

Transit Zero Emission Vehicle Roadmap



Transit & Rail Advisory Committee (TRAC)
March 11th, 2022



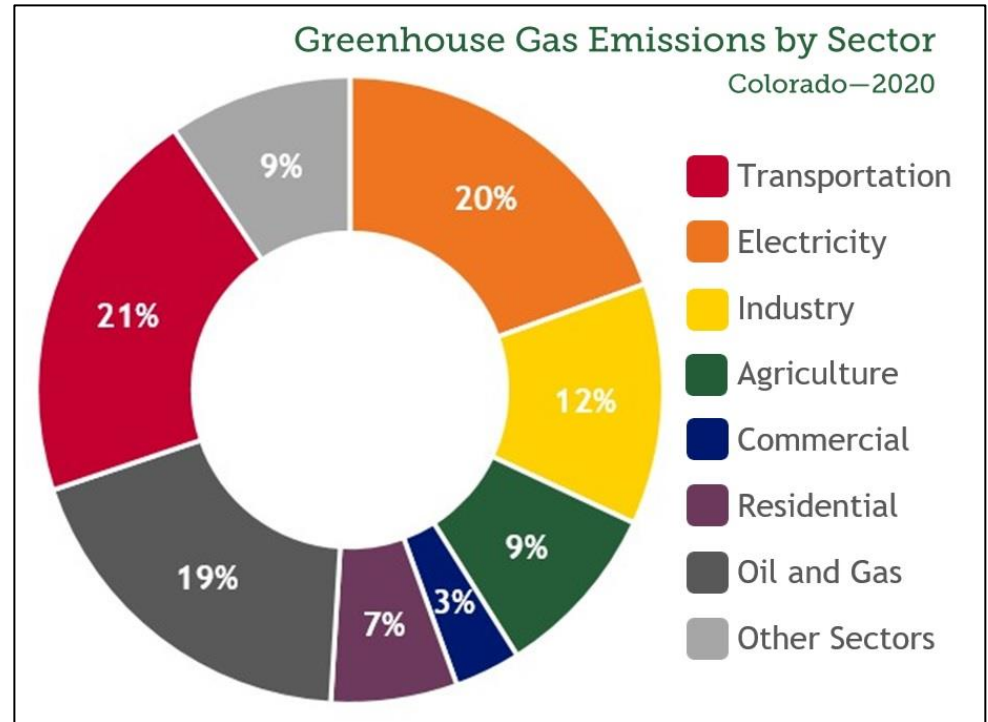
State of Colorado GHG Reduction Targets

House Bill 19-1261

Sets statewide greenhouse gas (GHG) reduction targets of:

- 26% by 2025
- 50% by 2030
- 90% by 2050

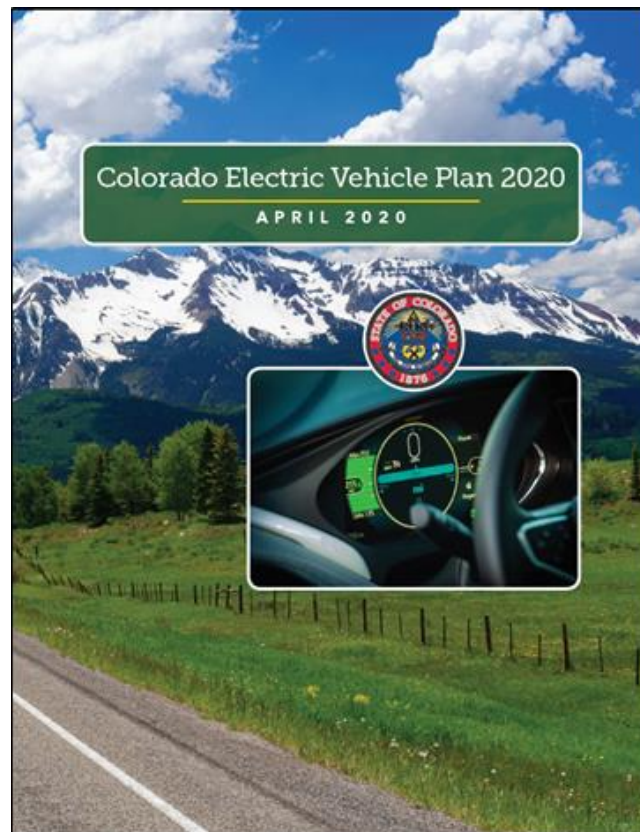
*From a 2005 baseline





2020 Colorado EV Plan

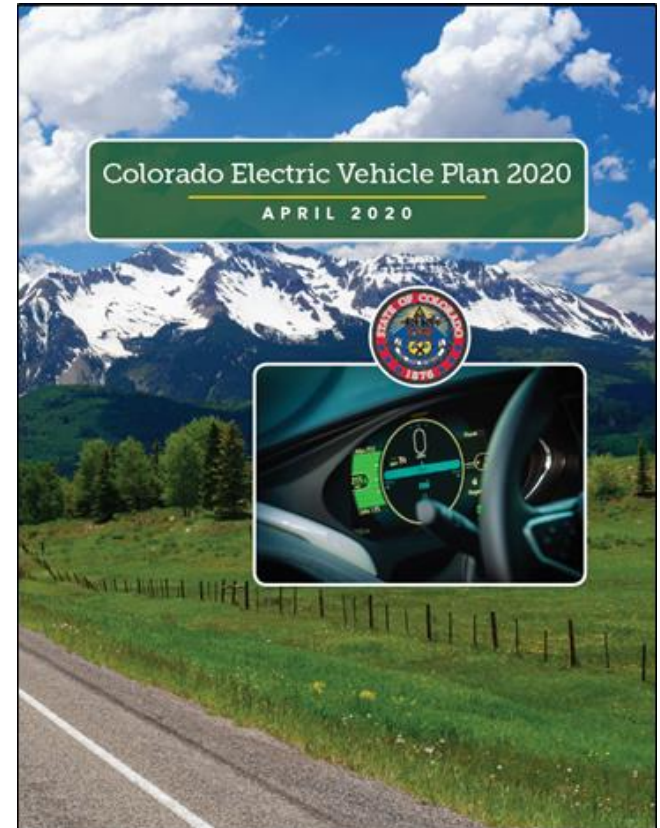
- Colorado's 2020 Electric Vehicle Plan established a state target of 940,000 registered ZEVs by 2030
- CDOT and its partner agencies are currently developing a Clean Trucking Strategy to reduce emissions from medium- and heavy-duty vehicles across the state
- Colorado also has a goal of converting all transit vehicles in-state to ZEVs by 2050, with an interim target of 1,000 transit ZEVs by 2030
- The plan also includes strategies to explore related issues like the hydrogen fuel market, supporting EV equity, and working with dealers and technical schools to develop a supportive ZEV workforce over the longer-term





2020 Colorado EV Plan

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Key Elements of the Transit ZEV Roadmap

- **Collecting data and conducting research and analysis** to inform the current state of Colorado's transit fleet, understand the current state of the national transit ZEV market, identify transit ZEV conversion barriers and opportunities, and determine and document complementary utility actions and policies needed to advance the transition of Colorado's transit fleet to ZEVs.
- **Conducting outreach and engagement with transit agencies and utilities** to understand current ZEV plans, issues, opportunities and potential strategies the State could implement to support the transit ZEV transition.
- **Crafting a comprehensive Transit ZEV Roadmap** that integrates findings and strategies from complementary planning efforts and provides statewide transit and utility decision-makers with the direction and tools to facilitate and manage the ZEV transition while continuing to deliver quality transit service to the traveling public



National ZEV Transit Trends

Barriers to ZEV Fleet Adoption



Knowledge Barriers

Lack of understanding of the technical, planning, financial, and governance factors critical to successful ZEV implementation.



Technological Barriers

Currently, available ZEV transit models cannot meet the needs of all transit services due to battery limitations that impact range and vehicles' ability to operate at varying grades and temperatures.



Financial Barriers

Some Colorado transit agencies report that the cost of transit ZEVs can be as much as double that of internal combustion engine vehicles. Significant financial barriers arise when combined with costly infrastructure upgrades and transit agency training required to develop electric rates collaboratively with utility companies.



Institutional Barriers

Transit agency and utility service territories cover diverse and dynamic geographic areas. Colorado utilities and transit agencies have varying levels of experience and inconsistent processes for coordinating across jurisdictional boundaries to meet service planning and transmission/distribution planning needs.



Colorado ZEV Environment

By the Numbers (2018)

- Approximately 3,301 total transit vehicles in Colorado*



ZEV Transit Buses Deployed, On Order or Soon to be on Order in Colorado



Electric Gondola Transit Vehicles



Light Rail Train Cars



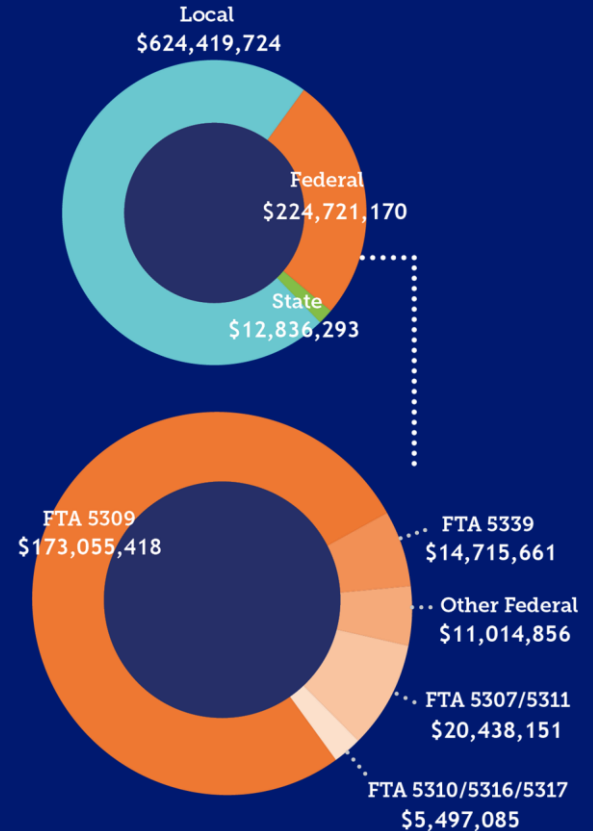
Commuter Rail Cars



Renewable Natural Gas (RNG) transit buses

*2021 data

Funding the 2018 Colorado Transit Fleet





Colorado ZEV Environment

2021 Transit ZEVs By the Numbers



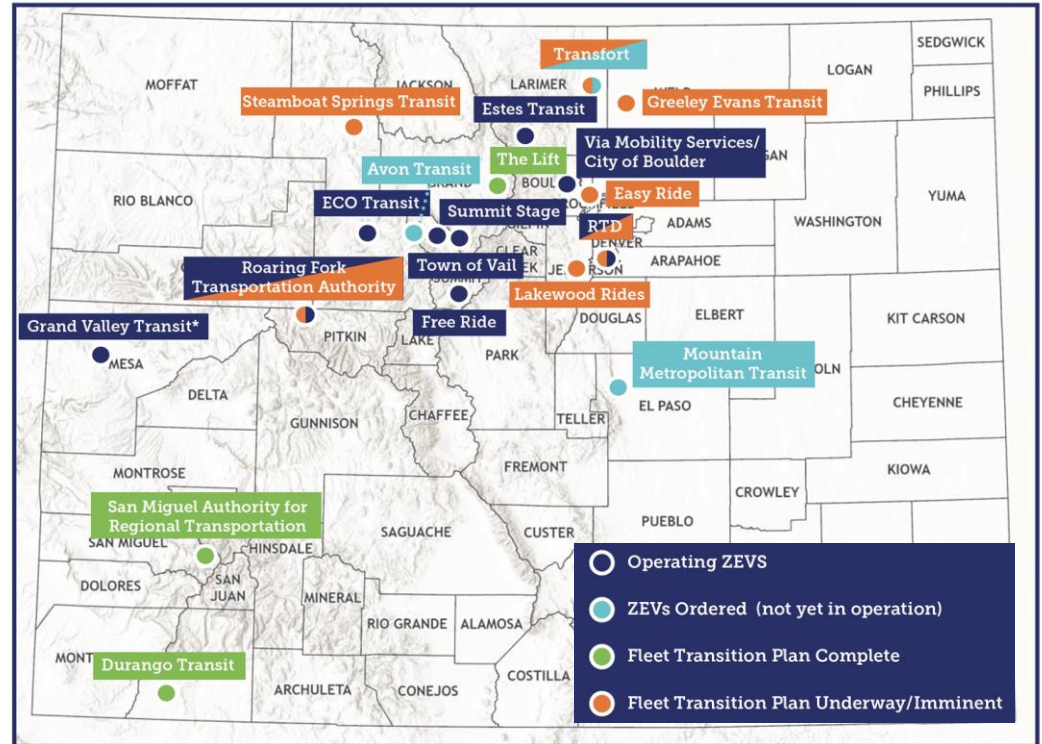
Colorado transit agencies operating ZEVs



Colorado transit agencies with ZEVs on order (not yet operational)



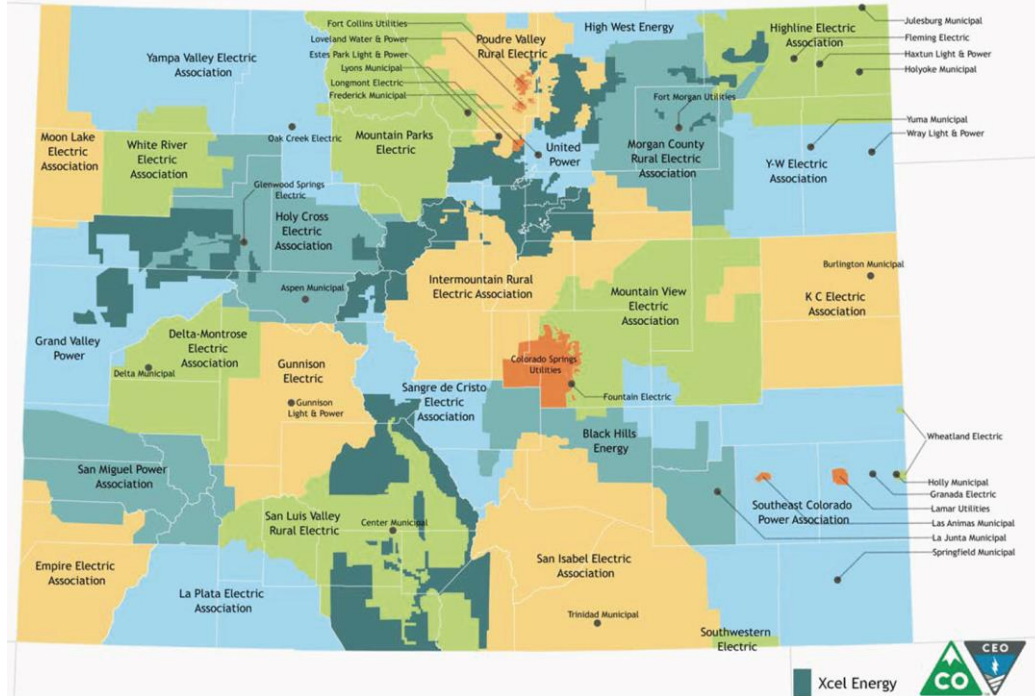
Colorado transit agencies that have completed, are in the process of, or will be completing a ZEV Transition Plan in the near future



*Grand Valley Transit uses Renewable Natural Gas (RNG) for 50% of its operations; the remaining 50% uses Xcel Energy natural gas.



The Role of Utilities



Local electric utilities will play an essential role in any successful ZEV planning and implementation process.

Increased load associated with charging transit fleets could put significant strain on the existing electric infrastructure. Utilities and transit agencies will both have to invest in distribution upgrades and new infrastructure to meet the increased electrical demand to support electric fleets.

The utility and transit agency relationship will look very different depending on the size of fleet, type of vehicles, type of chargers, and geographic location. Mutual understanding of both utility and transit agency operating needs will go a long way to ensuring reliable energy to meet evolving transit service schedules and operational needs. There are also opportunities to develop resiliency plans for planned and unplanned outages.

State and local governments can encourage utility investment in ZEVs by supporting infrastructure development. For example, the state and CDOT could oversee and manage coordinated infrastructure planning processes for both utilities and transit agencies.



Questions for the Financial Model based on the 2020 EV Plan's identified transit goals:

What does it take to get to 1,000 Vehicles by 2030?



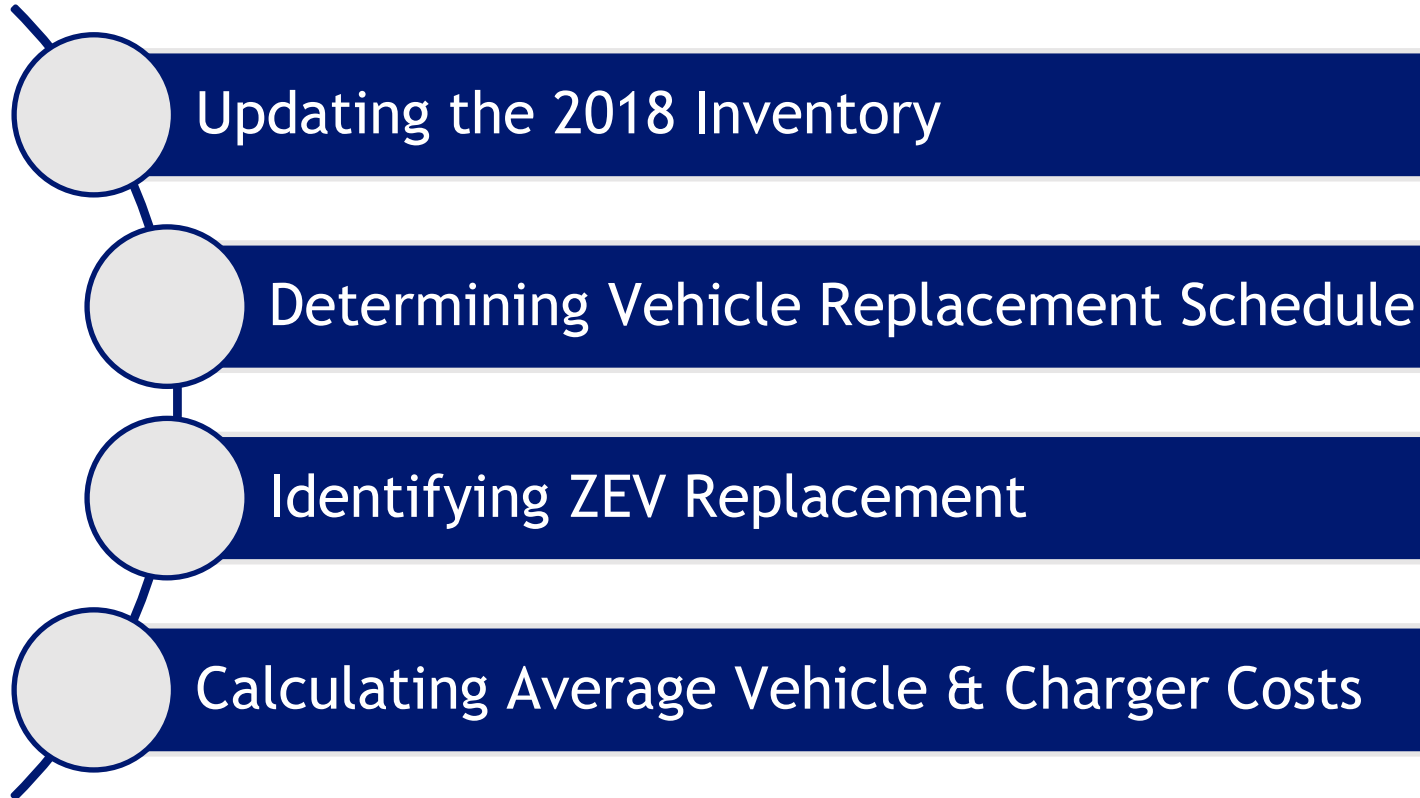
What does it take to get to 100 percent ZEV by 2050?



Is there a reasonable path forward?



Financial Modeling Assumptions





The Thought Exercise...

What will replacing vehicles like-for-like cost?

Scenario	Do we meet the 2030 goal? (# of ZEVs in 2030 Fleet, ULB/MUL)	Do we hit the 2050 goal? (Year Fleet is 100% ZEV, ULB/MUL)	Cost of Vehicle Replacements (ULB/MUL)	Incremental Cost (ULB/MUL)
No ZEVs (Baseline)	X (100)	X (N/A)	\$595M / \$785M	-

How does this compare to...

Replacing all
vehicles with
ZEVs starting
in 2022?

Somewhere in
between...2025?
2027?

Replacing all
vehicles with
ZEVs starting
in 2030?



Financial Modeling

Scenario	Do we meet the 2030 goal? (# of ZEVs in 2030 Fleet, ULB/MUL)	Do we hit the 2050 goal? (Year Fleet is 100% ZEV, ULB/MUL)	Cost of Vehicle Replacements (ULB/MUL)	Incremental Cost (ULB/MUL)
No ZEVs (Baseline)	X (100)	X (N/A)	\$595M / \$785M	-
2022	✓ (2,050 / 2,325)	✓ (2035 / 2033)	\$870M / \$1,070M	\$275M / \$285M
2025	✓ (1,580 / 2,250)	✓ (2038 / 2036)	\$840M / \$1,045M	\$245M / \$260M
2027	✓ (1,150 / 1,225)	✓ (2040 / 2038)	\$830M / \$1,020M	\$235M / \$235M
2030	X (245 / 205)	✓ (2043 / 2041)	\$825M / \$1,015M	\$230M / \$230M

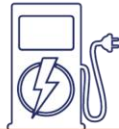
Transitioning the CO fleet to ZEVs is projected to cost \$230M to \$285M (30-45%) more than maintaining the existing fleet.



Financial Modeling



Transitioning the Colorado fleet to ZEVs is projected to cost \$230 to \$285 million more than the baseline scenario, equating to a 30 to 45 percent premium over maintaining the existing fleet.



Initial capital investment in EV chargers represent most of the incremental ZEV costs (\$225 million to \$230 million).



Incremental cost difference (excluding associated charger costs) is \$45 to \$60 million, reflecting a 5 to 10 percent premium over the vehicle costs of replacing the existing non-ZEV fleet.



The near-term push to 1,000 will cost an additional \$5 to \$10 million in transit ZEV replacement costs to meet the 2030 goal.



Achieving Colorado's Transit ZEV Goals



Policy

Identify policies to reduce barriers to ZEV transition and implementation.



Planning & Technical Support

Provide training to promote workforce readiness and educational programs for riders and policy-makers.



Information Sharing & Research

Increase access to technical resources and expertise to support the planning, design, and implementation activities.



Funding

Define data collection, research, and analysis methods to facilitate statewide information sharing and support a successful transition to transit ZEVs in Colorado.



Education & Training

Prioritize funding and identify state funding types and methods to effectively support ZEV planning and implementation.

Implementation Timeframes

Near-Term: 2021-2024

Mid-Term: 2025-2027

Long-Term: 2028-2030



Policy Strategies

Near-Term (2021 - 2024)



Policy

- Integrate Transit ZEV Roadmap strategies into the next revision of the Colorado EV Plan.
- Develop a ZEV Transition Plan for CDOT operated transit services (e.g., Bustang, Outrider, Snowstang) to demonstrate CDOT's commitment to ZEV goals and to lead by example.
- Integrate recommendations from CEO's EV Equity Study into transit electrification grants, programs, and initiatives.
- Explore opportunities to better define the process for tracking RNG and to substantiate the use of RNG as a transit ZEV option.
- Evaluate opportunities and methodologies for integrating environmental impact analyses to capture the environmental and societal costs of tailpipe emissions in procurement processes.
- ● Serve as a facilitator or convener to bring together transit agencies and utilities to actively address known ZEV transitio challenges and overcome barriers to transit ZEV fleet transition. Workshop and/or working group topics should include:
 - Transit agency and utility programmatic coordination
 - Generation, transmission, and distribution planning
 - Best practices for transit agency/utility coordination
 - Facility planning (including strategies for overcoming building and lease limitations)
 - Transit ZEV electric rate design
 - ZEV model availability and applications

- Education & Training
- Information Sharing & Research
- Funding
- Policy
- Planning & Technical Support

Strategies that span multiple goal areas are indicated with multicolored bullets.



Planning & Technical Support Strategies

Near-Term (2021 - 2024)



Planning & Technical Support

- Define a standard approach for measuring GHG emissions and reductions for transit agencies that is consistent with the Transit Emission Dashboard methodology.
- Hire staff and/or contract with consultants to provide on-call technical assistance to transit agencies to support ZEV fleet transition planning. Support activities could include utility coordination, grant application support, route modeling, maintenance/operations planning, facility planning, GHG emissions tracking, etc.
- Identify opportunities to streamline data collection for the entire Colorado transit fleet to efficiently track progress toward the statewide ZEV transit and related GHG emission reductions goals. Build on the CEVC Transit Subgroup Zero-Emission Bus Tracking Sheet and the COTRAMS database.
- Integrate the findings and data from the Transit ZEV Roadmap into the Group Transit Asset Management Plan update.
- Coordinate with transit agencies to better understand options and strategies for transitioning contractor owned facilities to support ZEVs.
- Track storage location of transit vehicles in COTRAMS to aid in ZEV replacement feasibility analysis and transition planning.

- Education & Training
- Information Sharing & Research
- Funding
- Policy
- Planning & Technical Support

Strategies that span multiple goal areas are indicated with multicolored bullets.



Information Sharing & Research Strategies

Near-Term (2021 - 2024)



Information Sharing & Research

- Education & Training
- Information Sharing & Research
- Funding
- Policy
- Planning & Technical Support

Strategies that span multiple goal areas are indicated with multicolored bullets.

- Create an informal transit-focused virtual peer exchange network (e.g., Slack channel, Listserv, etc.) to ask questions, share information and/or lessons learned, and facilitate ongoing conversations among transit agencies.
- Engage existing Colorado research groups and programs (e.g., NREL, ASPIRE⁵³, CU, CSU, etc.) to support and develop opportunities for transit agencies to test/evaluate ZEVs and research transit ZEV-related technologies such as battery recycling second use cases, transit and utility business models, smart vehicle charging solutions, etc.
- Convene a rural transit working group, including electric co-ops, to define barriers and potential solutions for rural transit agencies.
- Convene interested transit agency and hydrogen fuel providers to identify pilot project opportunities and discuss potential barriers to widespread fleet adoption in Colorado.
- Collaborate with the CEO and CDPHE to assess potential benefits, costs, and timing for adoption of the California Innovative Clean Transit Rule (ICTR) in Colorado.
- Integrate Transit ZEV Roadmap data and recommendations into the Clean Transit Enterprise's 10-Year Plan.
- Track real-world transit vehicle purchase and infrastructure upgrade costs to refine assumptions and inputs to the Transit ZEV Roadmap transition financial model and conduct future scenario analyses.
- Monitor and document real-world ZEV operational costs in Colorado to inform future planning efforts.



Funding Strategies

Near-Term (2021 - 2024)



Funding

- Evaluate strategies for vehicle leasing options, third-party financing, battery leases, utility on-bill financing, and other funding mechanisms and opportunities to use SB 21-260 Clean Transit Enterprise funds.
- Establish a permanent Statewide Local Match Fund to buy down the transit agency local match for the purchase of transit ZEVs to be equal to that of the comparable internal combustion engine vehicle option. Evaluate the potential to use the Clean Transit Enterprise to fund the Local Match Fund, as well as potential match funding strategies (e.g., incentivizing transit agencies to pursue federal funding sources by providing a higher percentage of matching funds for federal grants than state/local grants).
- Establish and maintain a state-approved master purchasing agreement for zero emission vans, cutaways, and buses to streamline transit agency procurement of transit ZEVs.
- Develop flexible funding programs to support ongoing maintenance and operations costs and long-term operations of transit ZEVs.
- Incentivize and promote private sector support for ZEV transit transition, including demonstration projects, vehicle testing and/or short-term proof of concept lease options, etc. to ensure vehicle types and technologies meet Colorado transit agency needs and to support the advancement of the larger transit ZEV market.
- Assess opportunities to support the replacement of vehicles with ZEVs prior to the end of their useful life to expedite ZEV transition.
- Consider establishing a more flexible vehicle replacement policy for zero-emission buses for so long as available vehicle technologies (i.e., battery range and low-temperature performance) do not align with the typical 1-to-1 replacement ratio.

- Education & Training
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- Funding
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Education & Training Strategies

Near-Term (2021 - 2024)



Education & Training

- Education & Training
- Information Sharing & Research
- Funding
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Strategies that span multiple goal areas are indicated with multicolored bullets.

- Develop Colorado-specific informational materials about transit ZEV challenges, opportunities, and benefits in coordination with existing transit and ZEV organizations (e.g., Colorado Association of Transit Agencies [CASTA]) to educate transit agency staff and key decision-makers.
- Partner with CASTA to provide OEM neutral training and/or educational sessions for transit operators and maintenance staff early in the ZEV transition process.
- Collaborate with CASTA to offer training on use of the Transit ZEV Roadmap financial modeling tool to transit agencies so that they can run their own fleet-specific analyses and effectively communicate the results to decision-makers and the public.



Further Reading

Transit Zero Emission Vehicle Roadmap

November 2021

[Read the full Transit ZEV Roadmap here:](https://www.codot.gov/programs/innovativemobility/electrification/planning-initiatives-and-documents)

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Questions & Discussion

