and

The rule contains multiple paths to compliance and multiple provisions that are tailored to the specific covered facilities to minimize, as possible, the cost impacts to the group of facilities. This also assures that the rule does not cause undue economic harm to the communities which depend economically on these facilities, while still achieving the required reductions from the rule.

The Division worked with the individual facilities to understand the risks and challenges of setting specific facility emission reduction requirements, taking into consideration that each of these facilities is unique. To illustrate, one GEMM 2 facility completed construction in the past five years, some facilities began operations ten years ago, and a few have been operating in Colorado for over a century - and have upgraded to cleaner technology over time. Additionally, four of the GEMM 2 facilities recently invested tens of millions of dollars to significantly increase the production capacity of the facility, prior to the passage of House Bill 21-1266 in July 2021. However, because of impacts from the COVID-19 pandemic, weather impacts on crops, or other reasons, these four facilities have not yet been able to realize those investments. It's well known that the COVID-19 pandemic sidelined the manufacturing industry and caused drops in production and increased lead times for equipment overall, among other impacts. It was essential for the Division to consider these variabilities when

[16] *See* § 25-7-102(2)(e), C.R.S.

[17] Supplementary Material for the Regulatory Impact Analysis for the Supplemental Proposed Rulemaking, "Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review" (available at: https://www.epa.gov/system/files/documents/2022-11/epa_scghg_report_draft_0.pdf).

setting facility baselines to assure the negative impacts on economic well-being were minimized. The Division's proposal reflects this in the following ways.

First, all GEMM 2 facilities were granted a baseline based on the highest reported emissions in either the 2021 or 2022 reporting year. The baseline represents the emissions level from which a GEMM 2 facility must reduce its emissions to meet its reduction goals. Instead of assigning the facility baselines from a single emissions year, where some facilities had reduced emissions because of production fluctuations and COVID-19 impacts, the Division's proposal allows a facility to be baselined at the higher emissions over two years.

Second, four GEMM 2 facilities have been granted adjusted baselines to accommodate the large capital investments and increased production capacity at the facilities prior to the industrial and manufacturing sector targets being signed into law, and prior to COVID-19 impacts on the manufacturing industry.

Third, GEMM 2 facilities that have already reduced at least 20% compared to what the facility emitted in 2015, are given near-term flexibility to increase emissions to 75% of what the facility emitted in 2015 to accommodate planned growth.

Last, all GEMM 2 facilities are able to comply with the GHG reduction requirements through use of the GHG credit trading system. Whereas covered facilities will be required to implement all technically feasible reduction measures up to a certain price towards achieving their 2030 requirement, facilities can achieve the remainder of their compliance obligation by obtaining and retiring GHG credits through the GHG credit trading system. A facility may also use the GHG credit trading system to comply with its pre-2030 GHG emissions reduction requirements without first demonstrating implementation of all technically feasible, onsite measures under the 2030 social cost of GHGs.

The Division is also including language in the Statement of Basis and Purpose to allow for the establishment of a state-managed industrial decarbonization fund. The purpose of this fund would be to receive monies from GEMM 2 facilities per ton of GHG emissions needed for compliance in a given year, and allocate the monies to finance projects to reduce GHG emissions from the industrial and manufacturing sector, prioritizing GHG reduction projects at or near GEMM 2 facilities in disproportionately impacted communities.

Throughout the lengthy rule input and development process, many different approaches to individual pieces of the rule and the rule as a whole were considered. The Division's proposal balances cost burden for facilities in an equitable manner, assures the reduction targets will be met, while meeting the multiple statutory directives set forth in HB-1266. In reality, there are multiple ways the GEMM 2 rule could be structured that might theoretically be less costly or intrusive, but the Division worked extensively with stakeholders and ultimately determined that the proposed rule was the best approach to achieving the statutory requirements while minimizing costs of implementation in the ways described above.

VI. A description of any alternative methods for achieving the purpose of the proposed rule that were seriously considered by the agency and the reasons why they were rejected in favor of the proposed rule.

An alternative that was considered, but was later abandoned, was a plan to require each individual GEMM 2 facility to reduce 20% below that specific facility's 2015 reported direct emissions by 2030. Although this would have reduced the same amount of GHG as the current proposal, it was abandoned because some facilities would have had to reduce well over 20%, up to 175% in some situations.

Requiring each facility to reduce 20% from 2015 levels would also fail to account for any change to operations that occurred at the covered facilities since 2015, including expanded production capacity and new product

lines. As shown in Figure 2, the current approach distributes the compliance obligation and associated cost more evenly than this alternative plan would have.

Figure 2

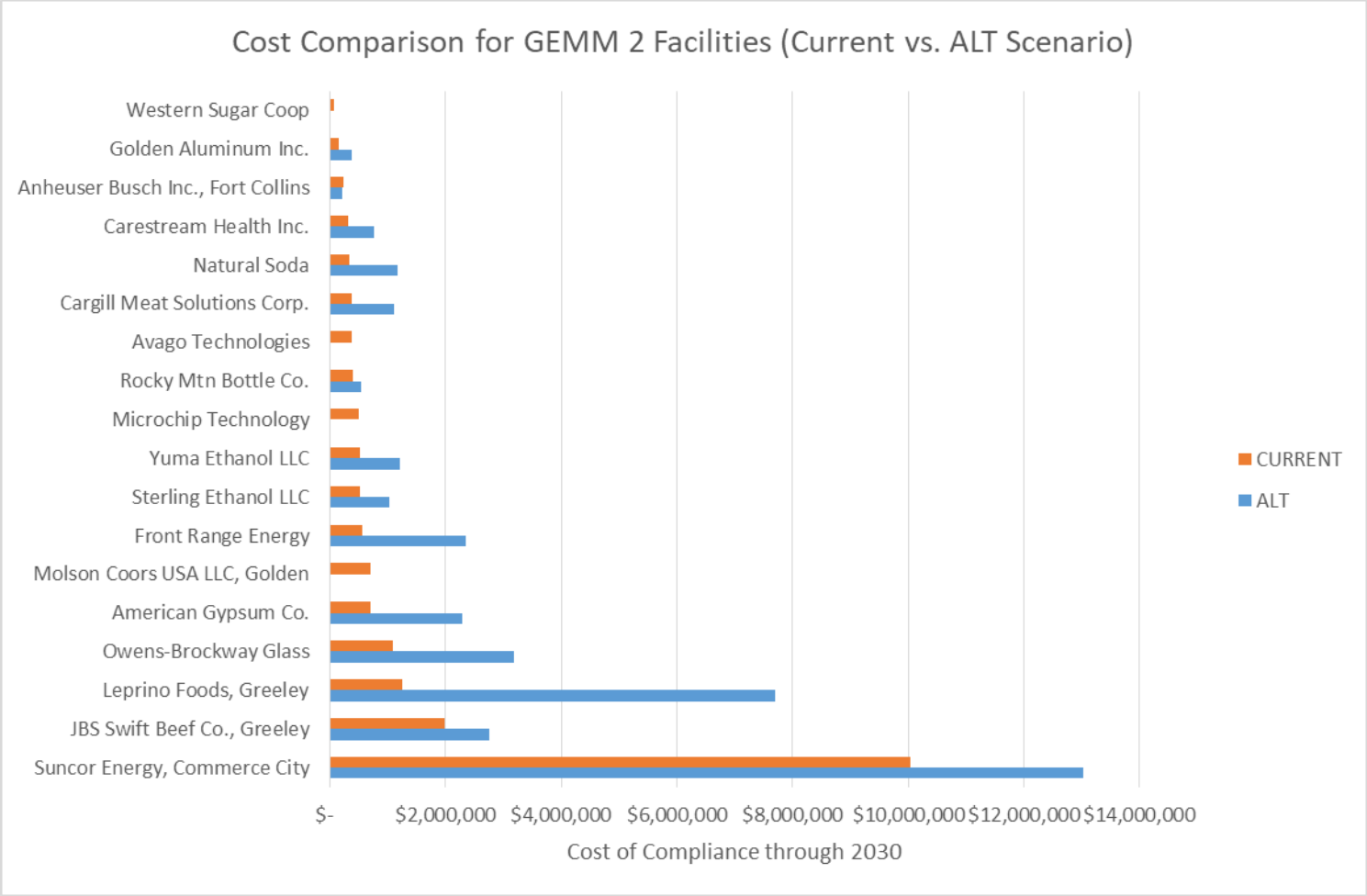


Figure 2: Current Proposal vs. Alternate, Cost Comparison for GEMM 2 facilities.[18]

Under the alternative plan, four facilities would have generated the majority of the GHG credits. In addition to monopolizing the credit market, it is unclear if they would have been able to generate enough credit to service the market as compared to having more facilities with relatively lower compliance obligations and thus greater ability to generate credits. In doing this, the current proposal also allows every facility to "do their part" without requiring any facility to have to reduce emissions by more than 15.5% from the facility's current emissions. The alternative also did not have interim requirements as the current proposal does. The addition of near-term compliance obligations to the rule allows emission reductions to occur sooner than later. By bringing those benefits to the fore, it increases the overall economic benefit of avoided emissions as the effect of discounting is lessened.

[18] Appendix A at pg. 5.

Year	Collective reduction (annual)	Social cost of cargon (2.5% discount rate)	Avoided social cost of carbon (future value) (upper bound cost estimate)	Discounting Factor	Avoided social cost of carbon (present value) (upper bound cost estimate)	Health benefit from co-pollution (present value)	Total ($)
2024	30009	$ 81.65	$ 2,450,085	0.97560976	$ 2,390,327	$ 527,707	$ 2,918,034
2025	30009	$ 82.95	$ 2,489,277	0.9518144	$ 2,369,329	$ 514,836	$ 2,884,165
2026	30009	$ 84.26	$ 2,528,468	0.92859941	$ 2,347,934	$ 502,279	$ 2,850,213
2027	30009	$ 85.56	$ 2,567,660	0.90595064	$ 2,326,173	$ 490,028	$ 2,816,201
2028	30009	$ 86.87	$ 2,606,852	0.88385429	$ 2,304,077	$ 478,076	$ 2,782,153
2029	30009	$ 88.18	$ 2,646,044	0.86229687	$ 2,281,675	$ 466,416	$ 2,748,091
2030	268400	$ 89.48	$ 24,016,700	0.84126524	$ 20,204,415	$ 455,040	$ 20,659,455
2031	268400	90.844	$ 24,382,530	0.82074657	$ 20,011,878	$ 3,851,562	$ 23,863,440
2032	268400	92.207	$ 24,748,359	0.80072836	$ 19,816,713	$ 3,757,621	$ 23,574,334
2033	268400	93.57	$ 25,114,188	0.7811984	$ 19,619,164	$ 3,665,972	$ 23,285,136
2034	268400	94.934	$ 25,480,286	0.76214478	$ 19,419,667	$ 3,576,558	$ 22,996,225
2035	268400	96.297	$ 25,846,115	0.74355589	$ 19,218,031	$ 3,489,325	$ 22,707,356
2036	268400	97.66	$ 26,211,944	0.72542038	$ 19,014,678	$ 3,404,219	$ 22,418,897
2037	268400	99.023	$ 26,577,773	0.7077272	$ 18,809,813	$ 3,321,190	$ 22,131,003
2038	268400	100.387	$ 26,943,871	0.69046556	$ 18,603,815	$ 3,240,185	$ 21,844,000
2039	268400	101.75	$ 27,309,700	0.67362493	$ 18,396,495	$ 3,161,156	$ 21,557,651
2040	268400	103.113	$ 27,675,529	0.65719506	$ 18,188,221	$ 3,084,055	$ 21,272,276
2041	268400	104.449	$ 28,034,112	0.64116591	$ 17,974,517	$ 3,008,834	$ 20,983,351
2042	268400	105.785	$ 28,392,694	0.62552772	$ 17,760,417	$ 2,935,448	$ 20,695,865
2043	268400	107.12	$ 28,751,008	0.61027094	$ 17,545,905	$ 2,863,851	$ 20,409,756
2044	268400	108.456	$ 29,109,590	0.59538629	$ 17,331,451	$ 2,794,001	$ 20,125,452
2045	268400	109.792	$ 29,468,173	0.58086467	$ 17,117,020	$ 2,725,855	$ 19,842,875
2046	268400	111.128	$ 29,826,755	0.56669724	$ 16,902,740	$ 2,659,371	$ 19,562,111
2047	268400	112.464	$ 30,185,338	0.55287535	$ 16,688,729	$ 2,594,508	$ 19,283,237
2048	268400	113.799	$ 30,543,652	0.53939059	$ 16,474,958	$ 2,531,227	$ 19,006,185
2049	268400	115.135	$ 30,902,234	0.52623472	$ 16,261,829	$ 2,469,490	$ 18,731,319
2050	268400	116.471	$ 31,260,816	0.51339973	$ 16,049,295	$ 2,409,259	$ 18,458,554
Total	**5,816,454**				**$ 395,429,264**	**$ 64,978,069**	**$ 460,407,333**

Benefit per ton CO2e reduced and associated copollution in present day USD

$ 1,715.38

Year	Collective reduction (annual)	Social cost of cargon (2.5% discount rate)	Avoided social cost of carbon (future value) (upper bound cost estimate)	Discounting Factor	Avoided social cost of carbon (present value) (upper bound cost estimate)	Health benefit from co-pollution (present value)	Total ($)
2024	328884	$ 81.65	$ 26,851,734	0.97561	$ 26,196,814	$ 5,994,313	$ 32,191,127
2025	328884	$ 82.95	$ 27,281,257	0.951814	$ 25,966,693	$ 5,848,110	$ 31,814,803
2026	328884	$ 84.26	$ 27,710,779	0.928599	$ 25,732,213	$ 5,705,474	$ 31,437,687
2027	328884	$ 85.56	$ 28,140,302	0.905951	$ 25,493,724	$ 5,566,316	$ 31,060,040
2028	328884	$ 86.87	$ 28,569,824	0.883854	$ 25,251,562	$ 5,430,552	$ 30,682,113
2029	328884	$ 88.18	$ 28,999,347	0.862297	$ 25,006,046	$ 5,298,099	$ 30,304,145
2030	567276	$ 89.48	$ 50,760,424	0.841265	$ 42,702,980	$ 5,168,877	$ 47,871,857
2031	567276	90.844	$ 51,533,621	0.820747	$ 42,296,043	$ 5,042,807	$ 47,338,850
2032	567276	92.207	$ 52,306,818	0.800728	$ 41,883,553	$ 8,244,225	$ 50,127,778
2033	567276	93.57	$ 53,080,015	0.781198	$ 41,466,023	$ 8,043,146	$ 49,509,169
2034	567276	94.934	$ 53,853,780	0.762145	$ 41,044,377	$ 7,846,972	$ 48,891,349
2035	567276	96.297	$ 54,626,977	0.743556	$ 40,618,210	$ 7,655,582	$ 48,273,792
2036	567276	97.66	$ 55,400,174	0.72542	$ 40,188,415	$ 7,468,861	$ 47,657,276
2037	567276	99.023	$ 56,173,371	0.707727	$ 39,755,423	$ 7,286,693	$ 47,042,116
2038	567276	100.387	$ 56,947,136	0.690466	$ 39,320,036	$ 7,108,969	$ 46,429,005
2039	567276	101.75	$ 57,720,333	0.673625	$ 38,881,855	$ 6,935,580	$ 45,817,435
2040	567276	103.113	$ 58,493,530	0.657195	$ 38,441,659	$ 6,766,419	$ 45,208,078
2041	567276	104.449	$ 59,251,411	0.641166	$ 37,989,985	$ 6,601,385	$ 44,591,369
2042	567276	105.785	$ 60,009,292	0.625528	$ 37,537,475	$ 6,440,375	$ 43,977,850
2043	567276	107.12	$ 60,766,605	0.610271	$ 37,084,093	$ 6,283,293	$ 43,367,386
2044	567276	108.456	$ 61,524,486	0.595386	$ 36,630,835	$ 6,130,042	$ 42,760,877
2045	567276	109.792	$ 62,282,367	0.580865	$ 36,177,626	$ 5,980,529	$ 42,158,155
2046	567276	111.128	$ 63,040,247	0.566697	$ 35,724,734	$ 5,834,662	$ 41,559,396
2047	567276	112.464	$ 63,798,128	0.552875	$ 35,272,413	$ 5,692,353	$ 40,964,766
2048	567276	113.799	$ 64,555,442	0.539391	$ 34,820,598	$ 5,553,515	$ 40,374,113
2049	567276	115.135	$ 65,313,322	0.526235	$ 34,370,138	$ 5,418,064	$ 39,788,202
2050	567276	116.471	$ 66,071,203	0.5134	$ 33,920,938	$ 5,285,916	$ 39,206,854
Total	**13,886,100**				**$ 959,774,460**	**$ 170,631,129**	**$ 1,130,405,589**

Benefit per ton CO2e reduced and associated copollution in present day USD

$1,992.69

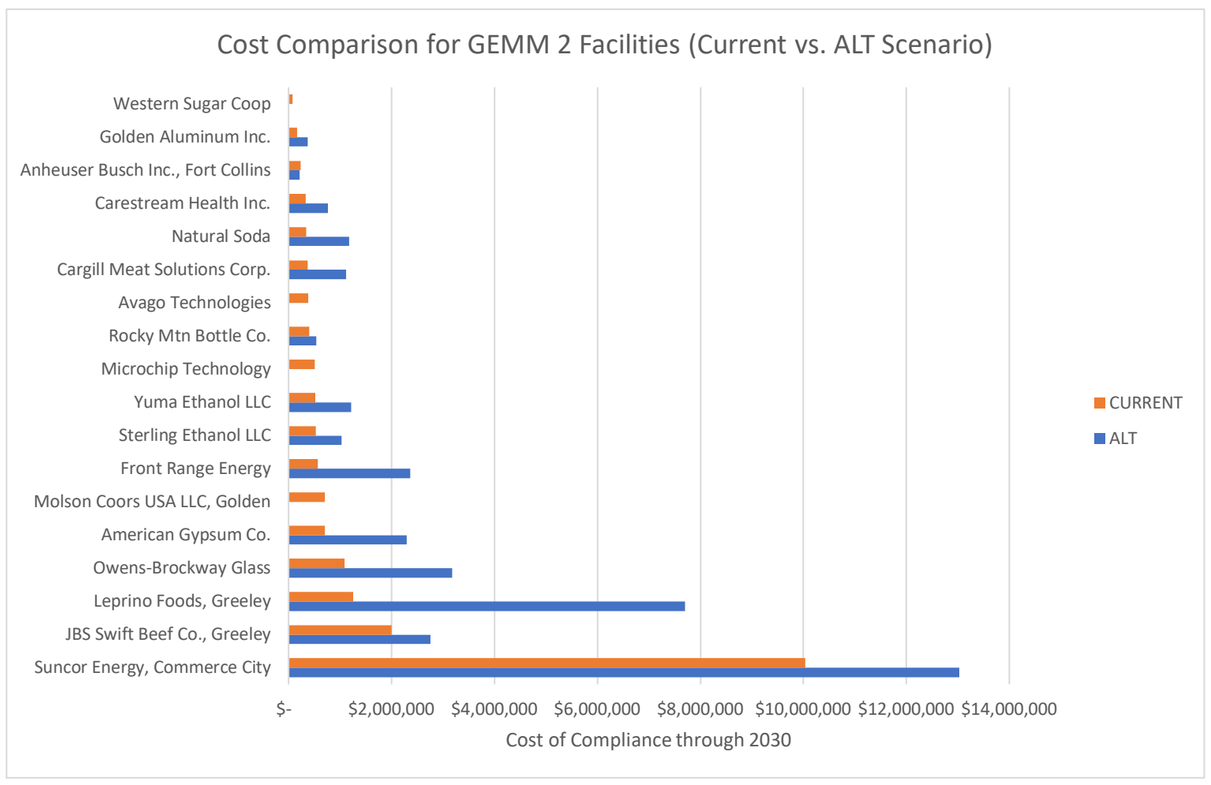
	Required Reduction by 2030	2030 Social Cost of GHGs (PV)	Estimated Cost (PV)
Suncor Energy, Commerce City	133,266	$ 75.28	$ 10,031,904.66
JBS Swift Beef Co., Greeley	26,521	$ 75.28	$ 1,996,429.27
Leprino Foods, Greeley	16,610	$ 75.28	$ 1,250,355.95
Owens-Brockway Glass	14,500	$ 75.28	$ 1,091,520.85
American Gypsum Co.	9,381	$ 75.28	$ 706,176.35
Molson Coors USA LLC, Golden	9,355	$ 75.28	$ 704,219.14
Front Range Energy	7,546	$ 75.28	$ 568,042.51
Sterling Ethanol LLC	7,046	$ 75.28	$ 530,403.86
Yuma Ethanol LLC	6,937	$ 75.28	$ 522,198.63
Microchip Technology	6,756	$ 75.28	$ 508,573.44
Rocky Mtn Bottle Co.	5,368	$ 75.28	$ 404,088.55
Avago Technologies	5,014	$ 75.28	$ 377,440.38
Cargill Meat Solutions Corp.	4,949	$ 75.28	$ 372,547.36
Natural Soda	4,498	$ 75.28	$ 338,597.30
Carestream Health Inc.	4,362	$ 75.28	$ 328,359.58
Anheuser Busch Inc., Fort Collins	3,060	$ 75.28	$ 230,348.54
Golden Aluminum Inc.	2,141	$ 75.28	$ 161,168.70
Western Sugar Coop	1,091	$ 75.28	$ 82,127.53
			$ 20,204,502.60

Cost of Independent Third Party Review (PV)	**$ 360,000.00**
Cost of Independent Third Party Review and GHG emission reductions (PV)	**$ 20,564,502.60**
GHG Emission Reduction (mt CO2e)	**268400**
Cost per mt of CO2e Reduced (PV)	**$ 76.62**

In 2030			
upper bound cost estimate		**multiplier (per $1 million) - direct, indirect, induced**	**jobs created**
$	20,204,415	1.8	36.37
$	20,204,415	4.9	99.00
$	20,204,415	11.6	234.37
			370

2024 - 2030		
upper bound cost estimate	**multiplier (per $1 million) - direct, indirect, induced**	**jobs created**
$34,583,981	1.8	62.25
$34,583,981	4.9	169.46
$34,583,981	11.6	401.17
		633

	2015 Emissions	20% from 2015	2021/2022 Emissions	ALT Reduction Required	Cost (using 2030 SCGHGs in PV)	Current Reduction Required	Cost (using 2030 SCGHG in PV)
Suncor Energy, Commerce City	973,484	778,787	951,898	173,111	$ 13,031,781	133,266	$ 10,032,264
JBS Swift Beef Co., Greeley	168,143	134,514	171,101	36,587	$ 2,754,239	26,521	$ 1,996,501
Leprino Foods, Greeley	38,254	30,603	132,878	102,275	$ 7,699,247	16,610	$ 1,250,401
Owens-Brockway Glass	92,157	73,726	116,002	42,276	$ 3,182,567	14,500	$ 1,091,560
American Gypsum Co.	55,647	44,518	75,047	30,529	$ 2,298,253	9,381	$ 706,202
Molson Coors USA LLC, Golden	388,752	311,002	234,938	-76,064	-	9,398	$ 707,481
Front Range Energy	36,282	29,026	60,369	31,343	$ 2,359,531	7,546	$ 568,063
Sterling Ethanol LLC	53,324	42,659	56,370	13,711	$ 1,032,149	7,046	$ 530,423
Yuma Ethanol LLC	49,193	39,354	55,500	16,146	$ 1,215,441	6,937	$ 522,217
Microchip Technology	260,845	208,676	168,907	-39,769	-	6,756	$ 508,592
Rocky Mtn Bottle Co.	86,973	69,578	76,684	7,106	$ 534,910	5,368	$ 404,103
Avago Technologies	289,356	231,485	125,339	-106,146	-	5,014	$ 377,454
Cargill Meat Solutions Corp.	30,923	24,738	39,588	14,850	$ 1,117,878	4,949	$ 372,561
Natural Soda	50,796	40,637	56,227	15,590	$ 1,173,630	4,498	$ 338,609
Carestream Health Inc.	30,998	24,798	34,894	10,096	$ 759,997	4,362	$ 328,371
Anheuser Busch Inc., Fort Collins	51,002	40,802	43,710	2,908	$ 218,944	3,060	$ 230,357
Golden Aluminum Inc.	27,237	21,790	26,759	4,969	$ 374,096	2,141	$ 161,174
Western Sugar Coop	150,657	120,526	109,141	-11,385	-	1,091	$ 82,130

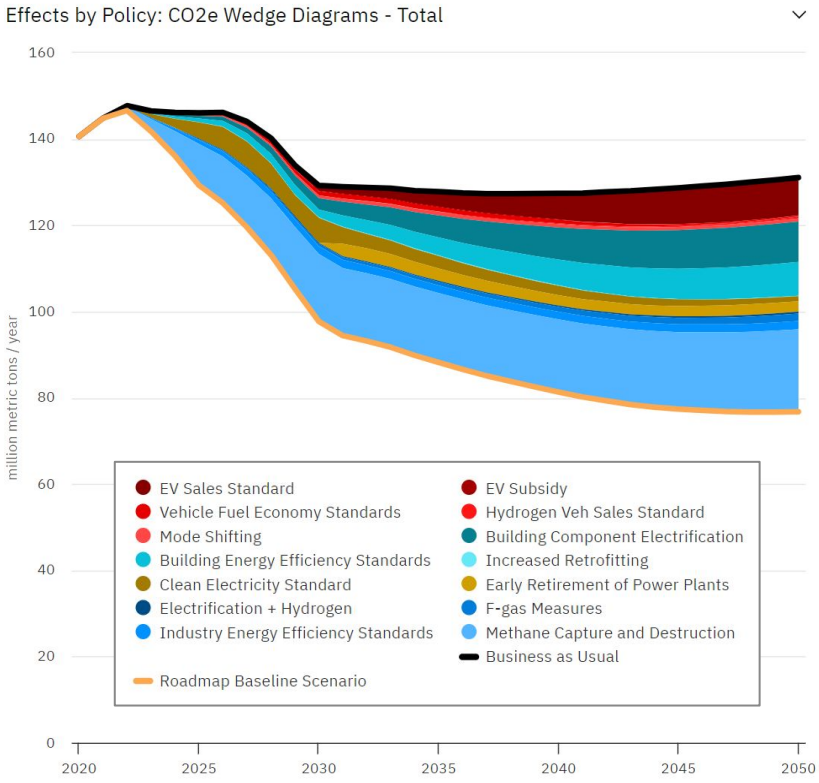


Appendix C: Near-Term Actions Modeling Results

Roadmap Baseline Scenario

- Includes all policies “on-the-books” by end of 2023
- Builds on EPS Business-as-Usual (BAU) that uses publicly available data to capture projected changes in economic growth, technology and fuel costs, and existing federal policy
- In some cases, requires translating policies into EPS policy levers that reasonably reflect the effect of the Colorado-specific mechanism
- Reflects (conservative approach) to Inflation Reduction Act (IRA) and Infrastructure Investment and Jobs Act (IIJA) provisions
- Requires assumptions about policy efficacy, incentive uptake, rule compliance, and more - will be developing uncertainty analysis in Dec

Roadmap Baseline Scenario Results



Near-Term Actions DRAFT IMPACT

	2030 Impact	2035 Impact	2040 Impact
Net-GHG-Neutral Oil & Gas	2.0%	3.8%	5.8%
Expanded Clean Air Grant Program	1.8%	2.6%	2.9%
Midstream Combustion Reductions	1.4%	1.0%	1.0%
Carbon Capture Support	1.2%	1.3%	1.3%
Building Electrification	0.8%	2.4%	3.5%
Funding for Soil Health	0.8%	0.7%	0.6%
Clean Miles Standard for TNCs	0.7%	0.7%	0.4%
Expanded Methane Rules	0.4%	0.6%	0.7%
Building Efficiency	0.2%	0.4%	0.3%
2040 Clean Energy Planning	0.0%	3.7%	7.6%
Expanded Clean Heat Targets	0.0%	0.8%	1.3%

Note 1: Percentages shown are the percent reductions from the Roadmap Baseline Scenario.
Note 2: A 0.0% value does not mean that there is no impact, rather that impact is less than 0.05% below Roadmap Baseline emissions.

Utilities

Actions in Roadmap Baseline Scenario

Policy/Strategy	Modeled as…
Resource usage necessary to achieve sector targets in HB21-1266	• Clean Electricity Standard lever is set to 83% with the implementation schedule ramping up fully from 2022 to 2030.
Funding for geothermal electricity from HB23-1252 grant program and HB23-1272 tax credits	• Subsidy for geothermal electricity capacity construction set to 14% between 2023 and 2025. • Subsidy for electricity production from geothermal set to $3/MWh for 2024–2032.
Xcel retirement of Comanche Unit 3	• Additional early retirement of 0.75 GW of coal in 2031
IIJA Section no. 41001 projected to increase storage capacity online by 2026	• Grid-Scale Electricity Storage set at 8% with an implementation schedule ramping up fully by 2026.

Proposed Near-Term Actions

- Update Clean Energy Planning for 2040
- Reform Distribution System Planning for New Electric Loads
- Modernize Clean Energy Permitting and Siting
- Ensure Fairness in Distributed Energy Resource Compensation
- Pursue Strategic Electrification Projects to Improve Safety and Affordability of Natural Gas Distribution

Summary of Modeled Near-Term Actions

	Modeling Assumptions	2030 Impact	2035 Impact	2040 Impact
2040 Clean Energy Planning	Builds on Colorado's existing Clean Energy Plans by requiring utilities to achieve 100% clean electricity generation by 2040. We use the Clean Electricity Standard lever as a proxy for Clean Energy Plans and set it to 100% in 2040, which achieves an electricity sector emissions reduction of >95% by 2040.	0.0%	3.7%	7.6%

Note 1: Percentages shown are the percent reductions from the Roadmap Baseline Scenario.
Note 2: A 0.0% value does not mean that there is no impact, rather that impact is less than 0.05% below Roadmap Baseline emissions.

Transportation

Actions in Roadmap Baseline

Policy/Strategy	Modeled as…
• Existing state EV tax credit and HB23–1272 extension	• Electric vehicle subsidy lever set to 13% with an implementation schedule that matches tax credit values from 2020–2028
• Compliance with 2021 CDOT rulemaking	• 9% LDV vehicle miles traveled (VMT) reduction below BAU by 2050 for passenger vehicles
• ACT and Low NOx rules for M/HDVs • IRA Section no. 60101: addition of clean HDVs • IIJA Section no. 30018, 71101: replacement and addition of school buses with clean vehicles	• EV Sales Standard lever for Buses, Light Commercial Trucks, and Heavy and Medium Duty Trucks set to 46% by 2035
• Compliance with the Advanced Clean Cars (LEV/ZEV) standard in effect and Advanced Clean Cars II rule for passenger vehicles through 2032	• EV Sales Standard lever for Cars and SUVs set to 82% by 2032 • Fuel Economy Standard lever for Cars and SUVs set to 68% by 2032
• HB23-1281 tax credit for clean hydrogen	• Shift to hydrogen in medium- and heavy-duty vehicles 9% by 2050
• HB23-1272 tax credit for sustainable aviation fuel	• Mode shifting lever for aviation used as proxy to reduce aviation emissions by approximately 10% relative to BAU by 2032
• SB21-260 investments in electric vehicle (EV) infrastructure and fleet electrification • IRA Section no.11101 and 11401: grants for charging and fueling infrastructure	• These policies are not modeled using a lever. Instead, we adjust the model's input data on charging costs underlying the BAU to represent increased funding for chargers.

Proposed Near-Term Actions

- Streamline Local EV Charger Deployment
- Enact a Clean Miles Standard
- Build More Complete and Connected Streets
- Expand and Increase Statewide Transit Service, incl Front Range Rail
- Expand the Zero Fare Transit Program
- Encourage Land Use Policies to Build More Housing, Grow Walkable Neighborhoods, and Increase Transit Access
- Reduce Pollution from Urban Freight

Summary of Modeled Near-Term Actions

	Modeling Assumptions	2030 Impact	2035 Impact	2040 Impact
Clean Miles Standard for TNCs	CDOT analysis shows 5.5% of passenger vehicle travel demand is from TNCs and rental cars. This action is modeled as 90% of this demand to be electrified by 2030 and 100% by 2035. We estimate that ~4% of the fleet in addition to the Roadmap Baseline would be electric by 2035. The implementation for ACC2 is adjusted in 2025 until the additional electrified stock percentage in 2035 is 4%.	0.7%	0.7%	0.4%

Note: Percentages shown are the percent reductions from the Roadmap Baseline Scenario.

- **VMT-reduction strategy modeling not yet completed**
  - Land use, transit service, transit fare, and bike/pedestrian infrastructure
  - Anticipate results in January
- **Some strategies (e.g., urban freight) don't yet have sufficient detail to model**

Buildings

Actions in Roadmap Baseline

Policy/Strategy	Modeled as…
SB21-264 Clean Heat Plans	• Building component electrification ramps to 60% by 2030 • Building energy efficiency ramps to 25% by 2030
HB22-1362 Near-Zero Energy Codes	• Increases building energy efficiency to 36% by 2050, with interim increase from 2022-26 to represent 2021 IECC
SB21-246 Utility Beneficial Electrification Plans	• Retrofit existing buildings lever set to 5% by 2038 to match emissions reductions in 2022 Xcel BE Plan
Building Performance Colorado	• Increases building energy efficiency to 75% for commercial buildings by 2030
HB23-1161 Appliance Standards	• Increases building component electrification to 70% for heating only

Proposed Near-Term Actions

- Develop 2035 Clean Heat Targets
- Develop a Strategic Plan for Electrification of Buildings and Appliances
- Increase Energy Efficiency and Electrification for State Affordable Housing Programs
- Expand Low-Income Access to Distributed Solar
- Adopt Low-Energy and Low-Carbon Building Codes
- Extend GHG Reduction Targets for Existing Large Buildings
- Expand On-Bill Financing for Building Energy Improvements
- Accelerate Heat Pump Deployment for Equitable Access to Heating and Cooling

Summary of Modeled Near-Term Actions

	Modeling Assumptions	2030 Impact	2035 Impact	2040 Impact
Expanded Clean Heat Targets	We model a decrease in building gas consumption from 2015 levels and electrify 66% of newly sold non-electric building components by 2035.	0.0%	0.8%	1.3%
Building Electrification	We assume electrification approaching Energy Innovation's NDC-aligned scenario by further increasing the electrification lever to 90% by 2030. This means 90% of all **new** buildings and new appliances are electric by 2030.	0.8%	2.4%	3.5%
Building Efficiency	We assume efficiency retrofits in line with Energy Innovation's NDC-aligned scenario by setting the Retrofit Existing Buildings lever to 15% in 2050.	0.2%	0.4%	0.3%

Note 1: Percentages shown are the percent reductions from the Roadmap Baseline Scenario.
Note 2: A 0.0% value does not mean that there is no impact, rather that impact is less than 0.05% below Roadmap Baseline emissions.

Oil and Gas

Actions in Roadmap Baseline

Policy/Strategy	Modeled as…
Compliance with requirements for oil and gas in AQCC Regulations 7, extrapolating impacts from APCD and EDF analysis	Methane capture lever 100% by 2030; methane destruction lever 67% by 2030, and Industry Energy Efficiency Standards lever for Oil and Gas Extraction set to 13%. Implementation schedule for all levers ramps up fully from 2022 to 2030. These are used to approximate emissions abatement scenarios from RMI and CDPHE analysis on the Intensity Standard, and additional portions of Regulations 7.
Strong compliance with the Intensity Standard for O&G production given in Regulation 7, assuming a robust verification rule	
SB22-198 and Financial Assurance Rules, which provide funding mechanisms for the remediation of orphaned wells	

Proposed Near-Term Actions

- Enforce Intensity Requirements for Preproduction and Production Operations
- Develop Strategies for Net-GHG-Neutral Oil and Gas Development and Operations
- Achieve Emissions Reductions from Well Plugging
- Track and Reduce Truck Emissions from Oil & Gas Operations
- Study Alternative Uses of Oil & Gas Wells

Summary of Modeled Near-Term Actions

	Modeling Assumptions	2030 Impact	2035 Impact	2040 Impact
Net-GHG-Neutral Oil & Gas	Assume that oil and gas operations become more efficient and electrify where possible at an aggressive rate by increasing the Industry Energy Efficiency Standard and Electrification for Low/Med to High Heat to the levels in the NDC scenario.	2.0%	3.8%	5.8%

Note: Percentages shown are the percent reductions from the Roadmap Baseline Scenario.

Industry

Actions in Roadmap Baseline

Policy/Strategy	Modeled as…
• State hydrofluorocarbon (HFC) regulations	• F-gas measures are implemented 50% by 2030 and fully by 2040
• GEMM Phase I rulemaking, which requires four heavy-emitting industrial facilities to demonstrate compliance with emissions reductions targets through an audit process • Completion of the GEMM Phase II rulemaking, which requires about 20 facilities to demonstrate compliance with 20% emissions reduction by 2030 relative to 2015	• 8% efficiency improvement in industrial energy consumption by 2030 (lever set to match annual expected abatement of 0.5–0.6 MMT CO2e by 2030 for GEMM Phase I and GEMM Phase II each)
• HB23-1281 tax credit for clean hydrogen	• Incentive assumed to create demand pull that leads to an industry shift to hydrogen aligned with 5% achievement of NDC pathway, ramping up fully from 2022 to 2050
• HB23-1272 tax credits for industrial facility clean energy investments	• Industry Energy Efficiency lever increased by 5% (adding to the 8% corresponding to GEMM Phase I and GEMM Phase II) for Industry Categories most directly affected by this bill

Proposed Near-Term Actions

- Expand Methane Regulations for Landfills and Coal Mines
- Develop a Statewide Industrial Decarbonization Strategy
- Expand Funding For Voluntary Industrial Decarbonization Projects
- Reducing Waste: Circular Economy, Renewable Energy Decommissioning, and Composing
- Lead a Regional Strategy on Direct Air Capture (DAC)
- Establish Statewide Regulations for Carbon Management
- Enable the Clean Hydrogen Economy

Summary of Modeled Near-Term Actions

	Modeling Assumptions	2030 Impact	2035 Impact	2040 Impact
Expanded Clean Air Grant Program	Assumed that the $25 million in CAP grant funding was accompanied by tax credit financing of $16 million/year through 2028 and $24 million/year through 2032 and CPRG funding of $200 million total through 2030. Assumed 50% of projects covered by funding would be additional to projects already being pursued through other state action. Modeled impact of CAP grants as electrification of low-temperature facilities across industries.	1.8%	2.6%	2.9%
Midstream Combustion Reductions	Matched analysis from CDPHE on the 2030 abatement potential of the midstream combustion rule using the Industry Energy Efficiency Standard.	1.4%	1.0%	1.0%
Carbon Capture Support and DAC	Researched and used data provided by CEO CCS projects that are planned or operational. Modeled annual capture of 90% of emissions from cement production starting in 2027 based on schematics of planned project. In addition, used data from CEO on plans to establish DAC facilities that create and sell credits in Colorado. Modeled 1% of potential achieved beginning in 2023 in accordance with planned project schematics. Voluntary purchases of DAC by emitters in the state could increase the impact of the technology.	1.2%	1.3%	1.3%
Expanded Methane Rules for Waste & Coal Mining	Based on CDPHE guidance, achieved an additional 10% reduction in emissions from coal mining and an additional 10% reduction in emissions from water and waste by 2030.	0.4%	0.6%	0.7%

Note: Percentages shown are the percent reductions from the Roadmap Baseline Scenario.

Natural and Working Lands

Actions in Roadmap Baseline

Policy/Strategy	Modeled as…
Support for Colorado's healthy soils programs via SB21-235 as well as HB21-1181	• Cropland and Rice Measures lever set to 25% with implementation ramping up fully from 2021 to 2050

Note that the focus of the EPS is modeling the major demand sectors (transportation, buildings, and industry). The tool can only capture agriculture and land use policies at a high level.

Proposed Near-Term Actions

- Extend Existing Tax Incentives for Beetle-Killed Wood
- Expand Methane Emissions Reductions from Agricultural Operations
- Expand Renewable Energy Development and Transmission on State Lands
- Provide Guidance on the Production and Use of Biochar
- Implement the Natural and Working Lands Strategic Plan
- Secure Permanent Funding for Soil Health Program
- Augment Funding for Renewable Energy and Energy Efficiency Projects on Agricultural Operations

Summary of Modeled Near-Term Actions

	Modeling Assumptions	2030 Impact	2035 Impact	2040 Impact
Funding for Soil Health	Modeled abatement of approximately 470,000 metric tons of CO2e annually through 2026, which reflects CDA's estimate for abatement levels if 10% of Colorado's farms were managed for healthy soils	0.8%	0.7%	0.6%
RE and EE Projects for Agriculture Operations	Extrapolated 2022-2023 level of ACRE funding through 2025, which found 3,900 tons in CO2e emissions reductions	0.0%	0.0%	0.0%

Note 1: Percentages shown are the percent reductions from the Roadmap Baseline Scenario.
Note 2: A 0.0% value does not mean that there is no impact, rather that impact is less than 0.05% below Roadmap Baseline emissions.

Appendix D: 2022-2023 Legislative Summaries

1. 2022 Legislative Session Snapshot
2. 2023 Legislative Session Snapshot

Colorado Energy Office | 2022 Legislative Session Snapshot | June 2022

More than 25 bills passed in the 2022 Colorado legislative session advancing climate and air quality, clean buildings, renewable energy, community resilience, transportation use, just transition, and healthy forests and sustainable water. These bills also continue making progress on Colorado Greenhouse Gas Pollution Reduction Roadmap, which is the state's strategic plan to achieve the statutory goal of a 50% reduction in greenhouse gas (GHG) pollution from economy-wide emissions below 2005 levels by 2030, and a 90% reduction by 2050.

The Roadmap is a sector-based plan with strategies to achieve at least 80% reduction from electricity generation by 2030, 60% from oil and gas development, 40% from transportation, and 20% from industry and buildings. The package of legislation makes major progress on all of these goals, including public investments in market transformation, creation of incentives from electric and gas utilities, and regulatory requirements to be implemented through the Public Utilities Commission, Transportation Commission and Air Quality Control Commission.

For climate and air quality, legislation creates incentives for:

- eBikes
- Electric school buses
- Air pollution reduction projects in industrial processes
- Funding for oil and gas aerial air quality monitoring and pilot projects to increase energy efficiency
- Water efficiency in cannabis facilities

Investments were also made to address air quality challenges. These include initiatives to help meet Colorado's ozone, greenhouse gas, and environmental justice goals; incentives to transition to electric lawn and garden equipment; and investments in air quality science. In addition, newly passed legislation initiates programs to both remediate orphaned oil and gas wells and advance plastics recycling.

- For buildings, legislation creates a set of tools and incentives to improve existing structures, including:
- State incentives for public building electrification and high-efficiency electric heating and appliances
- The creation of an Energy Code Board that will set requirements for new building energy codes
- Tax credits for high efficiency electric heating and cooling systems
- Grants and loans for use in affordable housing development, including provisions to enhance energy efficiency
- Incentives for installing energy efficiency measures in manufactured homes

For renewable energy, legislation both incentivizes the development of geothermal energy use and funds the creation of educational tools and guides related to this renewable energy source. Beyond that, bills will help spur electricity generation and adoption of space heating and cooling, water heating, and district heating.

For community resilience, legislation strengthens communities affected by natural and climate disasters through incentives that help them build back green. This includes the creation of a Climate Preparedness office, the development of a grid resilience and reliability roadmap, and the creation of rural grants for microgrids. All this aligns with security goals for older Coloradans, which include energy efficiency, renewable energy and electric vehicle investments.

For transportation, legislation creates pilot programs for free transit fares; expansion of transit services along interstates; and incentives for improving bicycle, pedestrian and transit improvements to main streets. Legislation also creates corporate tax credits that provide employees alternative transportation options; allows bicyclists to make safety stops at intersections; and aligns regulations to incentivise the construction of bike paths in powerline right of ways.

For just transition, legislation invests in assistance efforts and funding for communities making the transition away from coal and for worker assistance programs.

Legislation also incentivizes carbon-adaptive practices in forest management; enhanced wildfire mitigation capacity; and climate-resilient watersheds and forests. In addition, bills improve carbon storage capacity to meet the state's climate mitigation goals, and aim to increase turf replacement programs to promote water-wise landscaping.

Environment, climate & air quality (broadly)

Senate Bill 22-193 Air Quality Improvement Investments delivers a priority set of clean air and climate change investment programs from the Governor's budget.The law includes:

- $25 million in funding for the Clean Air Grant Program, which will provide grants for energy efficiency improvements, renewable energy, electrification projects, methane capture projects, sustainable aviation fuel, low carbon hydrogen use and carbon capture at industrial facilities to achieve emission reductions required by current and future regulation.
- $12 million in rebates for eBike purchases and programs that provide eBikes and safety equipment to approximately 12,000 low- and moderate-income Coloradans.
- $65 million to start a new school bus electrification grant program, which aims to transition Colorado's diesel school bus fleets to electric buses. Grants will be prioritized for vehicles operating in disproportionately impacted communities, the ozone nonattainment area, and schools with high proportions of students receiving free or reduced school meals. The program provides flexibility for applying districts to pay for charging infrastructure and buses, as well as covering administrative costs for applying to both the state and federal electric school bus programs.
- $7 million for an oil and gas aerial monitoring program to identify leaks from such sources as pipelines and flowlines, production pads, tanks, central gathering facilities, and compressor stations to quickly identify, inventory, and fix methane and other leaks from oil and gas infrastructure.

- $2 million to increase energy efficiency, reduce water use, promote renewable energy implementation, and enhance sustainable practices in operations of cannabis facilities in Colorado, which are major users of electricity and water.

House Bill 22-1329 Long Bill (State Budget) addresses air quality transformation.

- A $47 million, three-year investment to help address air quality challenges:
    - Cutting-edge regulations - Regulatory initiatives to help meet Colorado's ozone, greenhouse gas and environmental justice goals.
    - Immediate emissions reductions - Incentives for state and local government, schools and other public entities to transition from gasoline-powered to electric engines for lawn equipment.
    - Air quality science - Investments in additional and updated air quality data and analysis to inform future strategies and investments.
    - Community relations - Improvements in communication and outreach capacity to meet public expectations regarding engagement and availability of air quality information.
    - Driving air pollution control board performance - Support more stringent permitting, compliance, enforcement and oversight as required under the Clean Air Act.

Senate Bill 22-198 Orphaned Oil And Gas Wells Enterprise initiates a program for plugging, reclaiming and remediating orphaned oil and gas wells, which, if left unattended, can lead to leaks of organic compounds that can emit ozone precursors and adversely impact public health. This will also reduce emissions of methane, the second most important greenhouse gas. The enterprise is funded by oil and gas operators.

House Bill 22-1355 Producer Responsibility Program For Recycling establishes a producer responsibility recycling program to provide convenient and equitable access to recycling services for covered materials, in order to achieve recycling, collection, and post consumer-recycled-content rate goals. Recycling services meeting these goals must be provided for all readily recyclable materials at no charge to single-family and multi-family residences, as well as nonresidential locations identified in the final plan, including public places, small businesses, schools and government buildings. The state GHG roadmap identifies increasing recycling rates as an important nearterm action, which both reduces energy needed for new products and reduces methane emissions from landfills.

Emissions from the built environment

House Bill 22-1362 Building Greenhouse Gas Emissions creates requirements to adopt the most recent International Energy Conservation Code in new buildings; prewire for EVs, solar and heat pumps; and locally adopt a low carbon code starting in 2026 toward near net zero building energy codes by 2030. It also provides:

- $3 million to support local governments and state agencies in adopting and enforcing advanced energy codes. In part, this will be done by funding technical assistance and training for local building department officials and staff, builders, architects, designers, contractors and other stakeholders

- $1 million to support contractor training
- $10 million to the clean air building investments fund for the creation, implementation and administration of the building electrification for public buildings grant program
- $10.85 million to the clean air building investments fund for the creation, implementation, and administration of the high-efficiency electric heating and appliances grant program for neighborhood scale electrification

Senate Bill 22-051 Policies To Reduce Emissions From Built Environment gives purchasers of an air-source, ground-source and water-source heat pump system or variable refrigerant flow heat pump system an income tax credit equal to 10% of the purchase price of the heat pump system or heat pump water heater. This legislation provides the same benefit for the purchase and installation of an energy storage system. In addition, the bill waives sales and use taxes in the sale of heat pump systems, heat pump water heaters, storage systems and other "decarbonizing building materials."

House Bill 22-1304 State Grants Investments Local Affordable Housing includes a strong community grants program developed by a multi-agency team with the assistance of stakeholders, to determine a list of sustainable land use best practices aimed at enabling more housing within existing communities. This will be a key factor in considering a local government's viability for these affordable housing development grants. It includes $40 million for grants to local communities to advance land use best practices, including infill development for affordable housing.

Senate Bill 22-159 Revolving Loan Fund Invest Affordable Housing creates the transformational affordable housing revolving loan fund program. The loan program provides flexible, low-interest, and below-market rate loan funding to assist eligible recipients in completing the eligible loan projects identified in the bill. The program can include financing for energy improvements in affordable housing, which will fund incremental up-front costs for efficient, electric measures, and renewable energy systems for both existing buildings and new housing construction.

House Bill 22-1282 The Innovative Housing Incentive Program creates a program in the Office of Economic Development to provide grants or loans to new or existing businesses with fewer than 500 employees that develop manufactured homes. The program may include incentives for installation in certain areas of the state, resiliency criteria, compliance with international energy conservation code requirements, or energy efficiency requirements, such as pre-wiring for solar improvements, home energy rating system score of fifty or less, and near net-zero energy efficiency.

Senate Bill 22-239 Buildings In The Capitol Complex creates the Capitol Complex Renovation Fund for construction needs in existing state-owned facilities, including installation of electric vehicle charging stations and LEED certification for specified state-owned buildings.

Solutions for 100% Renewable Energy by 2040

House Bill 22-1381 Colorado Energy Office Geothermal Energy Grant Program incentivizes the expansion of Colorado's use of geothermal energy by providing grants to start programs supporting geothermal for electricity generation, space heating and cooling, water heating and district heating. The program will support the development of geothermal space conditioning (i.e. heating and cooling) and water heating, as

well as public-private partnerships on the development of geothermal electricity generation — either as a stand-alone or paired with electrolyzers for the production of green hydrogen.

Senate Bill 22-118 Encourage Geothermal Energy Use creates a program for basic consumer education and guidance for systems that use geothermal energy for water heating,space heating or cooling. The bill also establishes a business model for community geothermal gardens, comparable to community solar gardens.

Resilience in our communities

Senate Bill 22-206 Disaster Preparedness And Recovery Resources aims to strengthen communities affected by natural and climate disasters, and incentivizes coordinated statewide planning on climate change preparedness. Elements include:

- A program to help homeowners and businesses rebuild more efficiently after declared natural disasters. A $20 million pool is being established to deliver a combination of low-interest loans and grant opportunities to cover costs associated with building high-performing, energy-efficient and resilient homes and structures. These include the installation of high-efficiency space and water heat pumps, work to net zero energy buildings,advanced energy certification, or assistance in adding battery storage or an electric vehicle charging station.
- The establishment of the Governor's Office of Climate Preparedness. This office will not only increase capacity for recovery efforts, but will also support a climate-prepared future, starting with the development of the climate preparedness roadmap, which will enable the state to anticipate the needs in the event climate-related crises and will encourage land use patterns that reduce both greenhouse gas emissions and exposure to climate driven hazards, such as wildfires and floods.

House Bill 22-1249 Electric Grid Resilience And Reliability Roadmap commissions a grid resilience and reliability roadmap to develop a statewide strategy on the use of microgrids to harden the grid, improve grid resilience and reliability, deliver electricity where extending distribution infrastructure may not be practical, and operate autonomously and independently of the grid, when necessary.

House Bill 22-1013 Microgrids For Community Resilience Grant Program creates the microgrids for a community resilience grant program with $3.5 million in funding for initial projects. A cooperative electric association or a municipally owned utility may apply for a grant award to finance the purchase of microgrid resources in eligible rural communities within the utility's service territory that are at significant risk of severe weather or natural disaster events, and in which there are one or more community anchor institutions.

Senate Bill 22-185 Security For Colorado Seniors extends the grant program indefinitely to continue the support of projects promoting the health, equity, well-being and security of older Coloradans across the state. It includes coordination with the Colorado Energy Office on incentives and potential investments that align with the greenhouse gas emissions goals described in statute to increase energy efficiency and renewable electricity in buildings used by older Coloradans and increase the use of electric vehicles for transporting older Coloradans.

Emissions from transportation and expanding public transit:

Senate Bill 22-180 Programs To Reduce Ozone Through Increased Transit creates a $28 million grant program that enables transit agencies statewide to provide free transit fares for at least a month during ozone season for two years. Vehicles are the largest single source of nitrogen oxide pollution, a key contributor to the formation of ozone, as well as the largest source of greenhouse gas pollution. The bill also provides $30 million for a three-year Colorado Department of Transportation pilot project that expands existing transit services along the interstates, and $10 million to support bicycle, pedestrian and transit improvements to main streets.

House Bill 22-1026 Alternative Transportation Options Tax Credit eliminates the current corporate income tax deduction for expenses incurred providing alternative means of transportation for employees, and replaces this deduction with a refundable tax credit equal to 50 percent of expenditures incurred by providing alternative transportation options to their employees beginning in 2023. Alternative transportation includes free or partially subsidized mass transit; free or partially subsidized ridesharing arrangements, including bike sharing and electric scooter sharing programs; provision of ridesharing vans; and guaranteed ride home programs. Expanding employer-based programs to reduce vehicle travel is a near term action strategy in the state GHG roadmap.

House Bill 22-1028 Statewide Regulation Of Controlled Intersections establishes uniform statewide requirements that allow bicycles, electric-assisted bicycles, electric scooters, and other non-motorized vehicles to make safety stops at intersections throughout the state, and reduces the maximum allowable speed of a safety stop to 10 miles per hour. The bill also requires the Department of Transportation (CDOT), in collaboration with other agencies and non-government entities, to develop educational materials concerning legal requirements and safe practices for approaching controlled intersections. One indirect benefit of this legislation may be an increased use of bicycles for commuting, decreasing motor vehicle use and associated energy use and emissions.

House Bill 22-1104 Powerline Trails authorizes transmission providers to enter into contracts with public and private entities to construct and maintain powerline trails in an existing or future transmission corridor. One indirect benefit of this legislation may be an increased use of bicycles for commuting, decreasing motor vehicle use and associated energy use and emissions.

Climate-smart investments in forestry

House Bill 22-1012 Wildfire Mitigation and Recovery directs the Colorado State Forest Service to create a carbon accounting framework and train practitioners in carbon-adaptive practices in forest management. The bill also includes $7.2 million in general funds to support wildfire mitigation programs in the Colorado State Forest Service and the Department of Natural Resources.

House Bill 22-1379 Wildfire Prevention Watershed Restoration Funding invests $20 million in American Rescue Plan Act funding to increase Colorado's capacity to enhance wildfire mitigation. This is necessary for reducing the risk of catastrophic wildfires and promoting faster watershed recovery to protect watershed health and replant burn scars. HB22-1379 includes $5M for DNR to offer assistance to communities/NGOs in

the pursuit of federal funds for water projects. It is our intent to prioritize assistance for disproportionately impacted communities.

House Bill 22-1323 Updates to the State Forest Tree Nursery provides $5 million for improvements to the Colorado State Forest Service's tree nursery to substantially increase its capacity to provide low-cost, native and climate-adapted trees; to build climate-resilient watersheds and forests; and to enhance carbon storage to meet the state's climate mitigation goals.

Reducing water consumption

House Bill 22-1151 Turf Replacement Program directs the Colorado Water Conservation board to provide state matching funds for turf replacement programs to promote water-wise landscaping.

Just transition for workers and communities away from the use of coal

House Bill 22-1193 Adjustments to expenditures from funds dedicated to assisting those impacted by the transition to a clean energy economy transfers $2 million in previously appropriated funds from worker assistance programs to community assistance efforts to ensure more timely, efficient and effective use of Just Transition funding.

House Bill 22-1394 Fund Just Transition community and worker supports provides $15 million to Just Transition Cash Fund this includes $5 million for implementation of the Colorado Just Transition Action Plan and support for coal transition communities and $10 million to the Coal Transition Workforce Assistance Program Account to support worker assistance programs.

COLORADO
Energy Office

Colorado Energy Office | 2023 Legislative Session Snapshot | June 2023

The Colorado General Assembly passed 25 bills during the 2023 Colorado legislative session to advance environmental justice, climate, and clean energy goals. This included roughly $120 million a year of investment in clean energy tax credits for electric vehicles, e-bikes, heat pumps, industrial decarbonization, clean hydrogen, electric lawn and garden equipment, sustainable aviation fuel, and geothermal energy. Other bills focused on reducing energy use in buildings, supporting emerging technologies, renewable energy, community resilience, transportation, and just transition.

These bills continue making progress on implementing Colorado's Greenhouse Gas Pollution Reduction Roadmap, which is the state's strategic plan to achieve the statutory greenhouse gas (GHG) pollution reduction goals of 50% from economy-wide emissions by 2030, and 90% by 2050, below 2005 levels. The Roadmap is a sector-based plan with strategies to achieve at least an 80% GHG emissions reduction from electricity generation by 2030, a 60% reduction from oil and gas development, a 40% reduction from transportation, and a 20% reduction from both the industry and buildings sectors. This year's legislative package makes major progress on all of these goals, including providing public investments in market transformation, incentives for electric and gas utilities, and regulatory requirements to be implemented through the Public Utilities Commission (PUC), Transportation Commission, and Air Quality Control Commission (AQCC).

Environment, climate & air quality (broadly)

House Bill 23-1272 Tax Policy That Advances Decarbonization: This bill creates tax credits for electric vehicles, electric trucks and buses, electric bicycles, air source and ground source heat pumps, sustainable aviation fuels, and industrial decarbonization. The bill also provides support for geothermal electricity through an investment tax credit for exploration, drilling, and development of new wells; investments in geothermal electricity production; and production tax credits. The industrial tax credits build on one-time funding for industrial clean air grants. The Energy Office will competitively allocate industrial tax credits to projects based on the level of expected GHG emissions reductions, co-benefits in disproportionately impacted communities and the nonattainment area, and advancement of innovative technology. These tax credits are an important tool to achieve deep GHG reductions from industry that go beyond the 20% reduction expected from regulation. This will help to advance important technologies like industrial electrification, thermal energy storage, CCUS, and replacement of fossil fuels with clean hydrogen.

House Bill 23-1210 Carbon Management: This bill directs the Colorado Energy Office to develop a carbon management roadmap. It specifies guidelines, including sectors to study and stakeholders to consult, and requires CEO to make recommendations on policies for carbon management. CEO must present the carbon management roadmap to the General Assembly before the start of the 2025 legislative session. It also makes carbon management projects eligible for industrial clean air grants.

Senate Bill 23-016 Greenhouse Gas Emission Reduction Measures: This bill updates the state's greenhouse gas reduction targets by changing the 2050 target from 90% reduction to net zero emissions and adding interim targets of 65% by 2035, 75% by 2040, and 90% by 2045. For the years 2024 to 2026, this bill creates a 30% income tax credit for new electric powered lawn and garden equipment. The bill also authorizes the Colorado Oil and Gas Conservation Commission (COGCC)to seek state primacy for regulation of class 6 carbon dioxide injection wells, revises the duties of the Colorado Energy Office, creates new rules governing utility interconnection of distributed generation, and expands the powers of the Colorado Electric Transmission Authority.

Senate Bill 23-285 Energy And Carbon Management Regulation In Colorado: This changes the name and mission of the Colorado Oil and Gas Conservation Commission (COGCC) to the Energy and Carbon Management Commission and broadens the Commission's regulatory authority to include the regulation of deep geothermal resource operations and intrastate underground natural gas storage facilities. This will facilitate the development of geothermal electric generation, complementing the investment and production tax credits in HB 23-1272. The bill also directs a study of hydrogen pipelines and hydrogen storage.

Emissions from the built environment

House Bill 23-1005 New Energy Improvement Program Changes: Through the property assessed clean energy program (C-PACE), owners of eligible real property can apply to Colorado's new energy improvement district to finance a variety of energy efficiency improvements. The bill expands eligibility of the C-PACE program to allow financing for resiliency and water efficiency improvements.

House Bill 23-1161 Environmental Standards for Appliances: The bill expands the list of appliances subject to statutory Water and Energy Efficiency Standards. It requires the Colorado Department of Public Health and Environment (CDPHE) to update the list according to standards that exist in at least three other states or are published by the Energy Star or WaterSense programs, and to promulgate other rules as necessary every five years, beginning January 1, 2026. The bill phases in prohibitions on the sale of certain fluorescent lights and heating appliances. It also sets NOx emission standards for fossil fuel fired heating appliances. CDPHE's Air Quality Control Commission is required to lower these emission limits by 2029. The bill requires CDPHE to verify compliance, report findings to the General Assembly, and deliver any violation findings to the Attorney General.

House Bill 23-1233 Electric Vehicle Charging and Parking Requirements: The most important element of this bill is a requirement for the state electrical board to adopt the multifamily EV pre-wiring requirements created by the Energy Code Board. This will accelerate the implementation of these standards statewide by 2024, rather than over several years as local governments update their building codes. This change is important to ensure new multifamily housing is built with low-cost prewiring for EV charging infrastructure in parking areas to increase affordable access to EV charging for future residents of multifamily buildings. The bill also prohibits unreasonable restrictions on EV parking, and provides a temporary reduction in certain property taxes on EV

charging. This bill was also amended to include a streamlined definition of disproportionately impacted community, as drafted by the Environmental Justice Task Force, ensuring that one definition exists throughout all of Colorado's statutes.

Renewable Energy and utilities

House Bill 23-1234 Streamline Solar Permitting and Inspection Grants: The bill invests $1 million into a streamlined solar permitting and inspection grant program. The program will grant money to local governments to implement free automated permitting and inspection software.

House Bill 23-1252 Thermal Energy: As part of implementing the state's GHG Roadmap, Colorado adopted a goal of reducing greenhouse gas emissions from gas utilities 22% by 2030. This bill creates a regulatory pathway for gas utilities to develop thermal energy networks, such as geo-exchange district heating. Specifically, this will pave the way for public utilities regulated by the Public Utilities Commission to develop, construct, and operate these networks, allowing them to transition from gas utilities to thermal utilities.

House Bill 23-1039 Electric Resource Adequacy Reporting: The bill requires each load-serving entity in the state, or its designated wholesale electric supplier, to create a resource adequacy annual report by April 1 each year, beginning in 2024. The reports must be published online and delivered to the entity's regulatory oversight entity, which in turn must submit them to the Colorado Energy Office by April 30. Finally, the Colorado Energy Office must compile the reports received and publish a statewide resource adequacy aggregate annual report each year by July 1.

House Bill 23-1281 Advance The Use Of Clean Hydrogen: This legislation puts in place a regulatory framework to support the development of a clean hydrogen economy in Colorado and bolster the Western Interstate Hydrogen Hub application, a four-state coalition application to the U.S. Department of Energy. This framework aims to help secure $600 million in federal funding for the hydrogen hub by defining clean hydrogen; creating market pull by incentivizing the use of clean hydrogen in hard-to-electrify sectors where it has the greatest climate benefits; and developing a process for the utilities that are part of the hydrogen hub application to seek Public Utilities Commission approval for investments supporting the hub.

Senate Bill 23-198 Clean Energy Plans: This bill updates Colorado's Clean Energy Policy framework, expands the applicability of Clean Energy Plans, and requires verification and enforcement of the plans. For a Clean Energy Plan submitted on or after July 1, 2023, the submitting entity must base its greenhouse gas emission calculations on the resources it uses to supply electricity to its customers and the resources it owns that are not otherwise required to be included in another entity's Clean Energy Plan. As long as certain reliability and cost considerations are satisfied, any plan submitted on or after January 1, 2024 must achieve a 46 percent reduction in greenhouse gas emissions and an 80 percent reduction by 2030 compared to 2005 baseline emissions. By June 1, 2028, CDPHE must calculate the percentage reduction in greenhouse gas emissions from electricity sales for each entity from 2005 to 2027 and evaluate whether the entity is on track to achieve an 80 percent reduction by 2030.

Senate Bill 23-092 Agricultural Producers Use Of Agrivoltaics: Authorizes the Agricultural Drought and Climate Resilience Office (ADCRO) within the Colorado Department of Agriculture (CDA) to award grants, and allows the Commissioner to make rules regarding recommendations from subsequent studies. Requires the CDA to oversee a task force that will complete feasibility studies on the use of agrivoltaics and dry digesters to reduce greenhouse gas emissions in Colorado and present its findings to the legislature by October 2024 and February 15, 2024, respectively. Includes additional technical changes and requires the Colorado Water Conservation Board (CWCB) to complete a study on the use of aquavoltaics in Colorado. Exempts qualified machinery from property tax and exempts qualified machinery from special fuel tax if renewable or biodiesel equals at least 5% of the blend. Appropriates $4 million to the CDA to issue grants.

Senate Bill 23-291 Utility Regulation: The bill makes a number of changes to how utilities set rates and recover costs from consumers. It also commissions two studies and directs the Public Utilities Commission (PUC) in the Department of Regulatory Agencies (DORA) to adopt rules. The PUC must establish rules to limit the amount of rate case expenses that an investor-owned or gas utility may recover from ratepayers. Utilities must submit a rate trend report showing the previous ten years of rate changes when filing a request to increase rates. Utilities must also keep the rate trend report data updated on their websites. When a utility files a gas cost adjusting filing or an electric commodity adjustment filing, it must provide copies of all confidential materials to the PUC and the Office of the Utility Consumer Advocate (UCA). The bill limits certain costs that utilities may recover from ratepayers.

The bill has a major focus on reducing consumer's exposure to the impacts of volatile gas commodity prices. Investor-owned gas utilities must file a gas price risk management plan with the PUC by November 1, 2023. The plan must include proposals for reducing the volatility of fuel costs that are recovered pursuant to an annual gas cost adjustment filing and a maximum per-month fuel cost. When submitting a gas infrastructure plan, utilities must include additional information on system pipes. The Colorado Energy Office (CEO) must commission a study with an independent third party to evaluate the risk of stranded or underutilized natural gas infrastructure and its impact on ratepayers by July 1, 2024. CEO must submit the results to the PUC, which must consider updating rules or depreciation schedules as determined by the study. The bill also prohibits line extension allowances and requires measures to make it easier for customers who switch to all electric heating to disconnect from the gas system. It also requires the PUC to evaluate whether current tariffs and interconnection policies should be modified to better support beneficial electrification.

Senate Bill 23-292 Labor Requirements For Energy Sector Construction: The bill creates a category of public works projects called energy sector public works projects, which consist of projects that generate, transmit, or distribute electricity or natural gas or invest in clean energy, and are built by or for a public utility using ratepayer or public funding or are approved by a cooperative electric association. These projects must comply with the apprenticeship and prevailing wage requirements established by Senate Bill 19-196. The bill specifies the parameters by which projects must comply and exceptions to these requirements, which include projects

supported by federal funds and those that include a project labor agreement. The bill also applies these labor standards to certain other state projects. The PUC must adopt rules requiring utilities to provide information concerning “best value” employment metrics when submitting annual progress reports for electric resource acquisition. The PUC must then submit a summary report to the General Assembly by December 31 of each year, beginning in 2024.

House Bill 23-1137 Solar Garden Net Metering Credits Stabilization: The bill modifies how utility bill credits are calculated for community solar gardens that receive a net metering credit from a utility by permitting use of a fixed bill credit and specifying what charges and exclusion must be applied. Current law requires an electric retail utility to offer a net metering credit as the means of purchasing output from a community solar garden located within the utility's service territory and establishes the means of annually calculating the net metering credit.

Transportation and expanding public transit

House Bill 23-1101 Ozone Season Transit Grant Program Flexibility: This bill increases the flexibility of the Ozone Season Transit Grant program by allowing eligible transit agencies to use funds for zero-fare transit when ozone levels in the area are the highest, rather than just during the previously mandated period of June 1 to August 31. It also provides flexibility in awarding grant amounts to transit associations or to the regional transportation districts. Specifically, if less than the applicable maximum amount allowed by law is awarded to an agency in a given year, then the maximum amount of such a grant the following year can be increased by an amount equal to that total.

Senate Bill 23-236 Electric Vehicle Service Equipment Fund: The bill creates the Electric Vehicle Service Equipment Cash Fund for use by the Department of Military and Veterans Affairs (DMVA). The DMVA is authorized to spend money from the fund to defray the costs associated with operating electric vehicle services equipment. Money received by the DMVA from charges imposed on use of electric vehicle service equipment at facilities operated by the department must be credited to the fund, as well as any gifts, grants, donations, or other appropriations or transfers to the fund by the General Assembly. Currently, the Colorado National Guard, under the DMVA is allowed to pull down federal funding to install charging stations throughout the state. This is part of the Army's effort to make all non-tactical vehicles electric by 2035. Previously, these stations could only be used by the DMVA fleet. The creation and operation of this new fund will allow DMVA to charge the federal government, military, and civilians for using these EV charging stations to recoup costs. This effectively opens these stations up to the public. Thus, public charging stations are now available on military installations and DMVA facilities around the state that were built using federal dollars.

Climate-smart investments in forestry and wildfire resilience

House Bill 23-1060 Update to State Forest Service Tree Nursery: The bill requires the Colorado State Forest Service to make certain upgrades and improvements to its seedling tree nursery in order to expand its capacity and its ability to contribute to reforestation efforts in the state. The

general assembly is required to appropriate money to the Colorado State University system for the 2023-24 state fiscal year for allocation to the State Forest Service.

Senate Bill 23-166 Establishment Of A Wildfire Resiliency Code Board: The bill establishes a wildfire resiliency code board in the division of fire prevention and control within the department of public safety (department) for the purposes of ensuring community safety from and more resiliency to wildfires by reducing the risk of wildfires to people and property through the adoption of statewide codes and standards. The board will develop model codes that will serve as minimum requirements for local building and fire codes in areas within the wildland-urban interface.

Senate Bill 23-005 Forestry and Wildfire Mitigation Workforce: Concerning measures to expand the forestry workforce, and, in connection therewith, directing the Colorado state forest service to develop educational materials for high school students about career opportunities in forestry and wildfire mitigation; creating a timber, forest health, and wildfire mitigation industries workforce development program to help fund internships in those industries; allocating general fund money to the wildfire mitigation capacity development fund; authorizing the expansion and creation of forestry programs; directing the state board for community colleges and occupational education to administer a program to recruit wildland fire prevention and mitigation educators; and making an appropriation.

House Bill 23-1075 Wildfire Evacuation And Clearance Time Modeling: The bill requires the office of emergency management to study the efficacy and feasibility of local or interjurisdictional emergency management agencies with jurisdiction in a wildfire risk area to integrate evacuation and clearance time modeling into the emergency management plans that such an agency is required to adopt for its area. The report must be completed on or before December 1, 2023, and the office must report the findings of the study to specific committees of the general assembly during the 2024 legislative session.

Just transition for workers and communities

House Bill 23-1074 Study Workforce Transitions To Other Industries: The Office of the Future of Work will contract for a study exploring workforce transitions for oil and gas workers and workers impacted by automation. The study includes an evaluation of transferable and non-transferable skills, identification of existing and emerging industries for job transferability, assessment of how technology is impacting workers and which occupations are facing the most disruption due to automation, and identification of barriers for workers and ways to remove those barriers. The study will also develop policy and incentive proposals for programs transitioning workers to existing and emerging industries.

House Bill 23-1247 Assess Advanced Energy Solutions in Rural Colorado: This bill requires the State to conduct studies to assess the use of advanced energy solutions such as geothermal, clean hydrogen, gas with carbon capture, long duration storage, renewables coupled with storage, advanced nuclear and new transmission in rural Colorado. One study must consider ways to assist northwestern and western Montrose County as it transitions to producing advanced new clean

energy resources. The other study must consider the potential for the development of new energy resources in southeastern Colorado. All studies must assess the effects of various resources on electricity costs and on disproportionately impacted communities.

Senate Bill 23-283 Mechanisms for Federal Infrastructure Funding: Adds $84 million to the state's existing Infrastructure Investment and Jobs Act (IIJA) cash fund and also allows Colorado communities to use money from the fund for planning and grant matching for federal Inflation Reduction Act (IRA) grant applications. This bill is not specific to transition communities, but as many IRA and IIJA grant opportunities are dedicated to energy communities, this can assist transition communities.

Appendix E: 2022 and 2023 Regulatory Actions

This section includes a summary of regulations recently adopted by the Air Quality Control Commission. Commission regulations, meeting materials, and additional information are available at the Commission's website. Additional details on regulatory actions taken by the Commission may be found in the Reports to the Public, required per C.R.S. § 25-7-105 (5), for fiscal years 2021-2022 and 2022-2023.

Recovered Methane

SB21-264 directed the Commission to adopt rules concerning recovered methane protocols no later than February 1, 2023. The rule was adopted by the Commission in November 2022. The protocols address recovered methane projects in the areas of manure management systems, municipal solid waste/landfills, wastewater treatment, coal mines, and leak reductions in gas utilities' delivery systems. The rule also establishes a recovered methane crediting and tracking system for the GHG reductions achieved through these projects, finalized by the Division in October 2023. The system allows GHG reduction credits from recovered methane projects to be registered and tracked for use in clean heat plans for gas distribution utilities, municipal gas distribution utilities, or small gas distribution utilities. The credits must be generated pursuant to the relevant protocols outlined in Section I.C. of the recovered methane rule. The requirements for a gas distribution utility or recovered methane project developer/operator seeking issuance of credits to it in the Division's recovered methane crediting and tracking system

GHG Air Pollutant Emissions Notice Reporting

The Environmental Justice Act, HB21-1266, requires the inclusion of GHGs in the list of air pollutants required to be reported in an air pollutant emissions notice (APEN) and the setting of fees for GHG emissions. The Commission adopted GHG APEN reporting requirements in December 2022. The rule involved changes to Colorado Regulation 3, adding GHG emissions to the list of air pollutants that must be reported through APEN requirements. This established the necessary structure for the GHG fee rulemaking, discussed in the Upcoming Rulemakings section of this report.

Advanced Clean Trucks

In April 2023 the Commission adopted Advanced Clean Trucks (ACT) and Low NOx (Nitrogen Oxides) Omnibus rules, which take effect starting with model year 2027 vehicles and help ensure low- and zero-emission medium and heavy-duty trucks are available on the Colorado market. The Advanced Clean Truck rule requires manufacturers of medium- and heavy-duty vehicles to sell an increasing share of zero-emission vehicles over time, while the complementary Low NOx Omnibus rule strengthens the air pollution standards for the internal combustion engine vehicles that manufacturers sell. Transportation

Commercial Building Benchmarking and Performance Standards

As a result of HB21-1286, the Colorado Energy Office (CEO) developed a statewide benchmarking program that requires commercial, multifamily, and public buildings 50,000

square feet or larger to report their energy use annually on June 1. These reports provide building owners and tenants with information about how their building's energy performance compares to similar buildings and helps them identify opportunities to reduce energy waste that, in turn, reduces the costs of operating the building. Since the start of the program, CEO has received benchmarking reports from an estimated 60% of building owners covered by this program (as of December 1, 2023).

HB21-1286 also requires covered buildings to collectively achieve GHG emission reductions of 7% by 2026 and 20% by 2030, from a 2021 energy data baseline. CEO collaborated with the Division to write the rules that the Commission adopted in August 2023, which took effect in October 2023. CEO and the Division incorporated recommendations from the Building Performance Standards (BPS) Task Force, a diverse group of stakeholders convened to advise CEO on the development and implementation of benchmarking and building performance standards, into the rule. These rules provide three flexible compliance pathways for building owners to decrease their energy use and GHG emissions. The state anticipates these building performance standards will reduce energy bills for tenants and long-term operating costs for building owners.

CEO will lead the program's implementation, with the Division leading the enforcement process. CEO is currently notifying building owners of these new requirements and developing resources to assist owners in implementing energy and cost savings projects. CEO is also conducting stakeholder engagement with building owners regarding the BPS draft guidance, and will also offer webinars and office hours to support building owners over the next few months.

Colorado Clean Cars

In October 2023 the Commission adopted the Colorado Clean Cars standard. The standard directs vehicle manufacturers to ensure 82% of new light duty vehicles sold in Colorado are electric by model year 2032. This will support Colorado's goal of nearly one million electric vehicles on the road in Colorado by 2030. The adopted rule also includes a directive for the Division to revisit the rule in 2028 to determine whether to extend it beyond model year 2032.

Midstream Oil and Gas Fuel Combustion Equipment

In July 2023 the Commission adopted a new GHG intensity verification rule. The GHG intensity program applies to upstream oil and gas operations, which are also known as "well sites" or "production" facilities. The program includes two main parts: the new verification rule and GHG intensity standards. The new verification rule will ensure facilities adhere to the GHG intensity standards adopted in 2021. The standards become more protective over time in accordance with the 2021 Colorado Greenhouse Gas Pollution Reduction Roadmap, which calls for the oil and gas industry to achieve a 36% reduction in GHGs by 2025 and a 60% reduction by 2030.

The Division has also convened the Midstream Steering Committee (MSC) as required in Regulation Number 7, Part B, Section VII. The MSC convened at least monthly meetings to plan reductions of GHGs from midstream oil and gas fuel combustion equipment (i.e., engines, turbines, heaters, boilers, and reboilers). The MSC published a final guidance document and workbooks in March 2023 to guide each midstream operator in the development of their

company-specific emission reduction plans that are due to the Division by the end of September 2023. Operators are using that guidance to develop company specific emission reduction plans which were due to the Division by September 2023. Based on those company-specific plans, the MSC will develop a segment-wide emission reduction plan to be delivered to the Division by March 2024.

GHG Emissions and Energy Management and Audit Program for Manufacturing

HB21-1266, which codified the GHG roadmap sectoral target for the industrial sector, requires the Commission to adopt rules that achieve a 20% GHG emissions reduction across the industrial sector by 2030 relative to 2015 levels. To achieve this, specific industrial and manufacturing facilities will be subject to reduction requirements established in a phase two GHG Emissions and Energy Management for Manufacturers (GEMM) rulemaking.

In September 2023, the Commission adopted a first-of-its-kind rule to reduce industrial air pollution in local communities and GHG emissions from manufacturers. GEMM 2 aims to ensure that 18 of Colorado's highest-emitting manufacturers collectively reduce their GHG emissions 20% by 2030, compared to 2015 levels. These manufacturers emit air pollutants when producing a wide range of products, including petrochemicals, microchips, and glass. GEMM 2 covers facilities with manufacturing operations that emit 25,000 or more metric tons of GHGs per year. GEMM 2 builds upon the progress of the existing GEMM rule – GEMM 1.

GEMM 2 includes measures to protect disproportionately impacted communities.These include communities overburdened by multiple pollution sources, communities of color, and low-income communities. Facilities located within one-mile of a disproportionately impacted community must take extra steps to prioritize GHG reduction measures that also reduce the greatest amount of co-pollutants. The division worked with a diverse array of stakeholders to ensure the rule achieves the intent of the Colorado Environmental Justice Act by prioritizing air pollution reductions in local communities near the facilities covered under GEMM 2. The division incorporated input through a year and a half long public participation process and over 100 hours of stakeholder meetings.

In addition to reducing future emissions, the GEMM 2 rule ensures any emissions reductions that covered facilities already made from 2015 to the present stay in place. The state's economic analysis found that these reductions will result in over $460 million in economic benefits through 2050. Benefits include:

- Over $950 million from the avoided cost of climate change resulting from GHG emissions.
- Over $170 million from health benefits of avoiding emissions of co-pollutants.

GEMM 2 also provides significant short-term economic benefits. From 2024 to 2030, the rule will yield $24 million from the avoided cost of climate change and health benefits.

Appendix F: Upcoming Rulemakings

Ozone Planning

In December 2023 the Commission will consider revisions addressing the Clean Air Act Ozone Nonattainment requirements for the 2008 and/or 2015 Ozone National Ambient Air Quality Standards (NAAQS) along with proposed revisions to associated regulations to reduce the emissions of ozone forming pollutants. This rulemaking will also support the Division in meeting the Governor's March 2023 directive to develop rules by the end of 2024 that require upstream oil and gas operators in the ozone nonattainment area to achieve at least a 30% reduction of nitrogen oxides (NOx) during the ozone season in 2025 and at least 50% in 2030. It is likely that actions taken to reduce NOx emissions will deliver broad environmental and public health benefits, including GHG emissions reduction benefits.

GHG Fee Rulemaking Reporting and Permitting Requirements

The Environmental Justice Act, HB21-1266, also requires the inclusion of GHGs in the list of air pollutants required to be reported in an air pollutant emissions notice (APEN) and the setting of fees for GHG emissions. In October 2023 the Division proposed a rule to establish GHG emissions fees, as required by HB21-1266. The proposed rule would require regulated sources to pay fees based on their GHG emissions. GHG fees would be used to fund staff and other costs associated with the Division's Climate Change Program. This includes things like developing emissions inventories, researching emerging technologies, providing expanded stakeholder outreach, expanding the Division's capacity to quickly respond to and better understand public health issues related to air toxics exposure, responding to community complaints, and more. The Commission will consider the proposal in February 2024. In August 2022 the Commission will consider revisions to Regulation Number 3 to establish GHG emissions reporting, set emission fees, and clarify permitting requirements, in response to the act.

Emissions Reductions from Oil and Gas Sources

As discussed in the Regulatory Actions section of this report, the Mistream Steering Committee (MSC) continues to meet regularly. Currently, the MSC is using the company emission reduction plans and other gathered data to develop a midstream segment-wide emission reduction plan to propose to the Division in March 2024. The Air Pollution Control Division will subsequently create a regulatory proposal addressing midstream fuel combustion emissions for a Commission rulemaking in mid-to-late 2024. The MSC's segment emission reduction plan will ensure and prioritize GHG emission reductions with co-benefits (i.e., hazardous air pollutant and criteria pollutant reductions) in disproportionately impacted communities.