The Electricity Journal 35 (2022) 107107

Contents lists available at ScienceDirect

The Electricity Journal

journal homepage: www.elsevier.com/locate/tej

Colorado clean energy policy landscape: A case study

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ARTICLE INFO

Keywords:
Energy transition
Clean energy policy
Climate change policy

ABSTRACT

For decades, countries, states, and municipalities have established energy policies to address local air pollution and global climate change goals. The thousands of policies and measures enacted globally take various forms but are aimed at different sectors of the economy. These policies are the result of a complicated process of analysis, budgeting, management, and politics. Still, greenhouse gas emissions have continued to rise globally. Good models remain rare that bridge the gap between high level aspirations and implementation. The U.S. state of Colorado offers an example over the last two years for bridging the aspiration and implementation gap. This paper provides an overview of the recent legislative sessions, and how the policies enacted support the Colorado Climate Change Roadmap.

1. Introduction

According to the International Panel on Climate Change (IPCC), the greenhouse gas emissions generated on a global scale break down by economic sector as follows: Electricity and Heat Production (25%), Agriculture, Forestry and Other Land Use (24%), Industry (21%), Transportation (14%), Other Energy (10%), and Buildings (6%) (IPCC, 2014). Since energy is encompassed in each of these sectors, there is significant potential for reducing greenhouse gases and local air pollution through clean energy solutions across all of them. Clean energy solutions are those which reduce greenhouse gases at the point of generation, such as renewable energy sources (e.g., solar, wind, hydro, marine) and nuclear power. Energy efficiency and demand response programs also offer emissions reductions, especially in the built environment.

Incorporating greenhouse gas reduction through these energy efficiency, demand response, and clean energy goals into models and national policy has been increasingly important, over the last few decades. The International Energy Agency (IEA) World Energy Outlook (WEO) provides an overview of policies and measures considered in various scenarios, providing policy indicators for decarbonization goals and milestones. The WEO provides an overview of clean energy incorporation, building and industrial sector policies and measures, and transportation. According to the IEA, "the growth of modern renewables has outpaced the rate of increase of energy consumption, allowing for an increase in modern renewables' share of total final energy consumption, reaching almost 11% in 2018″ (IEA, 2020). The scenarios used in the WEO indicate a growth of 15% by 2030 (IEA, 2020).

The World Bank's Energy Sector Management Assistance Program (ESMAP) tracks progress and compares national policy and regulatory frameworks for sustainable energy implementation, including renewable energy. According to the ESMAP, by 2019 one third of the world's countries had developed legal frameworks to enable renewable energy policies (ESMAP, 2020). The indicators used to track progress include legal frameworks for renewable energy, carbon pricing and monitoring, counterparty risk, network connection and use, attributes of financial and regulatory incentives, planning for renewable energy expansion, and incentives and regulatory support for renewable energy.

As of 2021, at least 67 countries have incorporated some type of renewable energy policy. The proposed American Renewable Energy Act of 2021 would establish a renewable energy standard to achieve 20% renewable energy implementation in 2021 and gradually increases to 70% by 2030 (American Renewable Energy Act, 2021). Many policies focus on percentage of electricity production, including primary energy supply and installed capacity. As of 2020, roughly 80% of the United States' energy was sourced from fossil fuels, 12% from renewable energy, and 8% from nuclear energy sources (Center for Sustainable Systems, 2021). Many of the goals established across the world align with the IPCC greenhouse gas emissions reductions of 25–40% by 2020 and are being updated to reflect more rigorous goals beyond 2020 and address generation source emissions through policies, such as those related to renewable or clean energy.

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https://doi.org/10.1016/j.tej.2022.107107
Received 13 February 2022; Accepted 7 March 2022
Available online 11 March 2022

On January 20, 2021, the United States rejoined the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement (UNFCC, 2015). Four months later, the White House announced a new target for the United States to achieve a 50% reduction in greenhouse gas emissions (White House, April 2021). Total 2019 greenhouse gas emissions reported by the U.S. Environmental Protection Agency (EPA) indicated electricity, industry, and commercial and residential buildings comprised the majority of emissions at nearly 60%, with transportation contributing another 29% (U.S. EPA, 2021). In April 2021, the United States set a goal to reach 100% carbon-pollution-free electricity by 2035 (White House, April 2021). Individual states have followed suit and have been passing legislation tackling greenhouse gas emissions in the energy and transportation sector. As of December 2021, 22 states and Puerto Rico had developed 100% clean energy goals. Colorado was one of these states, creating a law in 2019 to have 100% carbon-free electricity through the major utility by 2050 (SB 19–236, 2019).

Clean energy policies have different components throughout the United States. Some policies include incorporating renewable portfolio standard (RPS) requirements for achieving a percentage of renewable energy, or a clean energy standard, which includes renewable energy goals as well as carbon-free technologies, such as nuclear power. Thirty states have renewable energy or clean energy requirements, with three additional states having voluntary renewable energy goals (Cleveland and Shields, 2021). Seven states have lapsed RPS targets since 2018, and four other states have targets that expire in 2021. At a time when RPS goals are being retired or amended, Colorado's RPS targets are setting the stage for more rigorous greenhouse gas reductions, going beyond just energy generation.

2. Colorado's energy legislation

In the past decade, deployment of clean energy technologies has increased on a global scale due predominantly to policies that address economic and technical barriers. However, according to Renewable Energy Policy Network for the 21st Century (REN21), "the focus of policies and targets continued to be on the power sector, with policies for the heating and cooling and transport sectors advancing at a much slower pace" (REN21, 2019). Colorado's energy policies addressing climate change are no different and address the emissions from these sectors.

The target for reductions in emissions in Colorado by 2030 is 70 million metric tons (MMT) of carbon dioxide equivalent (CO_2e). The strategies in the Roadmap are targeting reductions including 32 MMT from electricity, 12.7 MMT from transportation (3.25), 12 MMT from oil and gas, 4.7 MMT from buildings and industrial fuel use, and 7 MMT from reduced methane emissions as a result of closing coal mines, as shown in Fig. 2 (Colorado Energy Office, 2021). In 2019, Colorado passed a total of 14 energy related bills in the categories of energy efficiency, electric vehicles, and climate/utility policy. Over 30 bills were passed in the 2021 Colorado legislative session within the categories of better buildings, financing for energy efficiency and clean energy, transportation, renewable energy measures, climate education; and environmental justice, climate, and a just transition. There wasn't a significant difference between the 2019 and 2021 state legislatures in terms of the ratio of Republicans and Democrats, and yet the number of energy related bills doubled in that timeframe. In January 2019, the Colorado State Senate comprised 19 Democrats and 16 Republicans, for a total of 35 state senators, with the Colorado House of Representatives comprising 41 Democrats and 24 Republicans, for a total of 65 representatives (Colorado General Assembly, 2019). As of January 2021, the Senate had 20 Democrats and 15 Republicans, while the House of Representatives had 41 Democrats and 24 Republicans (Colorado General Assembly, 2021). This illustrates Colorado's significant and nonpartisan contributions in the climate and clean energy legislation as the nation moves to decarbonize, and an example of potential opportunities for replication in other states across the U.S.

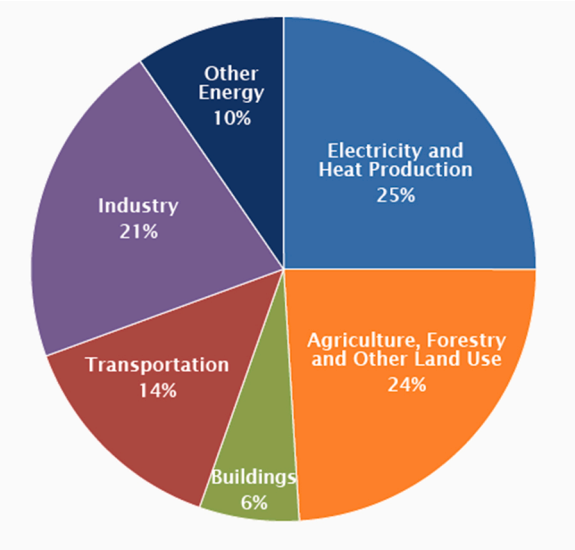

Fig. 1. Global Greenhouse Gas Emissions by Economic Sector. Source: Edenhofer, 2015.

Colorado Governor Jared Polis campaigned on a platform that included a goal for the state to reach 100% renewable electricity by 2040. As a state with a predominantly coal-based electric grid, this was a lofty goal. Since Governor Polis took office, the state has worked with its electric utilities to commit to reducing greenhouse gas emissions by at least 80% by 2030, all while maintaining reliability and saving money for customers (Colorado Energy Office, 2021). During the 2019 legislative session, House Bill 19–1261, dubbed the Climate Action Plan (2019), passed, establishing targets for reducing greenhouse gas emissions 26% by 2025, 50% by 2030, and 90% by 2050 from 2005 levels, and giving a broad grant of authority to state air regulators to adopt rules to reduce greenhouse gas (GHG) pollution. To support reaching these goals, the Greenhouse Gas Pollution Reduction Roadmap (Roadmap) was developed, which outlines near term actions to achieve reductions based on Colorado's 2015 Greenhouse Gas inventory, with a primary focus on achieving the 2030 targets. The Roadmap was developed by Colorado state agencies with substantial public input and review by a technical advisory group, using updated datasets and models to establish a reference case, reduction scenarios based on state policies adopted in 2019, as well as the pathways to meet emissions targets established in House Bill 19–1261. The analysis determined the four largest emitting sectors: a) transportation; b) electricity generation; c) oil and gas production; and d) fuel use in residential, commercial, and industrial facilities, as shown in Fig. 3.

> In 2018, Democrats gained a trifecta in the state — the governorship and both houses of the legislature — for the first time since 2013. They promptly got busy passing a vast array of clean energy policies: reform of electric utilities, support for electric vehicles and charging infrastructure, new restrictions on oil and gas production. During this year's legislative session, Gov. Jared Polis released a comprehensive roadmap to 90% statewide reductions in greenhouse gas emissions by 2050 and the state legislature tackled clean buildings, industry, environmental justice, reform of state transportation agencies, reform of natural gas utilities, and on and on.
> *David Roberts, Volts podcast*

The Roadmap includes science-based analyses to support different actions for greenhouse gas reductions in each of these sectors and supports the targets established in HB19–1261, as shown in Fig. 2.

2.1. Implementing legislation

The Roadmap uses the modeled scenarios and related analyses to recommend regulatory and legislative measures to reduce emissions in

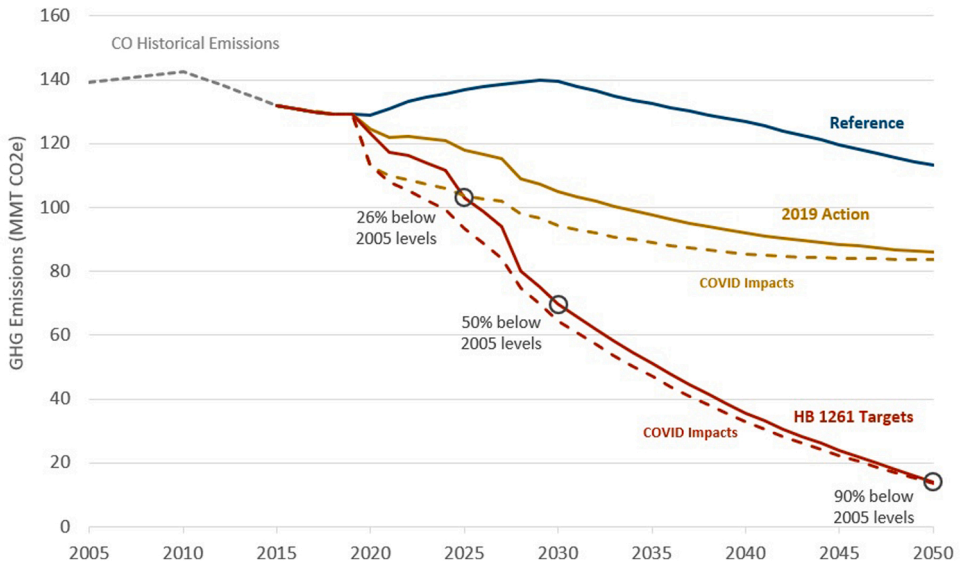

Fig. 2. Scenario Projections of Colorado's Potential GHG Emissions. Source: Colorado Greenhouse Gas Pollution Reduction Roadmap.

Fig. 3. 2020 Colorado State Greenhouse Gas Emissions (MMT CO_2e). Source: Colorado Greenhouse Gas Pollution Reduction Roadmap.

the different sectors (Fig. 1). Building on the near-term actions identified in the Roadmap, the 2021 legislative session focused on key areas to adopt policies that support deep decarbonization, namely energy efficiency and better buildings, transportation, climate and utilities, industrial decarbonization, and renewable energy.

2.1.1. *Energy efficiency and better buildings*

In the 2019 legislative session, two bills were passed related to energy efficiency and better buildings, House Bill 19–1231 New Appliance Energy and Water Efficiency Standards and House Bill 19–1260 Building Energy Codes. In the 2021 legislative session, there were six bills related to energy efficiency and better buildings, including Senate Bill 21–246 Electric Utility Promote Beneficial Electrification, Senate Bill 21–264 Adopt Programs Reduce Greenhouse Gas Emissions Utilities, House Bill 21–1009 update Division Housing Function and Local Development, House Bill 21–1238 Public Utilities Commission Modernize Gas Utility DSM Standards, House Bill 21–1286 Energy Performance for Buildings, and House Bill 21–1303 Global Warming Potential for Public Project Materials.

Of these bills, Senate Bill 21–264 is the most innovative; it sets GHG pollution reduction requirements for gas distribution utilities, including meeting a 22% reduction by 2030. The bill requires gas distribution utilities to reduce the carbon dioxide emissions from combustion of gas by their customers and requires these utilities to develop "Clean Heat Plans" that demonstrate how the utility will achieve the targets. The legislation, which is technology neutral, allows the plans to include the use of energy efficiency, beneficial electrification, methane leak reduction, green hydrogen, and the use of recovered methane (often referred to as renewable natural gas). The plans will be evaluated and approved by the Public Utilities Commission, in consultation with state air regulators to certify that the plans will achieve the required level of emissions reductions. Senate Bill 21–246 is also exemplary in its action to require regulated electric utilities to develop beneficial electrification plans that will provide rebates and other programs to support customers in switching from gas appliances and heating systems to high efficiency electric appliances such as heat pumps. Notably, the administration and legislators worked with labor unions to ensure that all bills that created new utility investment programs included language designed to assure that these investments support high quality jobs.

2.1.2. *Transportation*

Colorado has a goal of having 940,000 electric vehicles (EVs) on the road by 2030 (State of Colorado, 2020). In 2019, one bill passed, SB 19–077, which requires regulated electric utilities to file plans every three years to help achieve state transportation electrification goals (SB 19–077, 2019). Xcel Energy, the state's largest utility, received approval to invest over $100 million over three years, including infrastructure spending, to support residential as well as commercial customer investments. The approval allows the utility to propose ownership of charging stations, and, to address equity goals, provides rebates to customers from low-income households. Three bills concerning transportation passed in 2021, two focused on affordable housing and transportation needs in affordable housing developments. The three 2021 bills included Senate Bill 21–260 Sustainability of the Transportation System, House Bill 21–1271 Innovative Affordable Housing Strategies, and House Bill 21–1117 Local Government Authority to Promote Affordable Housing.

Senate Bill 21–260 was a major step forward for both transportation electrification and for incorporating GHG pollution reduction into

transportation planning and investment. The bill created new fees on residential deliveries (e.g., UPS, Amazon, or FedEx) and on transportation network companies (like Uber and Lyft), to support approximately three quarters of a billion dollars of investment in EV charging infrastructure, fleet incentives for electric buses and school buses, trucks, and transportation network company vehicles, and to support low- and moderate-income electric vehicle adoption. It also requires the Colorado Department of Transportation (CDOT) to make achieving the state GHG targets a core element of the transportation planning process. In response, CDOT conducted a rulemaking to adopt a transportation GHG pollution standard, which requires state and regional transportation plans to support GHG reductions to meet pollution budgets aligned with the GHG roadmap. In practice, this is expected to shift significant funding to public transit, walkable and bikeable communities, and infrastructure for denser infill development.

2.1.3. Climate and utilities

Similarly, in 2019 seven climate- and utility-related bills passed, and the 2021 legislative session passed six bills in this category. The six bills passed in 2021 included House Bill 21–1269 Utilities Commission Study of Community Choice Energy, Senate Bill 21–072 Public Utilities Commission Modernize Electric Transmission Infrastructure, Senate Bill 21–103 Concerning the Continuation of the Office of Consumer Counsel, Senate Bill 21–261 Public Utilities Commission Encourage Renewable Energy Generation, Senate Bill 21–272 Measures to Modernize the Public Utilities Commission (PUC), and House Bill 21–1324 Promote Innovative and Clean Energy Technologies. Addressing greenhouse gas emissions through the utilities and energy providers is a potentially unique approach, which could be replicated by other states, to address emissions in the power sector.

2.1.4. Renewable energy

Five bills were passed in the 2021 legislative session related to renewable energy, including two on tax valuation and classification, and one on a fee limit for solar installations. The 2021 bills included House Bill 21–1052 Define Pumped Hydroelectricity as Renewable Energy, House Bill 21–1180 Measures to Increase Biomass Utilization, Senate Bill 21–020 Energy Equipment and Facility Property Tax Valuation, Senate Bill 21–293 Property Tax Classification and Assessment Rates, and House Bill 21–1284 Limit Fee Install Active Energy Solar System.

Other proposed measures included in the Roadmap addressed the need for incentives and an equitable transition to a clean energy economy. These areas were included in the 2021 legislative session with the following bills: House Bill 21–1105 Low Income Utility Assistance Payment Contributions, Senate Bill 21–230 Transfer to Colorado Energy Office Energy Fund, Senate Bill 21–231 Energy Office Weatherization Assistance Grants, House Bill 21–1253 Renewable and Clean Energy Project Grants, Senate Bill 21–235 Stimulus Funding Department of Agriculture Efficiency Programs, Senate Bill 21–260 Sustainability of the Transportation System, House Bill 21–1271 Innovative Affordable Housing Strategies, House Bill 21–1117 Local Government Authority to Promote Affordable Housing, House Bill 21–1162 Management of Plastic Products, House Bill 21–1189 Regulate Air Toxics, House Bill 21–1290 Additional Funding for Just Transition, House Bill 21–1149 Energy Sector Career Pathway in Higher Education, and House Bill 21–1141 Electric Vehicle License Plate.

2.1.5. Just and equitable transition

Colorado is working toward a transition to a more equitable, low-carbon, and clean energy economy by promoting resources that reduce air pollution and supporting economic development and high-quality jobs in Colorado through advancing clean energy, transportation electrification, and other technologies that reduce air pollution and GHG emissions. In 2019, HB 19–1314 created the Office of Just Transition and required the development of a Just Transition Action Plan with a goal "help each community end up with more family-sustaining jobs, a broader property tax base, and measurably more economic diversity than when this process began in 2019" (Colorado Department of Labor and Employment, 2020). To further just and equitable transition in the pursuit of 100% carbon-free electricity, Senate Bill 19–236 requires a utility to incorporate Workforce Transition Plans and Community Assistance Plans when retiring any existing coal plants (SB 19–236, 2019). Just transition has been a major focus of the Public Utilities Commission consideration of Xcel Energy's electric resource plan. While this plan is still under consideration at the time of writing, a partial settlement agreement would both achieve a GHG emissions reduction of 85–87% by 2030 and address just transition in several important ways, including providing replacement of lost property tax revenues for up to six years after plant closure, and a process to prioritize communities with retiring coal plants for future firm zero carbon generation investments that can provide both tax revenue and jobs.

One of the most significant bills passed in 2021 was House Bill 21–1266, Environmental Justice Disproportionate Impacted Community, which addressed procedural issues to ensure that disproportionately impacted communities have a voice in the development and implementation of climate policy, directed fines for pollution violations into mitigation in these communities, and took several of the sector-specific pollution reduction targets in the Roadmap and placed them into statute. In particular, it strengthened the requirements that all electric utilities over a de minimis size threshold achieve at least 80% GHG reduction by 2030; required the state Air Quality Control Commission (AQCC) to adopt regulations to ensure at least 60% reduction from the oil and gas industry; and required the AQCC to adopt regulations to ensure at least 20% reduction from the rest of industry. Between these requirements and the SB 21–264 requirements on gas distribution utilities, this creates sector-specific binding regulatory requirements to achieve the Roadmap targets in four of the five largest sectors of GHG emissions. The Roadmap was developed at the same time as an equity framework was being established for the state of Colorado. The Roadmap includes key concepts of equity in relation to greenhouse gas pollution reduction and Colorado's climate response (Colorado Energy Office, 2021):

1. *Equitable Representation – policies that impact communities should be shaped by community input and the process should be open to any interested person wanting to participate.*
2. *Prioritizing Benefits – Disproportionately impacted communities should be prioritized.*
3. *Economic Impacts – GHG reduction strategies should reduce costs and increase economic benefits, especially for disproportionately impacted communities, wherever possible*
4. *Health Impacts – negative health impacts should be reduced for disproportionately impacted communities.*
5. *Access to Solutions – strategies should ensure clean technologies are available to everyone who wants them.*
6. *Building Resilience - GHG reduction strategies should improve resilience and quality of life for disproportionately impacted communities.*

HB 21–1266 went further by creating an environmental justice ombudsperson position and an environmental justice advisory committee and redirecting pollution fine revenues to mitigation projects in disproportionately impacted communities. SB 21–260 also directed the creation of a new office of environmental justice within CDOT, and SB 21–272 requires the PUC to incorporate environmental justice into utility decision-making.

3. Pathway to establishing legislation

To create a pathway for implementing climate goals, including through legislation, Governor Polis directed multiple state agencies to work together to create the Roadmap. The process started with modeling

and analysis, near-term policy actions, and other recommendations to reduce greenhouse gas emissions. Technical modeling and analysis were conducted to support different scenarios and identify the measures that need to be implemented to reduce emissions in all sectors, but particularly the four major polluting sectors.

One reason for the number of innovative clean energy bills passed in the 2021 legislative session was the involvement of stakeholders and a technical advisory group. The state hired a firm, Energy and Environmental Economics, to conduct detailed modeling and analysis, then met with technical advisory group members and presented to stakeholders to receive feedback on the results and process. Experts were engaged from the Center for the New Energy Economy, Colorado Energy Office, Colorado Department of Public Health and Environment, the Governor's Office, Colorado Departments of Transportation, Natural Resources, and Agriculture, as well as the Transportation Commission, Public Utilities Commission, Agriculture Commission, and Oil and Gas Conservation Commission. The technical advisory group included members with knowledge in clean energy, academic research, local government, business, and industry.

The purpose of the outreach efforts was to solicit input to ensure "transparency, gauge reactions to policy options, develop support for the Roadmap, and to implement stakeholder engagement requirements established by House Bill 19–1261 and Senate Bill 19–096" (Colorado Energy Office, 2021). This process resulted in two key outcomes for implementation: coordination with the AQCC in accordance with its statutory mandates to adopt rules for GHG reporting and abatement in Senate Bill 19–096 and House Bill 19–1261, and collaboration with other state commissions involved in the development and implementation of policies to address GHG emissions in the state.

Another key factor in the number of bills related to clean energy passed in the state of Colorado was cross-party collaboration. Only a few bills were sponsored by a single party. Most of the bills had sponsors from both the Republican and Democratic parties, which is important to consider in a state with multi-party representation, as opposed to a state with a dominating party. Table 1 shows the bills from the 2021 legislative session, along with the policy category and primary sponsor by party (State of Colorado, 2021). However, many of the most impactful bills had primarily Democratic support.

Many of the bills from the 2021 legislative session built on bills passed in 2019, including: SB19–077 Electric Motor Vehicles (EV) Public Utility Services to increase the infrastructure to support EV charging, HB19–1261 Climate Action Plan (2019) to Reduce Pollution, SB19–236 Sunset Public Utilities Commission, and HB19–1314 Just Transition from Coal-based Electrical Energy Economy. In a diverse state, such as Colorado, where demographics and economies vary between urban and rural locations, these clean energy bills are intended to support growth, health, and sustainability for all residents.

After the 2019 legislative session and creating the Roadmap, state agencies worked closely with the Governor's office and legislative leadership to identify near-term actions and legislative needs. The Roadmap helped establish recommendations to implement statutory changes and allowed state agencies to create fiscal notes on the bills to request funding for implementation from state appropriations. The Roadmap created a framework to allow state agencies and legislators to review the analysis and identify what was most feasible, leading to bills being passed. Creating the Roadmap, drafting bills, and passing bills is just the first step on a long road to implementation, but it illustrates the commitment the state has made to reducing greenhouse gas emissions. In addition, there is such a strong focus on clean energy, air quality and climate among constituents that many legislators proposed and passed additional bills that complemented, but were not contained in, the Roadmap.

Table 1
Colorado Clean Energy Bills With High Impact by Primary Sponsors, 2021 Legislative Session.

Colorado state BILL NO.	BILL TITLE	PRIMARY SPONSORS (Party affiliation)
HB21–1238	Public Utilities Commission Modernize Gas Utility Demand-side Management Standards	Tracey Bernett (Democratic), Chris Hansen (Democratic)
HB21–1052	Define Pumped Hydroelectricity As Renewable Energy	Hugh McKean (Republican), Rob Woodward (Republican)
HB21–1266	Environmental Justice Disproportionate Impacted Community	Dominique Jackson (Democratic), Michael Weissman (Democratic), Faith Winter (Democratic), Janet Buckner (Democratic)
HB21–1286	Energy Performance For Buildings	Cathy Kipp (Democratic), Alex Valdez (Democratic), Brittany Pettersen, (Democratic), Kevin Priola (Republican), Tracey Bernett (Democratic)
SB21–246	Electric Utility Promote Beneficial Electrification	Stephen Fenberg (Democratic), Alex Valdez (Democratic), Meg Froelich (Democratic)
SB21–072	Public Utilities Commission Modernize Electric Transmission Infrastructure	Chris Hansen (Democrat), Don Coram (Republican), Alex Valdez (Democrat), and Marc Catlin (Republican)
SB21–272	Measures to Modernize the PUC	Tracey Bernett (Democratic), Stephen Fenberg (Democratic), Chris Hansen (Democratic)
SB21–260	Sustainability Of The Transportation System	Kevin Priola (Republican), Matt Gray (Democratic), Alec Garnett (Democratic), Faith Winter, (Democratic), Stephen Fenberg (Democratic)
SB21–261	Public Utilities Commission Encourage Renewable Energy Generation	Alex Valdez (Democratic), Judith Amabile (Democratic), Kevin Priola (Republican), Stephen Fenberg (Democratic)
SB21–264	Adopt Programs Reduce Greenhouse Gas Emissions Utilities	Alex Valdez (Democratic), Tracey Bernett (Democratic), Chris Hansen (Democratic)

4. Conclusion

In 2019, Colorado passed a total of 14 energy-related bills in the categories of energy efficiency, electric vehicles, and climate/utility policy. Over 30 bills were passed in the 2021 Colorado legislative session within the categories of better buildings, financing for energy efficiency and clean energy, transportation, climate education and awareness, renewable energy measures, and public utilities commission climate bills; and environmental justice, climate, and just transition. While the number of clean energy related bills passed in the 2021 session places Colorado in the top tier of states passing clean energy legislation, after Maryland (41), Texas (33), and Virginia (20) in terms of the number of bills enacted (New Energy Economy, 2021), the impact of those bills is equally important. After passing bills, it is essential to establish a clear pathway to a just and equitable decarbonization in the state's economy as the state's leadership addresses the climate crisis.

The commitment made by the state of Colorado, the development of a Roadmap to reduce greenhouse gas emissions, and the bipartisan support for clean energy bills has paved the way for progress in reducing emissions. The state's emissions reduction target of 70 MMT of CO_2e will need to address emissions from electricity, transportation, oil and gas, buildings and industrial fuel, and methane emissions from coal mines (Colorado Energy Office, 2021). Bi-annual state-wide greenhouse gas inventories indicate the largest sources of emissions from human activities are "electric generation, transportation, and fuel combustion to heat buildings and provide heat for industrial processes shown in the inventory as residential, commercial and industrial fuel use" (Colorado

Department of Public Health and Environment [CDPHE], 2021). The inventory shows that Colorado's greenhouse gas emissions have decreased 9% between 2005 and 2019, and 16% since 2010. Greenhouse gas emission forecasts from 2020 through 2050, in compliance with the reduction goals established in HB12–1261, project a decrease in emissions from 2005 levels of 27% by 2025, 51% by 2030, indicating Colorado is on track to meet its near- and mid-term goals (Taylor, 2021). However, projections past 2030 are far more uncertain, and additional actions are likely needed to achieve the 2050 targets. Emissions are projected to continue to decrease significantly due to current and anticipated emission reduction efforts including legislation, regulations, and policy initiatives (CDPHE, 2021).

While equity is acknowledged in the Roadmap, there is more work to be done to ensure clean energy solutions are implemented in a fair, just, and equitable manner. Equity in Colorado will need to address issues for vulnerable populations, those oppressed by energy burden, and those in need of economic growth in rural areas where industries are changing. Just as the 2019 legislative session paved the way for innovative and effective policies to be introduced and passed in 2021, the 2021 session will have an impact on future bills. Reviewing analyses, roadmaps, and progress being made on clean energy solutions will help to uncover gaps in policy, and highlight areas where new bills can be introduced.

Climate change will impact all residents of a state, the nation, and the world. Creating effective policies and then implementing a roadmap with clear procedures to address climate change is key. Having already made progress to reduce emissions, these and future bills will help Colorado meet its targets of 90% statewide reductions in greenhouse gas emissions by 2050. Bills addressing clean buildings, industry, environmental justice, reform of state transportation agencies and natural gas utilities is just the start to the progress the state can make over the coming years. According to Colorado Senator Chris Hansen, "In previous years' sessions, the state has focused a majority of the climate legislation on the energy and transportation sectors. We have worked to reduce the greatest amount of emissions using the lowest cost and most technologically feasible mechanisms. As Colorado looks to the future to meet our climate goals, we are broadening legislation to reach the agriculture sector, the built environment, and more. These sectors are important to accelerating Colorado to decarbonization and better air quality. Prioritization of sectors is a difficult part of the job—there are so many ways to achieve a cleaner environment, and I am excited to start tackling more" (Hansen, 2022).

Colorado is setting an example for the types of policies that will reduce emissions within the energy sector and improve greenhouse gas emissions overall.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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