ZERO EMISSION TRANSIT

Moving Colorado Towards a Cleaner Future
Today’s Panelists

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CDOT - Office of Innovative Mobility
Assistant Director of Electrification & Energy

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Assistant Planner
AGENDA

- Colorado State Policy Background - Moving Towards a Zero Emission Vehicle Future
- Colorado’s Transit ZEV Roadmap
- Coordinated ZEV Funding Strategies
- Roaring Fork Transportation Authority (RFTA) Case Study
- Q & A
State Policy Background

Moving Colorado Towards a Zero Emission Vehicle Future
CDOT Vision

To enhance the quality of life and the environment of the citizens of Colorado by creating an integrated transportation system that focuses on safely moving people and goods by offering convenient linkages among modal choices.

Electric Vehicles offer several benefits:

- No tailpipe emissions
- Cheaper maintenance and operations
- Additional traveler choice
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
As a result of the state’s actions to date, we are on a trajectory to achieving approximately half the level of emission reductions to meet the 2025 and 2030 goals.

Additional strategies can advance co-benefits such as reducing local air pollution, generating economic growth, advancing environmental justice and equity.
CDOT’s EV Goals

PD 14 Environmental Impact Objectives & Targets

CDOT will work collaboratively with other state agencies and local partners to reduce statewide GHG pollution from the transportation sector by 26% by 2025, 50% by 2030, 90% by 2050 relative to 2005 statewide GHG pollution levels.

Collaborate with other state agencies to increase electric vehicle registrations to support a future fleet of at least 940,000 light-duty EVs by 2030.

Work with other state departments, transit agencies, and electric utilities to meet the transit vehicle goals specified in its 2020 Electric Vehicle Plan to convert the state transit fleet to 100% ZEV by 2050, with an interim target of at least 1,000 ZEVs by 2030.

Collaborate with other state agencies, local governments, and private companies to increase the percentage of total state highway miles within a 30-mile travel buffer of DC fast-charging stations from 40% in FY 2020 to 100% by FY 2030.

Coordinate with other state agencies, the Colorado Scenic & Historic Byways Commission, local governments, and individual site hosts to increase the number of Colorado Scenic & Historic Byways classified as electrified byways from 3 in FY 2020 to 26 by the end of FY 2025.
Colorado’s Transit Zero Emission Vehicle Roadmap

Cady Dawson & Rachel Ackermann
Felsburg Holt & Ullevig
Transit ZEV Roadmap Project Overview

- Data collection, research, and documentation
- Outreach and engagement
- Develop strategies, policy tools, timelines, and responsibilities
- Craft comprehensive Transit ZEV Roadmap/ Integrate findings from other studies
- Gather stakeholder input on draft plan; address comments and finalize plan
National Transit ZEV Trends

Advancing ZEV transit fleets faces several challenges and barriers to realizing the full financial and environmental benefits of the next generation of transit vehicles. There is increasing national experience transitioning transit fleets to ZEVs, as shown in Figure 1.

Figure 1: 2020 ZEV Transit Buses Deployed, On Order, or Soon to be on Order in the US

Transit agencies must adapt to and embrace new vehicle standards, products and changing mobility needs. In addition to contemplating ZEV fleet adoption, many transit agencies are simultaneously evaluating service and technology changes including integration of mobility-on-demand and mobility-as-a-service options. Remaining on the cutting edge of new transit technology and ZEV planning should be evaluated at the local level with awareness and context of national issues and best practices.

Vehicle Availability

Full sized electric buses have been commercially available and their use has been increasing for over a decade. At the beginning of 2020, approximately 180 transit agencies were operating over 850 electric transit buses throughout the US with an additional 1,000 vehicles on order for delivery by 2022.

Decreasing battery and electricity costs have contributed to the growth of the battery electric ZEV market. Proterra has dominated the American ZEV bus market but faces competition from GreenPower, New Flyer, and BYD. The traditional transit vehicle OEMs - New Flyer, Gillig and Nova Bus - have collaborated with zero-emission powertrain suppliers to develop battery electric models to retain their market share.

Figure 2 provides a summary of zero emission bus sales in North America from manufacturers with at least 10 models, according to a previous detailed information about the state of zero emission transit vehicle model availability.

Figure 2. North American Zero Emission Bus Sales (2014-2020)

Manufacturers that initially focused on full-size electric transit buses are pivoting to integrate medium and small-size cutaway vehicles into their vehicle portfolios in meet the growing demand for vehicles offering in this market segment. Given the various needs and vehicle delivery models across Colorado, additional ZEV types will support faster adoption of ZEVs as cutaway vehicles make up approximately 23 percent of Colorado’s existing transit fleet. ZEV deployment should focus on proven vehicle models are available to meet current and future transit needs. In Colorado, this means vehicles must be able to operate with extended range in serve rural areas and vehicles must be able to operate successfully in areas with cold climates and steep grades.
Barriers & Lessons Learned

Fleet Electrification Readiness

Fleet agency needs that have not succeeded in ZEV transitions include the following actions. Additional information on each fleet electrification readiness action. Appendix A provides several case studies and lessons learned from ZEV deployment.

Conduct a fleet-wide assessment to develop short- and long-term ZEV transition goals.

- Plan for incremental deployment of electrification projects to clarify how different ZEV options meet the range of fleet needs and to refine ZEV charging and maintenance schedules
- Identify representative routes to model energy and vehicle range requirements
- Evaluate impacts of unique geographic and service characteristics to identify necessary strategies to prevent service quality impacts
- Leverage long-term planning goals to maximize use of available funding

- Long-term utility infrastructure hosting (make ready investments such as upstream transformer pads or laying additional conduit) strategies add minor additional costs to earlier deployments, but will reduce overall long-term costs

Develop phased plans to upgrade retrofit maintenance facilities and bus depots

- Arts installation, space, and power requirements for short- and long-term charging infrastructure needs
- Ensure clear communication with vendors to reduce costs associated with incremental retrofitting
- Evaluate and plan for land purchases to house current and future transit fleets
- Battery Electric Bus - Upgrade Retrofit bus yards to accommodate additional equipment and evaluate potential to site garages for onboard depot charging or cold management
- Fuel Cell Electric Vehicle Infrastructure - Evaluate opportunity to retrofit existing fuel storage and CHG fueling stations for potential hydrogen fuel

Connect early and often with electric utilities to plan for electric infrastructure needs, review rate schedules and collaborate to develop mutually beneficial incentives or pilot programs

- Use reliability reports to understand the frequency and types of outages that have occurred and develop resiliency plans with utilities

Provide proactive training for operations and maintenance staff

- Consult with labor unions to ensure needed accommodations are implemented in deployment plans

Involve diverse stakeholders early in the planning and transition process

- Internal Stakeholders to include Operations and planning, maintenance and engineering, training, facilities, finance procurement, IT sustainability manager, contract operations, board or executive leadership, public information officers
- External Stakeholders to include: governmental agencies, electric utilities, labor unions, environmental justice representatives, surrounding communities and other interest groups
Vehicle Options & Availability

Zero Emission Vehicle Options & Model Availability

Fuel cell systems largely dominate the early ZEV transit market. However, the lack of extensive hydrogen infrastructure has resulted in the majority of ZEV deployments using battery electric buses. Decreasing battery and renewable electricity costs have contributed to the growth of the battery electric ZEV market and the pursuit of clean transit vehicles. A complete list of existing ZEV model availability by manufacturer is provided in Table 1 below.

Table 1: Existing ZEV Model Availability by Manufacturer

<table>
<thead>
<tr>
<th>ZEV Manufacturer</th>
<th>Product Type</th>
<th>In Use/Procured by Colorado Transit Agency?</th>
</tr>
</thead>
<tbody>
<tr>
<td>APS Systems*</td>
<td>Conversion to battery operation or mix of battery and alternative fuels</td>
<td>No</td>
</tr>
<tr>
<td>AVASS Group*</td>
<td>BEB manufacturing</td>
<td>No</td>
</tr>
<tr>
<td>Build Your Dreams(RTD)*</td>
<td>Conversion to BEB</td>
<td>No</td>
</tr>
<tr>
<td>GreenPower Motor Company*</td>
<td>BEB, electric traction motor, and battery management systems</td>
<td>No</td>
</tr>
<tr>
<td>Lightning Motors*</td>
<td>Conversion to BEB</td>
<td>Town of Youn*</td>
</tr>
<tr>
<td>Motiv Power Systems*</td>
<td>Conversion to BEB</td>
<td>City of Boulder (Kal)*</td>
</tr>
<tr>
<td>New Flyer Industries*</td>
<td>Battery and Fuel Cell</td>
<td>RTA*</td>
</tr>
<tr>
<td>Novabus*</td>
<td>BEB manufacturing</td>
<td>No</td>
</tr>
<tr>
<td>Phoenix Motorcoach*</td>
<td>Conversion to BEB</td>
<td>Town of Avon, COD Transit, Summit Stage*, Town of Broomfield*</td>
</tr>
<tr>
<td>Van Hool*</td>
<td>Fuel Cell</td>
<td>No</td>
</tr>
<tr>
<td>ENS/E. Donato*</td>
<td>Fuel Cell</td>
<td>No</td>
</tr>
</tbody>
</table>

Market Readiness

ZEV transit purchase cost parity depends on the elimination of many of the technological, economic, and political barriers to ZEV fleet adoption.

Electricity is sold at commercial or industrial rates with demand-based surcharges. The cost of electricity is highly variable, depending on the cost of power purchases. COGOs in the transition phase from fossil fuel to clean power price rises are followed here.

Total Cost of Ownership (TCO)

Formulating efficient ZEV procurement practices can provide increased price transparency, strengthen contract buying power, and reduce the effort required for transit agencies to evaluate ZEVs. The primary benefit of ZEV options over diesel options lies in the reduced fuel and maintenance costs that accrue over time. The primary factors influencing a TCO comparison are:

- Electricity, fuel, sodium, and hydrogen fuel prices
- Average annual miles traveled (AVM)
- Access to financing infrastructure, installation and capital equipment costs, utility/meter design options, and funding strategies
- There is a strong inverse relationship between the TCO and annual fuel cost; fuel costs are assumed to be in US dollars.
- The TCO will take longer to achieve ownership cost parity with diesel buses, whereas operating short range buses on low-mileage miles are expected to reach parity sooner.
- As shown in Figure 3, lithium-based batteries are expected to be a major cost driver for battery electric vehicles in the near future. However, in the mid-term, advancements in battery technology and increased range are projected to coincide with the mid-term lithium battery technology period (2023).

Workforce Readiness

Leveraging national best practices and lessons learned during the 2017 procurement process can help support Colorado transit agency service and maintenance personnel readiness for the ZEV transition, maintaining and operating ZEV fleets in different parts, maintenance practices, and staff skills until new ZEV technologies, operational requirements, and state regulations converge.

- Preventive maintenance
- Diagnostics procedures
- Spare parts/materials
- Component repair
- Operations
- Safety
- Training materials
Colorado ZEV Environment

**Current Fleet Snapshot**

Colorado is home to a variety of transit options operated by public, private, and non-profit agencies. Transit service across the state includes bus service (local, regional, interregional, intercity), passenger rail service (light rail, commuter rail) and human services transportation.

The current fleet inventory includes open door, general public transit services. This section summarizes the transit agencies and providers included in the Transit ZEV Roadmap. The inventory of the existing general public transit fleet in Colorado was developed referencing the 2016 Statewide Transit Plan (STP), associated local Regional Transit Plans, federal transit data, and CDOT collected transit fleet information.

Several databases and resources provide information critical to understanding the current composition of the larger Colorado transit fleet, including:

- Colorado Transit and Rail Awards Management System (COTRAS) Capital Inventory records
- CDOT’s Transit Asset Inventory Master Database
- 2018 Colorado CDOT Transit Asset Management Group Plan
- FHWA’s National Transit Database (NTD) Annual Vehicle Tables

Additional information about the current reporting of transit fleet asset information, including information about which agencies report to each of the above noted databases, is included in Appendix C.

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**State of Transit ZEVs in Colorado**

Ten transit agencies across the State of Colorado have begun operating ZEVS or currently have them on order. Additionally, eight agencies have completed, are in the process, or will be completing a ZEV Transition Plan in the near future.

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*Great Valley Transit uses Renewable Natural Gas (RNG) for 50% of its operation; the remaining 50% uses fossil energy, natural gas.*
The Role of Utilities in Transit Fleet Electrification

Colorado is home to 56 public transportation providers and 56 electric utilities, highlighting the importance of coordinated planning for EEB deployments. Local electric utilities play an essential role in any successful E2E planning and implementation process. Utilities have a responsibility to provide customers with reliable electrical service. Proactive coordination between the local utility and transit agency allows both entities to identify fleet electrification needs and constraints early in the process to support ease of implementation.

Utility coordination and collaboration can help reduce the limitations of EEB deployments, including:
- Fleet charging time scheduling requirements
- Estimating operating costs associated with charging
- High upfront infrastructure capital costs

Electric utilities have the necessary experience to support the expansion of E2E transit infrastructure at a scale large enough to meaningfully impact the feasibility of transit electrification. Program development and strategic rate design to incentivize charging behaviors that benefit customers and society can expand the cost savings and emission reduction potential of transit electrification.

Colorado electricity customers are served by a combination of retail investor-owned utilities, cooperative utilities, and municipal-owned utilities. Investor-owned utilities (IOUs) are for-profit monopolies regulated by the Colorado Public Utilities Commission (CPUC).

Figure 6 provides a comparison of electric utility models. Colorado electric utilities’ service territories are shown in Figure 5.

- Investor-Owned Utility
- Municipal Utility
- CO-OP Cooperative Utility

**Figure 5: Types of Electric Utility Providers in Colorado**

**Structure:**
- Private, for-profit
- Public, not-for-profit
- Private, non-profit

**Owned by:**
- Shareholders
- Local Government
- Member-Owned

**Regulated by:**
- Public Utilities Commission
- Electors/Optics
- Coop Board of Directors

**Business Model:**
- Return on Investment
- All-Cost Electricity Rates
- All-Cost Electricity Rates

Battery Electric Bus Charging Infrastructure

Electric bus charging infrastructure falls into three categories:
- Plug-in depot charging
- On-route fast charging
- Overhead conductive charging (depot or on-route)

Typical charging configurations require a connection to the electric grid, transformer, switchgear, charger, and plug (displacen) as shown in Figure 7.

**Figure 6: Map of Colorado Utility Service Territories**

**Figure 7: Typical Battery Electric Bus Charging Station Schematic**

By working with utilities early in the planning process to integrate electrification plans into the utility’s 10-year plan rather than a lesser-term 5-year plan, they can significantly reduce the costs of infrastructural investment in substations upgrades, garage electrification, additional service-tries, etc.
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

- Updating the 2018 Inventory
- Determining Vehicle Replacement Schedule
- Identifying ZEV Replacement
- Calculating Average Vehicle & Charger Costs
### Financial Modeling Assumptions

<table>
<thead>
<tr>
<th>Updating the 2018 Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determining Vehicle Replacement Schedule</td>
</tr>
<tr>
<td>Identifying ZEV Replacement</td>
</tr>
<tr>
<td>Calculating Average Vehicle &amp; Charger Costs</td>
</tr>
</tbody>
</table>

- Vehicles reaching end of ULB between 2018-2021 have been replaced with “like” models.
- All known ZEV purchases are assumed complete by end of 2021.

At the start of 2022, the CO transit fleet is 100 ZEVs...puts us at 10 percent of the way to the 2030 goal!
Financial Modeling - Assumptions

- Updating the 2018 Inventory
- Determining Vehicle Replacement Schedule
- Identifying ZEV Replacement
- Calculating Average Vehicle & Charger Costs

Vehicles are replaced at or past their useful life benchmark

Between 2022 and 2030, 2000+ vehicles will be due for Replacement

Approx. 850 vehicles will be due for Replacement between 2028 and 2030
Financial Modeling Assumptions

- Updating the 2018 Inventory
- Determining Vehicle Replacement Schedule
- Identifying ZEV Replacement
- Calculating Average Vehicle & Charger Costs

<table>
<thead>
<tr>
<th>Initial Vehicle</th>
<th>Vehicle Length</th>
<th>Seating Min</th>
<th>Seating Max</th>
<th>Replacement Vehicle</th>
<th>Charging Requirement</th>
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</thead>
<tbody>
<tr>
<td>Articulated Bus</td>
<td>60</td>
<td>41</td>
<td>61</td>
<td>Articulated Bus</td>
<td>Level 3</td>
</tr>
<tr>
<td>Bus</td>
<td>40</td>
<td>31</td>
<td>40</td>
<td>Standard Bus</td>
<td>Level 3</td>
</tr>
<tr>
<td>Bus</td>
<td>30</td>
<td>18</td>
<td>30</td>
<td>Small Bus</td>
<td>Level 3</td>
</tr>
<tr>
<td>Cutaway</td>
<td>25</td>
<td>21</td>
<td>24</td>
<td>Large Cutaway</td>
<td>Level 2</td>
</tr>
<tr>
<td>Cutaway</td>
<td>25</td>
<td>15</td>
<td>20</td>
<td>Standard Cutaway</td>
<td>Level 2</td>
</tr>
<tr>
<td>Van*</td>
<td>15</td>
<td>6</td>
<td>14</td>
<td>Passenger Van</td>
<td>Level 2</td>
</tr>
<tr>
<td>Automobile*</td>
<td>5</td>
<td></td>
<td></td>
<td>Electric SUV</td>
<td>Level 2</td>
</tr>
<tr>
<td>Minivan*</td>
<td>5</td>
<td></td>
<td></td>
<td>Electric SUV</td>
<td>Level 2</td>
</tr>
<tr>
<td>Sports Utility Vehicle</td>
<td>5</td>
<td></td>
<td></td>
<td>Electric SUV</td>
<td>Level 2</td>
</tr>
<tr>
<td>Over-the-road Bus</td>
<td>60</td>
<td></td>
<td></td>
<td>Motorcoach</td>
<td>Level 3</td>
</tr>
</tbody>
</table>
### Financial Modeling Assumptions

- Updating the 2018 Inventory
- Determining Vehicle Replacement Schedule
- Identifying ZEV Replacement
- Calculating Average Vehicle & Charger Costs

#### Assumptions
- Vehicle Cost Parity between 2024 and 2030

#### Vehicle & Charger Costs

<table>
<thead>
<tr>
<th>Type Replacement</th>
<th>Cost</th>
<th>Charger Type</th>
<th>Charger Unit Cost</th>
<th>Charger Install</th>
<th>Total Charger</th>
<th>Non-ZEV Equiv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articulated Bus</td>
<td>$1,200,000</td>
<td>Level 3</td>
<td>$45,000</td>
<td>$40,000</td>
<td>$85,000</td>
<td>$850,000</td>
</tr>
<tr>
<td>Standard Bus</td>
<td>$800,000</td>
<td>Level 3</td>
<td>$45,000</td>
<td>$40,000</td>
<td>$85,000</td>
<td>$500,000</td>
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<tr>
<td>Small Bus</td>
<td>$525,000</td>
<td>Level 3</td>
<td>$45,000</td>
<td>$40,000</td>
<td>$85,000</td>
<td>$400,000</td>
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<tr>
<td>Large Cutaway</td>
<td>$250,000</td>
<td>Level 2</td>
<td>$5,000</td>
<td>$15,000</td>
<td>$20,000</td>
<td>$150,000</td>
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<tr>
<td>Standard Cutaway</td>
<td>$170,000</td>
<td>Level 2</td>
<td>$5,000</td>
<td>$15,000</td>
<td>$20,000</td>
<td>$90,000</td>
</tr>
<tr>
<td>Passenger Van</td>
<td>$150,000</td>
<td>Level 2</td>
<td>$5,000</td>
<td>$15,000</td>
<td>$20,000</td>
<td>$60,000</td>
</tr>
<tr>
<td>Electric SUV</td>
<td>$35,000</td>
<td>Level 2</td>
<td>$5,000</td>
<td>$15,000</td>
<td>$20,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Motorcoach</td>
<td>$850,000</td>
<td>Level 3</td>
<td>$45,000</td>
<td>$40,000</td>
<td>$85,000</td>
<td>$50,000</td>
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</table>
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?
## The Thought Exercise...

What will replacing vehicles like-for-like cost?

<table>
<thead>
<tr>
<th>Do we meet the 2030 goal?</th>
<th>Number of ZEVs in the Fleet in 2030</th>
<th>Do we hit the 2050 goal?</th>
<th>% of Colorado Transit Fleet that is ZEV in 2050</th>
<th>Cost of Vehicle Replacements</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>100</td>
<td>X</td>
<td>7%</td>
<td>$1.8-$1.9B</td>
</tr>
</tbody>
</table>

How does this compare to...

- Replacing all vehicles with ZEVs starting in 2022?
- Replacing all vehicles with ZEVs starting in 2030?
- Somewhere in between...2025?
### Financial Modeling

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Do we meet the 2030 goal? (# of ZEVs in 2030 Fleet)</th>
<th>Do we hit the 2050 goal? (% of Fleet that is ZEV in 2050)</th>
<th>Cost of Vehicle Replacements</th>
<th>Incremental Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>No ZEVs</td>
<td>✗ (100)</td>
<td>✗ (7%)</td>
<td>$1.85B to $1.95B</td>
<td>-</td>
</tr>
<tr>
<td>2022</td>
<td>✓ (2,100 to 2,200)</td>
<td>✓ (100%)</td>
<td>$2.05B to $2.15B</td>
<td>$185M to $195M</td>
</tr>
<tr>
<td>2025</td>
<td>✓ (1,650 to 1,750)</td>
<td>✓ (100%)</td>
<td>$2.0B to $2.1B</td>
<td>$150M to $160M</td>
</tr>
<tr>
<td>2030*</td>
<td>✗ (200 to 300)</td>
<td>✓ (100%)</td>
<td>$1.95B to $2.05B</td>
<td>$145M to $155M</td>
</tr>
</tbody>
</table>

Transitioning the CO fleet to ZEVs is projected $150M to $190M (8-10%) more than maintaining the existing fleet.
Key Takeaways

Transitioning the CO fleet to ZEVs is projected $150M to $190M (8-10%) more than maintaining the existing fleet.

- Cost of EV Chargers are a significant portion of the incremental costs

The near-term push to 1,000 will cost an additional $5-15M to meet the 2030 goal

- Waiting until 2030 delays hitting the 1,000 ZEVs target until 2033-2034
Next Steps & Lessons Learned

Limited CO Data to inform modeling

The ZEV Market is rapidly changing

Collecting Additional Data will inform the next iteration of the Transit ZEV Roadmap and Financial Model
Achieving Colorado’s ZEV Transit Goals

Transit ZEV Roadmap Goal: Full transition of Colorado’s transit fleet to Zero Emission Vehicles.

The Transit ZEV Roadmap is an outcome of the 2020 Colorado EV Plan and supports the following transit goals:

- Transitioning 1,000 transit vehicles to ZEVs by 2030.
- Operating a 100 percent ZEV transit fleet by 2050.

The 2020 EV Plan includes the following transit specific goals, objectives and actions:

- CEO, CDOT and CDPHE will work with stakeholders to investigate adoption of a Clean Bus Rule that requires a long-term transition to zero emission buses.
- CEO, CDOT, CDPHE and the CEVC will explore equity and rural-focused transit options and provide a recommendation for action in the next iteration of the EV Plan.
- CDOT will develop a state-approved master purchasing contract for zero emission vans, cutaways and large buses to streamline transit agency procurement of EVs.
- CDOT will continue and expand transit electrification planning in order to attain 2020 ZEV Plan Transit Goals.
- CEO will work through CEVC Beneficial Electrification Subgroup on a survey to gather data on utility rates with municipal utilities and rural co-ops to develop new rates that encourage EV charging and adoption by individuals, fleets and transit agencies in spring 2020.
- CDOT’s Division of Transit and Rail will continue to utilize remaining VW settlement funds to support the purchase of zero emission transit vehicles.
- CDOT will incorporate EV Plan transit goals into program planning by January 2021.
- CDOT will work to Integrate recommendations from CEO’s EV Equity Study into its transit electrification grant programs by January 2023.

The Transit ZEV Roadmap implementation plan has five goal areas:

POLICY
Identity policies to remove/reduce barriers to ZEV transition and implementation.

EDUCATION & TRAINING
Provide training to promote workforce readiness and educational programs for riders and policy decision-makers.

PLANNING & TECHNICAL SUPPORT
Increase access to technical resources and expertise to support the planning, design, and implementation activities.

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

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

Strategies for each goal area were developed through a collaborative process including CDOT, the Colorado EV Coalition Transit Subgroup, Colorado’s transit agencies and other key stakeholders. In support of the development of the Transit ZEV Roadmap and the Implementation Plan, virtual stakeholder interviews were held with transit agencies and an online survey was distributed to all transit agencies to inform the state of the current transit ZEV transition and to understand issues and opportunities and to inform priorities. The transit agency ZEV Transition Survey summary can be found in Appendix I. Stakeholder input, combined with the data, analysis and research informed the implementation plan and priorities to support Colorado’s transit agencies in transitioning to ZEV fleets.
Implementation Plan

Goal Areas

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

Implementation Timeframes

| Near-Term: 2021-2024 | Mid-Term: 2025-2028 | Long-Term: 2028-2030 |
Coordinated Zero Emission Vehicle Funding Strategy

Cady Dawson | Felsburg Holt & Ullevig
Mike King | Colorado Department of Transportation
$733 million of new fee revenue supports 3 new electrification and charging infrastructure Enterprises:

**Charging Infrastructure & Electric Vehicle Equity**
- New ‘Community Access’ Enterprise in Colorado Energy Office (CEO)
- Build charging infrastructure in communities across the State, and support electric vehicle and eBike adoption in low- and moderate-income communities
- **$310 million** investment
- Paired with existing CO EV Infrastructure Fund - $115 million and potential federal $115 million investment

**Fleet Electrification Incentives**
- New ‘Clean Fleet’ Enterprise in CO Department of Public Health and Environment (CDPHE)
- Support fleet replacement (delivery trucks, TNCs, school buses, and other light/medium/heavy duty vehicles) with incentives to meet climate and air quality goals
- Support CDPHE’s Mobile Source Program to complement vehicle investment.
- **$289 million** investment

**Public Transit Electrification**
- New enterprise in Colorado Department of Transportation (CDOT).
- Support electrification of public transit through electrification planning efforts, fleet replacement and associated charging infrastructure.
- **$134 million** investment
Application for membership in the Enterprise boards is now open. SB21-260 particularly encourages members representing:

- Disproportionately impacted communities
- The automobile industry including manufacturers and dealers, electric vehicle charging and fueling businesses, or owners and operators of motor vehicle fleets
- Business or organization that supports electric alternatives to motor vehicles
- General interest

If interested, please complete the survey form and application found here:

https://docs.google.com/forms/d/e/1FAIpQLSemzIPOojCoHokHwp12sWm6NizQg4vhjFCD7hqphzY_x67_jw/viewform
VW Transit Settlement Program

Past & Current Funding Rounds

Year 1 Awards
- $13,828,037
- 6 agencies
- 23 electric buses (with 20 EVSEs)
- 1 CNG buses
- 3 LPG buses

Year 2 Awards
- $2,903,940
- 3 agencies
- 6 electric buses (with 5 EVSEs)

Year 3 Awards
- $5,624,676
- 4 agencies
- 10 electric buses (with 9 EVSEs)
In 2018, Transfort (Fort Collins) was awarded $775,000 CMAQ funding from the North Front Range Metropolitan Planning Organization (NFRMPO) for the purchase of one ZEV and one charging unit.
Federal Transit Administration 5339 (c) “Low/No” Grant Program Eligibility

- Low or No Emission vehicles (purchase or lease)
- Charging/fueling equipment
- Construction or upgrade of facilities vehicles or equipment
Federal Transit Administration 5339 (c) “Low/No” Grant Program

FTA 5339 (c) – “Low/No” Grant Funding

Support from Colorado Association of Transit Agencies

Grant review and coordination with transit agencies

2021 Low/No Funding awarded to City of Fort Collins (Transfort)

Grants submitted through CDOT

Maximized funding allocation to Colorado

Support from Colorado Association of Transit Agencies

Grant review and coordination with transit agencies

2021 Low/No Funding awarded to City of Fort Collins (Transfort)
Roaring Fork Transportation Authority (RFTA)

Battery Electric Buses - Case Study

Jason White
Roaring Fork Transportation Authority
RFTA & City of Aspen
Battery Electric Bus (BEB) Pilot Project

Wednesday September 8th, 2021
Regional transit authority, 8 members
2nd largest transit agency in Colorado
Largest rural transit agency in the nation
First rural BRT System, opened in 2013
Spanning four rural utility regions
5.5 million passengers (2019)
5.15 million miles of service (2019)
360 employees during peak winter season
34-mile Rio Grande Rail Corridor and Trail
$60 million budget
100 revenue service vehicles
36 compressed natural gas (CNG)
8 battery electric buses (BEBs)
12 older diesel-electric hybrids
Over 80,000 annual WE-cycle public bike trips
DRAFT

Transit Zero Emission Vehicle Roadmap

August 23, 2021

Achieving Colorado’s ZEV Transit Goals

Transit ZEV Roadmap Goal: Full transition of Colorado’s transit fleet to Zero Emission Vehicles.

The Transit ZEV Roadmap is an outcome of the 2020 Colorado EV Plan and supports the following transit goals:

- Transitioning 1,000 transit vehicles to ZEVs by 2030.
- Operating a 100 percent ZEV transit fleet by 2050.

Why Electric?
Why RFTA?

**VISION, MISSION & VALUES**

**OUR VALUES**
- Safe, Accountable
- Affordable, Conveninet
- Dependable, Efficient
- Sustainable

**VISION**
RFTA pursues excellence and innovation to provide a preferred transportation choice that connects and empowers vibrant communities.

**MISSION**
Connecting our region with transit and trails.

**VALUES**

**SAFETY**

**ACCESSIBILITY AND MOBILITY**

**SUSTAINABLE WORKFORCE**

**FINANCIAL SUSTAINABILITY**

**SATISFIED CUSTOMERS**

**ENVIRONMENTAL SUSTAINABILITY**

**HIGH PERFORMING ORGANIZATION**
Jan. 2017 scoping workshop with bus vendors

Revenue operation in December 2019

(8) XE40 New Flyer CHARGE Excelsior buses

(4) dual ABB 150 kW depot chargers

$8.5 m project (50% local funding)

Align with Fleet Management/Replacement Plan

Fleet Diversity: 1/3 diesel, 1/3 CNG, 1/3 ZEV

Challenging Operational Conditions

Holy Cross Energy (HCE) time-of-use tariff

Exploring renewable energy offset options

2 years: 300,000 miles, 155-mile range, 1.6 kWh/mile
Quiet, Simple, Comfortable & Clean

- Coordinate early with utility companies, demand rates?
- Grant strategy
- Vendor contracts
- Total cost of ownership, O&M by fuel type
- Maximize public support
- Regenerative braking on icy roads
- Depot vs. on-route charging infrastructure
- Integrated data software
- Colorado Electric Vehicle Coalition (CEVC)
- Information exchange
- Driver champions