Capital District Transportation Authority
Climate Action Plan
February 2023

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Executive Summary

Transportation is a significant contributor to climate, and the reduction of greenhouse gas (GHG) emissions from the U.S. transportation sector is a top concern for both the federal and New York State governments. In 2021, the Biden-Harris Administration set a goal for the U.S. to reduce its net GHG emissions economy-wide by 50% to 52% of 2005 levels by 2030. New York State (NYS) has similarly set goals for the transition to zero-emission buses (ZEBs), school buses, and passenger vehicles to reduce transportation-related pollution.

In June 2021, the Federal Transit Administration (FTA) launched Phase 1 of the Sustainable Transit for a Healthy Planet Challenge to encourage transit agencies to act and invest in strategies to reduce their GHG emissions. Phase 2 of the challenge kicked off in April 2022 with the goal of increasing agency participation by 25%.

The Capital District Transportation Authority (CDTA) has developed this Climate Action Plan to augment its existing Zero-Emission Fleet Transition Plan and hone its holistic approach to contributing to a cleaner climate. The plan sets a baseline of the organization's current emissions levels, describes existing sustainability initiatives, and proposes future goals and implementation strategies to improve the air quality of the Capital Region through the reduction of GHG pollution.

1. Introduction

CDTA has developed its 2023 Climate Action Plan to assess its current emissions level and set emission reduction goals and implementation strategies, in conjunction with the FTA Sustainable Transit for a Healthy Planet Challenge. This plan works in tandem with the CDTA Zero-Emission Fleet Transition Plan, which charts a path toward a full zero-emission revenue fleet. These initiatives seek to fulfill the NYS mandate for the five largest upstate and suburban transit agencies to operate a zero-emission fleet by 2035, and the Biden-Harris Administration goal to reduce GHG pollution levels economy-wide by 50% to 52% from 2005 levels by 2030.

When emitted into the atmosphere, greenhouse gases trap heat, warming the earth's surface and contributing to climate change. The concentration of carbon dioxide (CO_2) in the atmosphere, a major factor on the warming effect, "has increased by 50% since the Industrial Revolution."[1] Nitrous oxides (NO_X) and particulate matter pollution decrease air quality, negatively affecting human health.[2][3] Diesel and gasoline vehicles are significant contributors to NO_X, CO_2, and particulate matter emissions released into the atmosphere. Transit agencies can significantly affect the air quality of their regions by shifting to low- or no-emission vehicles and improving the energy efficiency of their facilities.

This plan sets a baseline for CDTA's emissions by calculating its Fiscal Year (FY) 2022 revenue and non-revenue fleet emissions. The organization's total CO_2, NO_X, and particulate matter emissions are contextualized with CDTA's FY 2022 passenger miles, service area population, and unlinked passenger trips. An expanded inventory of facilities-related emissions is currently underway and will be included upon completion. Also included is a list of federal, state, and organizational initiatives to increase sustainability and reduce GHG emissions from transportation. Finally, the plan sets three primary goals and related strategies that CDTA can employ to operate in a more environmentally friendly way. These are:

1. Increase both percentage of the fleet that is zero-emission and the average miles per zero-emission bus.
2. Increase transit use in CDTA's service area.
3. Implement sustainable features in new facility construction.

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[1] What are greenhouse gases?, National Grid, https://www.nationalgrid.com/stories/energy-explained/what-are-greenhouse-gases.
[2] Nitrogen Oxides (NO_X) Control Regulations, EPA Region 1, https://www3.epa.gov/region1/airquality/nox.
[3] What is PM (Particulate Matter), EPA Region 1, https://www3.epa.gov/region1/airquality/pm-what-is.html.

This plan will guide CDTA in the pursuit of its three emissions reduction goals, in coordination with the core pillars established in CDTA's FY2020-2023[4] Strategic Plan. The foundation of the strategic plan was developed with input from CDTA's stakeholders, employees, and customers who benefit from efficient financial stewardship, innovation, and community-focused service and mobility options. This Climate Action Plan will be periodically revised to update the emissions inventory, track progress, and realign goals with future initiatives.

[4] CDTA's Fiscal Year = April 1st through March 31st.

2. Agency Overview

CDTA is headquartered in Albany, NY and provides regular route bus service, shuttle systems, and paratransit services to Albany, Rensselaer, Schenectady, Saratoga, and Montgomery Counties. With over 63 routes, CDTA serves approximately 12 million riders annually post-COVID and averages 30,000 to 40,000 weekday riders. The Northway Xpress is a commuter service that connects Saratoga County residents to the major government and business offices in Downtown Albany. Two BusPlus+ bus rapid transit (BRT) lines provide 40 miles of frequent bus service to connect the major population centers of the Capital Region with 10- to 15-minute headways. A third BRT route, the Purple Line, is currently in development. In addition to its bus-based services, CDTA offers a full menu of mobility options, which includes the CDPHP *Cycle!* shared bicycle program, the FLEX on-demand transit program, and the *Drive* electric car share program launched in January 2023. In January 2020, CDTA rolled out the first battery-electric bus (BEB) in Upstate New York. CDTA is committed to being the mobility manager of New York's Capital Region with a slate of convenient, sustainable mobility options.

Our Mission: CDTA provides mobility solutions that connect the region's communities.

CDTA's service operates out of three divisions located throughout the Capital Region in the cities of Albany, Troy, and Schenectady. Each division contains a maintenance facility and bus garage. The Albany Division is also home to CDTA's administrative headquarters. The organization's fixed route fleet consists of approximately 250 forty-foot buses, 8 of which are battery-electric, and 30 sixty-foot articulated buses. CDTA also utilizes 30 Ford E-350 cutaways for its paratransit service. The organization owns the Rensselaer Rail Station and Saratoga Springs Train Station, which serve as the primary Amtrak stations in the region, and the Defreestville, Menands, and Albany County Rail Trail Park & Rides.

CDTA prioritizes initiatives that benefit the authority's three core groups: employees, customers, and stakeholders. More specifically, projects and service goals are viewed through the lens of how they foster regional development, support the growth of employees, and service the authority's customers. Four additional strategic pillars that guide CDTA's work and initiatives are financial stewardship, innovation, community, and service & mobility. All initiatives are managed to be financially efficient, with innovative technology to establish CDTA's place in the community by expanding service options.

3. Emissions Inventory

This emissions inventory seeks to set a baseline using data from Fiscal Year 2022 to assess the progress of future emission reduction strategies. Considered are CDTA's primary areas of contribution to GHG emissions: revenue fleet operations and nonrevenue operations. An emissions inventory of CDTA's facilities is currently underway and will be added to this section upon completion. Total calculated emissions are then compared to annual passenger miles, unlinked passenger trips, and the service area population for context.

Revenue Fleet Operations

CDTA's emissions inventory is based on the revenue fleet mix typically employed throughout FY 2022. The fixed route fleet consists primarily of 40' Gillig diesel buses, many of which are hybrid-electrics, in addition to several articulated 60' diesel buses, and four New Flyer battery-electric buses. Seven gasoline trolleys serve special seasonal routes. The paratransit service is operated via 30 gasoline powered cutaways, primarily on Ford E-350 chassis, and the FLEX on-demand service uses 14 Ram ProMaster 3500 gasoline vans. Total vehicle miles in 2022 was 10.76 million across the 309-vehicle fleet.

Table 3-1 Revenue Fleet Mix

Vehicle Type	Count	Total Vehicle Miles	Average Miles per Vehicle
40' Buses Diesel	245	9,006,033.0	36,759.3
60' Buses Diesel	9	307,689.9	34,187.8
Trolley (Gasoline)	7	107,474.1	15,353.4
Cutaways (Gasoline)	30	934,600.4	31,153.3
Vans (Gasoline)	14	304,786.7	21,770.5
40' Battery-Electric	4	103,695.0	25,923.8
Total	**309**	**10,764,279.1**	

Non-Revenue Vehicle Operations

Revenue operations are supported by 41 non-revenue vehicles, of which 17 are passenger supervisor and on-road support vehicles and 22 are facilities and maintenance support vehicles. Two are Chevrolet Bolts EVs.

Table 3-2 Non-Revenue Fleet Mix

Vehicle Type	Count	Total Vehicle Miles	Average Miles per Vehicle
Passenger (Gasoline)	17	281,929.9	16,584.1

Support (Gasoline)	22	211,849.3	9,629.5
Passenger (Electric)	2	12,401.0	6,200.5
Total	**41**	**506,180.2**	

Fuel Breakdown

The fixed route fleet used over 2 million gallons of diesel fuel in Fiscal Year 2022 at an average cost of $2.02 per gallon. The vans, cutaways, and trolleys used 181,451 gallons of gasoline at an average cost of $2.51 per gallon. The total CO_2 emissions output of those 2.2 million gallons of fuel was 24,951.4 tons in Fiscal Year 2022. NOX emissions totaled 37.9 tons, and particulate matter emissions totaled 0.98 tons.

Table 3-3 Fuel Usage & Emissions

Fuel Type	Fuel Usage (gal)	Average Cost per Gallon	CO_2 (tons)[a]	NOx (tons)[b]	Particulate Matter (tons)[b]
Diesel	2,065,131.0	$ 2.02	23,173.9	36.5	0.92
Gasoline	181,451.6	$ 2.51	1,777.5	1.4	0.06
Total	**2,246,582.6**		**24,951.4**	**37.9**	**0.98**

[a] https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references

[b] https://www.bts.gov/content/estimated-national-average-vehicle-emissions-rates

CDTA's four BEBs used 238,681.6 kWh of energy to travel 103,695 miles in Fiscal Year 2022. Each BEB is outfitted with a data hub from ChargePoint (formerly ViriCiti) that tracks energy charged, miles driven, and energy used, among other data points. This information can be used to calculate the net emissions result from charging and operating the BEBs, shown in the tables below. As a result of their operation, CDTA's BEBs saved 14.2 tons and 0.29 tons of CO_2 and NO_X emissions, respectively, from being produced. It is estimated that the power generation for charging emits more particulate matter than is saved by operating the BEBs, therefore the net result is 1.3 tons of particulate matter emissions.

Table 3-4 BEB Net Emissions Result

Produced

CO_2		NO_X		Particulate Matter	
Energy Used (kWh)	238,681.62	*Energy Used (kWh)*	238,681.62	*Energy Used (kWh)*	238,681.62
Emissions (lb/kWh)	1.3062	*Emissions (lb/kWh)*	0	*Emissions (lb/kWh)*	0.01102
Total (lbs)	**311,765.93**	***Total (lbs)***	**0.00**	***Total (lbs)***	**2,630.27**

Saved

CO_2		NO_X		Particulate Matter	
Miles Driven (mi)	103,695.00	*Miles Driven (mi)*	103,695.00	*Miles Driven (mi)*	103,695.00

Emission from Diesel Bus (lb/gal)	22.0486	*Emission from Diesel Bus (lb/gal)*	0.0371	*Emission from Diesel Bus (lb/gal)*	0.0009
Diesel Bus Consumption Rate (gal/mi)	0.1488	*Diesel Bus Consumption Rate (gal/mi)*	0.1488	*Diesel Bus Consumption Rate (gal/mi)*	0.1488
Total (lbs)	**340,205.84**	***Total (lbs)***	**572.45**	***Total (lbs)***	**14.29**

Net Result (Produced – Saved)

CO_2		NO_X		Particulate Matter	
Total (lbs)	(28,439.91)	***Total (lbs)***	(572.45)	***Total (lbs)***	2,615.98
Total (tons)	(14.22)	***Total (tons)***	(0.29)	***Total (tons)***	1.31

Emissions Context

CDTA's calculated emissions in Fiscal Year 2022 are 24,937.2 tons of CO2, 37.6 tons of NOX, and 2.29 tons of particulate matter. The following tables contextualize those emissions results in comparison to CDTA's Fiscal Year 2022 passenger miles, service area population, and unlinked passenger trips.

Table 3-5 Emissions per Passenger Mile

Emission Type	Emissions Produced (tons)	Annual Passenger Miles	Emissions per Ride Mile
CO_2	24,937.2	41,973,361	0.0005941
NO_X	37.6	41,973,361	0.0000009
Particulate Matter	2.29	41,973,361	0.0000001

Table 3-6 Emissions per Service Area Population

Emission Type	Emissions Produced (tons)	Service Area Population	Emissions per Person
CO_2	24,937.2	511,949	0.0487103
NO_X	37.6	511,949	0.0000734
Particulate Matter	2.29	511,949	0.0000045

Table 3-7 Emissions per Unlinked Passenger Trips

Emission Type	Emissions Produced (tons)	Unlinked Passenger Trips	Emissions per Trip
CO_2	24,937.2	11,161,113	0.0022343
NO_X	37.6	11,161,113	0.0000034
Particulate Matter	2.29	11,161,113	0.0000002

4. Past & Current Initiatives

CDTA's climate action planning activities build upon past and ongoing initiatives, both external and internal. Externally, the federal and NYS governments have led the way in prioritizing the shift to more sustainable transportation options and influencing a mode shift to transit from single-occupancy car travel. Internally, CDTA has been researching what is needed for its workforce and facilities to implement a zero-emission fleet in the most financially responsible way. All of these activities are summarized below.

Federal

The Infrastructure Investment and Jobs Act of 2021 (IIJA), also known as the Bipartisan Infrastructure Law, amended the statutory provisions for the Grants for Buses and Bus Facilities Competitive Program and the Low or No Emission Program to require the inclusion of a Zero-Emission Transition Plan in all program applications. CDTA completed its Zero-Emission Transition Plan in May 2022, and it was submitted with the Low- or No-Emission grant application.

New York State

In his 2020 State of the State address, Governor Andrew Cuomo announced a target for the five largest upstate and suburban transit authorities to electrify 25% of their fleets by 2025 and 100% by 2035 (the state electrification goals).[5] Governor Kathy Hochul has since set targets to electrify all school buses and state fleet vehicles before 2035. New York State has set ambitious climate targets to reduce overall GHG emissions by 40% from 1990 levels by 2030 and 85% by 2050.[6]

The New York State Energy Research and Development Authority (NYSERDA) New York Truck Voucher Incentive Program (NYTVIP) provides vouchers for the purchase or lease of all-electric (battery electric or BEV), hydrogen fuel cell electric (FCEV) plug-in hybrid electric (PHEV), conventional hybrid electric (HEV), compressed natural gas (CNG), or propane medium- and heavy-duty vehicles. The first round of $16.7 million in funds was available to eighteen transit authorities throughout the state starting in February 2020. A second-round of $16.4 million of Volkswagen Settlement funding became available in December 2020 to the five largest transit

[5] NYS 2020 State of the State, Governor Andrew Cuomo, pg. 27, https://www.budget.ny.gov/pubs/archive/fy21/exec/book/briefingbook.pdf.
[6] New York's Nation-Leading Climate Targets, NYS Climate Act, https://climate.ny.gov/our-impact/our-progress/.

authorities identified by Governor Cuomo to fully electrify their fleets by 2035. CDTA used this NYTVIP funding to secure its first four BEBs.

In September 2022, Governor Kathy Hochul signed Executive Order 22: Leading by Example: Directing State Agencies to Adopt a Sustainability and Decarbonization Program setting sustainability standards for state-operated fleets, buildings, and procurement programs.[7] Executive Order 22 builds upon the success of the GreenNY Council, which provides resources for environmentally friendly purchasing, cleaning, and waste reduction for NYS agencies.[8] GreenNY also releases a regular progress report on state green procurement and agency sustainability initiatives. In the 2020-2021 report, CDTA was listed as the state agency with the tenth most solar energy generation with 48,000 kWh generated.[9]

Battery-Electric Bus Pilot Project

CDTA obtained four BEBs in January 2020 to pilot the technology, charging infrastructure, and delivery management of an electric bus fleet. These 40' buses were acquired from New Flyer of America, and the cost for the buses, charging infrastructure, training, and maintenance tools totaled $3.9 million. To charge the pilot BEBs, four Siemens RAVE direct current 150 kW depot chargers were installed in the Albany garage in February 2020. Each charger is connected to one plug-in dispenser that connects the charger to the bus. A SATEC submeter was installed with the chargers to determine the portion of the energy used by the BEBs. An additional four BEBs were purchased in 2022 and all were in service by November 2022. National Grid limits the chargers to 70 kW—less than half their capacity—and only two can be operating simultaneously due to the building's current power service.

In the first year of the pilot, each bus traveled an average of 22,122 miles and was tested on a range of routes and blocks. The electric buses were utilized in service 63% of the time and available, but not in service, 26% of the time. The BEBs were more efficient than the conventional diesel buses, having achieved 15 MPGe on average compared to 4.7 MPG. The fuel cost per mile for the BEBs was $0.21, and the maintenance cost per mile was $0.34 during the first year of the pilot, which is lower than the equivalent costs for the diesel buses.

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[7] NYS Executive Order 22, Governor Kathy Hochul, https://www.governor.ny.gov/executive-order/no-22-leading-example-directing-state-agencies-adopt-sustainability-and.
[8] GreenNY: State Purchasing and Operations, NYS Office of General Services, https://ogs.ny.gov/greenny.
[9] Greening New York State Fiscal Year 2020-2021 Progress Report, GreenNY Council, pg. 20, https://ogs.ny.gov/system/files/documents/2022/04/eo4_report_fy2020-21.pdf.

CDTA experienced many of the typical constraints and challenges of BEBs during the pilot period. The ambient temperature highly constrained the experienced range and endurance of the pilot BEBs, as well as the average speed traveled. Route characteristics and operator behavior also impacted range. In the transition from a diesel bus fleet, all transit authorities will need to address these challenges when deploying BEBs, particularly those in colder regions. Since the start of the pilot, CDTA has reviewed several software and hardware tools to more efficiently and effectively operate BEBs.

Zero-Emission Fleet Transition Plan

CDTA developed its first zero-emission bus transition plan in 2022. The plan reviews the purpose of CDTA's fleet transition, ZEB technology options, anticipated impacts on the workforce, and potential barriers to transitioning to a ZEB fleet. The plan was then submitted with the organization's Fiscal Year 2023 FTA Low- or No-Emission Vehicle Program application for which the organization was awarded $25.9 million for the purchase of vehicles, chargers, vehicle management systems, and facility upgrades at the Albany Division.

Facility Lighting Upgrades

CDTA has already taken steps to increase the energy efficiency of its facilities. In 2020 and 2021, all the lights at the Troy Division, Schenectady Division, and Saratoga Rail Station were upgraded to LEDs using $200,000 of internal funds. In 2022, CDTA received a discretionary grant from NYS Assemblymember John T. McDonald III through the Dormitory Authority of the State of New York (DASNY). The DASNY grant will be used to upgrade all LED lighting at the Albany Division and the nearby administrative building at 85 Watervliet Avenue for $292,000. The project is estimated to be completed by the end of 2023. The improved lighting in these five buildings will save 903,944 kWh of electricity use over the life of the lights. This LED replacement project is also in line with the goals of NYS Executive Order 22 and the GreenNY Council described above.

Facilities Alternatives Planning

In planning for a zero-emission fleet, CDTA has reviewed the state of its current facilities and their potential to support ZEB fueling. Of its three divisions, only Albany can support the existing BEBs. To house a 100% ZEB fleet, the Albany Division's power supply must be upgraded, work for which is currently in progress in conjunction with the utility provider, National Grid. The Troy and Schenectady Divisions are further constrained by space and available power supply. In 2022, CDTA undertook a facilities alternatives analysis to assess all options for expanding or building

new facilities throughout its footprint. The highest-rated alternative was the construction of a new West Facility to replace the current Schenectady Division, which would operate CDTA's expanding western and northern service areas. Further planning and design for a new West Facility are currently underway, with a focus on sustainability features, such as solar roofing panels, an offsite solar farm, heat pump technology for heating and cooling, anaerobic digestion for reducing organic waste, a green roof, and a bus wash water reclamation system.

5. Emission Reduction Goals & Strategies

CDTA plans to pursue three primary goals to reduce its emissions footprint. The most important of these is the expansion and greater utilization of the ZEB fleet. Additionally, CDTA will pursue methods for expanding ridership, shifting rides from single-occupancy vehicles, and seeking strategies for reducing its facility-related footprint.

Goal 1: Increase Both the Percentage of the Fleet that is Zero-Emission and the Average Miles per ZEB

- Procure BEBs as funding and charging capacity allows.
- Expand charging capacity at Albany Division.
    - Work currently underway in conjunction with the utility provider.
    - Expanded charging capacity will allow CDTA to use its four existing chargers at full capacity.
    - Install additional chargers for expansion of BEB fleet.
- Operate BEBs efficiently to increase average mileage per bus.
    - Leverage innovative technologies including software and hardware solutions to account for weather and charging constraints.

Goal 2: Increase Transit Use in CDTA's Service Area

- Expand service area to underserved areas.
    - 2022 Montgomery County expansion.
- Expand BRT offerings in the region, which have historically resulted in increased ridership overall.
    - Purple Line is currently under construction.
- Expand transit mobility offerings to promote a wide-ranging network of options.
    - Bike-share, scooter-share, car-share, and on-demand transit.
- Partner with municipalities on mutually beneficial programs.
    - Transit-oriented communities, mobility hubs, and traffic signal priority projects.

Goal 3: Implement Sustainable Features in New Facility Construction

- Research all sustainable features and renewable energy options in the design of a new West Facility.
    - Including, but not limited to, LED lighting, a green roof, solar generation, on-site energy storage, etc.
- Perform a cost-benefit analysis of all identified sustainable features at all facilities.
- Identify opportunities to retrofit existing facilities with renewable energy generation opportunities or more efficient features.

6. Implementation & Next Steps

CDTA regularly monitors the operation of its electric buses, the transition of the full fleet to zero-emission vehicles, and the most efficient and effective use of the recently awarded Low-No funding in 2022. This climate action plan and the goals outlined in the previous section are in line with all of those activities and will continue to be as the organization moves forward with its plans. Funding from programs such as the NYTVIP, the Low- or No-Emissions Program, and the RAISE Discretionary Grant Program, among other opportunities, has been and will continue to be leveraged to achieve these goals. The ZEB Transition Plan and the Climate Action Plan will be updated periodically to include new developments.

Moving forward, the largest challenge for CDTA's sustainability goals is the need for facility upgrades to support a ZEB fleet. CDTA has taken the steps necessary to identify the needs of each facility and assess a path forward for each. Additionally, CDTA will focus on the needs of its workforce in this transition and identify training and development opportunities that will help each department as they continue to adopt and optimize the use of zero-emission buses. As it is outlined in CDTA's Strategic Plan, the organization will pursue its climate goals in a way that benefits its regional partners, employees, and customers in an equitable, innovative, and financially responsible way.