ZERO EMISSIONS
Let's clear the air

Maryland Zero Emission Bus Transition Act Legislative Report

FEBRUARY 2022

Submitted by:

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
MARYLAND TRANSIT ADMINISTRATION

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Glossary of Terms

AFLEET	Alternative Fuel Lifecycle Environmental and Economic Transportation model
BEB	Battery-Electric Bus
BESS	Battery Energy Storage System
BGE	Baltimore Gas and Electric
CBA	Collective Bargaining Agreement
CMRTP	Central Maryland Regional Transportation Plan
CO_2	Carbon Dioxide
EPA MOVES 2014b	Motor Vehicle Emissions Simulator model
FCB	Fuel-Cell Bus
GGRA	Greenhouse Gas Reduction Act
GREET	Greenhouse Gases, Regulated Emissions and Energy Use in Transportation model
HFCB	Hydrogen Fuel-Cell Bus
kV	Kilovolt
kWh	Kilowatt-Hour
PSC	Maryland Public Service Commission
PM	Particulate Matter
PV	Photovoltaic
RFP	Request for Proposals
SB 137	Maryland Senate Bill 137
SO_c	Sulfur Oxide
MDOT	Maryland Department of Transportation
MDOT MTA	Maryland Department of Transportation - Maryland Transit Administration
NO_x	Nitrous Oxide
VOC	Volatile Organic Compounds
YOE	Year of Expenditure
ZE	Zero-Emissions
ZEB	Zero-Emissions Bus

1 Introduction

Maryland Department of Transportation Maryland Transit Administration (MDOT MTA) is submitting this Annual Report in adherence with the requirements within Section E of Senate Bill 137 (SB 137). This section requires MDOT MTA to compose an annual report detailing the Administration's progress in 2021 towards achieving zero-emissions fleet conversion goals, including an analysis of potential carbon emissions reduction and capital and operating expenses that will result from the conversion, as compared to the Administration continuing to purchase, operate, and maintain diesel buses.

In 2016, The Maryland Greenhouse Gas Reduction Act Reauthorization[1] set a 40-percent reduction target for statewide emissions by 2030 from 2006 levels. MDOT MTA subsequently established a goal to convert 50 percent of its fleet to zero emission buses (ZEBs) by 2030 in the Central Maryland Regional Transportation Plan (CMRTP). In 2020, MDOT MTA commenced a two-phase Transition Study evaluating facility upgrades, utility infrastructure, rolling stock, and charging infrastructure needed to achieve the 2030 transition goal.

In 2021, the passage of SB 137 confirmed that MDOT MTA is prohibited from entering into new procurements for non-ZEBs beginning in fiscal year 2023. MDOT MTA's current contract with Nova Bus includes the delivery of clean diesel buses through 2024; the subsequent bus procurement (which will include vehicles to be delivered from 2025-2030) must only include ZEBs.

Peer agencies have advised that it is critical for MDOT MTA to begin preparing for this upcoming bus procurement. Vehicle production lead times, strained by material sourcing delays, can be over 12 months. Transit agencies nationwide will be placing large ZEB orders as they are mandated or make policy commitments to grow their ZEB fleets. As ZEB technology is constantly changing, warranty terms for buses and chargers are critical to ensure transit service to the Baltimore region is not disrupted.

Only about 2% to 3% of the U.S. transit fleet currently consists of ZEBs. Full integration is a long way off, and agencies are facing steep learning curves as they integrate ZEBs into their fleets. Technology advancements are beginning to improve vehicle efficiency, such as battery capacity, but these innovations will take time to thoroughly test and evaluate.

Global supply chain issues will constrain delivery timeframes from vehicle and infrastructure manufacturers for the next few years. Where possible, MDOT MTA is preparing contingency plans to mitigate risk factors outside of their control, including vehicle and charger delivery delays.

2 Previous Work

MDOT MTA's Transition Study evaluated battery-electric buses (BEBs) and fuel-cell electric buses (FCEBs). Results from the study recommended that MDOT MTA pursue BEBs for an initial pilot program to assess performance, as well as for the first few years of ZEB-only procurement beginning in 2025. This recommendation to operate BEBs over FCEBs from 2025-2030 was based on several findings. First, BEBs are broadly present and available in the U.S. transit market, unlike FCEBs. Second, BEBs have lower initial

1 2030 GGRA Plan Executive Summary

capital costs – both vehicles and charging infrastructure (depending on scale) – than FCEBs. Finally, many of MDOT MTA's operating divisions are incompatible with existing fire safety codes that regulate the distance between hydrogen storage tanks, vehicles, and buildings.

Furthermore, service modeling during Phase II of the Transition Study found that BEBs can complete a majority of MDOT MTA's existing service blocks (the group of daily assignments for an individual bus), given current range capabilities and very conservative operating assumptions. These assumptions incorporate weather, gross vehicle weight, and battery availability. Inputs to this service modeling included assumptions that factored in:

- Baltimore's topography
- MDOT MTA service and schedule data, from General Transit Feed Specification (GTFS) data, representing pre-pandemic operations
- Gross Vehicle Weight of BEBs, based on vehicles available on the market in 2020
- Assumed temperature of winter months, to utilize as conservative an assumption as possible:

The facility transition schedule (Table 1) was developed based on a service block completion analysis. Due to its short service blocks, Kirk Division was identified as the most suitable pilot program location and the initial full-facility BEB retrofit. The rebuilt Kirk Division was also opened in 2021, which minimizes construction risk during the retrofit period compared to older facilities.

This study, which only provided the framework for MDOT MTA's fleet conversion through 2030, recommended that the integration of FCEBs should remain under evaluation for future facility transitions. Specifically, FCEBs should be considered for facility transitions at Northwest Division due to the division's longer service blocks that may exceed currently available BEB range capabilities, as well as ample space to accommodate the required setback requirements for hydrogen infrastructure in relation to buildings. A planned Hydrogen Fuel Study will evaluate the feasibility of hydrogen production, delivery, storage, and fueling at MDOT MTA, focusing on portions of Northwest Division. This analysis will commence in late 2021. MDOT MTA will complete ZEB transition planning to determine specific plans for propulsion type(s), charging/fueling and maintenance locations, and service integration in 2022.

3 Fleet Transition Schedule

MDOT MTA has developed a preliminary transition schedule for which facilities will be partially or entirely retrofitted to support ZEB deliveries from 2025-2030. More detailed transition planning analysis is ongoing, which will yield a quarterly phasing of charging infrastructure installation and vehicle delivery. An ongoing Charge Management study will provide detailed recommendations for how much energy will be consumed, time needed to pre-condition BEBs, and how many BEBs may be required to complete existing service requirements.

Table 1 depicts the preliminary transition schedule for facility design, construction, and ZEBs delivery at MDOT MTA's divisions.

Table 1: Preliminary Facility Phasing for BEBs (2025-2030)

Facility	**Phase**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Kirk Pilot	**Facility Design**									
	Retrofit Construction									
	ZEB Deliveries									
Kirk	**Facility Design**									
	Retrofit Construction									
	ZEB Deliveries									
Northwest	**Facility Design**									
	Retrofit Construction									
	ZEB Deliveries									
Eastern	**Facility Design**									
	Redevel. Construction									
	ZEB Deliveries									

Table 2 depicts the current draft fleet procurement and ZEB fleet growth schedule, based on an annual 70-bus procurement both prior to and during the transition to an all-ZEB procurement in 2025. This plan anticipates MDOT MTA will procure clean diesel vehicles until 2024, in addition to seven pilot BEBs in 2023, and assumes MDOT MTA will procure only ZEBs beyond 2024. Replacement of BEBs for clean diesel and hybrid buses on a 1:1 ratio was assumed, though a higher replacement ratio may be needed to maintain existing service levels, pending the results of Charge Management analysis. Retirement of buses was assumed to be 12 years, per current MDOT MTA retirement cycles. This procurement schedule is subject to refinement based on MDOT MTA's Bus Fleet Management Plan and the Charge Management assessment.

Table 2: Preliminary Annual Deliveries and ZEB Fleet Percentage Schedule[2]

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030[3]
Bus Deliveries[4]	70	70	77	70	70	70	70	70	70	70
Fleet Share of ZEBs (End of Year)	0.0%	0.0%	0.9%	0.9%	9.9%	18.2%	24.7%	33.8%	42.1%	50.4%

Several key transition considerations will impact the schedule in Table 2. Lead times to design and construct facilities, such as the multi-year reconstruction of Eastern Division to a purpose-built BEB facility, are subject to delays that may be outside of MDOT MTA's control. Contracting lead times, material shortages and delivery delays, and permitting are examples of construction delays that MDOT MTA needs to account for when developing facility charging schedules that precede vehicle delivery in Baltimore.

ZEBs require infrastructure to be constructed, installed, and tested at the divisions before the vehicles can begin operating. While work needs to begin on bus procurements one to two years in advance, MDOT MTA's procurement efforts must account for global supply chain issues that are impacting bus components, including chemicals needed for vehicle batteries. These delays may cause a production delay of several months.

Additionally, transit agencies across the U.S. are simultaneously delivering public commitments to scale their ZEB fleets and responding to state and municipality mandates to adopt ZEBs. As a result, MDOT MTA will need to proactively initiate bus procurements and execute orders in advance to ensure bus deliveries are not delayed due to production of larger orders for other transit agencies.

MDOT MTA is currently evaluating the number of spare vehicles needed for maintenance purposes, rail replacement ("bus bridges"), training, and other special uses. As the ZE fleet grows, MDOT MTA will need to ensure that consistent levels of reliable service can be delivered by ZEBs throughout the transition. While diesel vehicles will remain in the fleet through 2030, MDOT MTA will assess fleet transition needs beyond 2030 and the need for non-ZE vehicles for certain purposes, including fleet resiliency, in early 2022. One area that MDOT MTA will evaluate is emergency uses for buses throughout the state, such as supporting coastal storm evacuations on the Eastern Shore, that would not be compatible with ZEB range.

Additionally, funding in the Administration's capital program will need to be increased to account for the increased pricing of ZEBs, facility reconstruction to accommodate ZEB charging, and utility upgrades.
MDOT MTA is actively pursuing grant opportunities to help offset these costs.

2 To be revised during Transition Planning analysis
3 ZEB deliveries are expected to continue beyond 2030. Transition Planning analysis for vehicle deliveries beyond 2030 is underway.
4 Deliveries will be diesel vehicles through 2024, excluding 7 BEBs for a pilot program in 2023, and BEB from 2025-2030.

4 Evaluation of Charging Infrastructure

The Phase II Transition Study evaluated various types of BEB charging infrastructure, including overhead pantograph charging, ground-mounted and overhead plug-in charging, and inductive charging.

Currently, MDOT MTA intends to provide all BEB charging at the four bus operating divisions. However, the Administration is continuing to evaluate in-route fast charging stations and the viability and value of installing these at certain locations within the region.

Overhead pantograph charging was determined to be the optimal charging infrastructure method for the BEB pilot and initial facility conversions at MDOT MTA. In this type of charging, the pantograph on the bus is automatically deployed to begin charging when the bus parks and the emergency brake is engaged. Overhead pantograph charging provides the least disruptions to the existing site, is the least restrictive to future modifications, and minimizes additions to operations and maintenance staff workloads.

MDOT MTA has significant experience with overhead catenary power due to its existing Light Rail service. Consequently, training requirements for MDOT MTA staff to operate and maintain this high voltage power equipment will be reduced due to MDOT MTA staff's existing expertise and safety training.

Ground-mounted, plug-in charging stations would reduce the number of BEBs that MDOT MTA can store at facilities in which they are used, due to the additional ground space that they occupy. Due to their in-ground power distribution, these units are less flexible for redeployment upon a shift in fleet composition.

Overhead plug-in charging stations, where charging cords connect from ceiling-mounted dispensers, require additional staffing and labor, as staff must physically connect and disconnect the plugs to the buses. Additionally, charging cords between charging stations and buses present a tripping hazard to staff. The additional work required from unionized staff to plug in chargers could potentially result in Collective Bargaining Agreement (CBA) revisions.

Inductive charging, which wirelessly connects the bus to a charging unit embedded in the pavement, is demonstrably more expensive and complicated to install than plug-in or overhead charging. Inductive charging is disruptive to deploy and presents additional maintenance challenges and expenses associated with pavement upkeep.

Figure 1 provides an overview of hardware that will need to be installed at MDOT MTA operating divisions to power battery-electric buses and depicts the flow of electricity from transformers to overhead pantograph chargers, where it is dispensed to the bus.

Figure 1: Battery-Electric Charging Infrastructure Overview[5]

5 Utility Upgrades

Table 3 depicts the sample unit costs of two overhead pantograph charging products on the market in 2021.

Table 3: Sample Unit Costs of Charging Equipment (2021)

	ABB HVC 150	Siemens SiCharge 200
Cost per cabinet	$100,000	$67,000
Cost per dispenser	$85,000	$35,000
Cost per one cabinet and one dispenser	$185,000	$102,000

New, large scale electrical service will be required to install the new charging stations. The new loads are greater than 10 times higher than the existing electrical loads at the sites and will require significant investments by MDOT MTA to support electrical service upgrades to each facility. The voltage and capacity of that service will be determined by Baltimore Gas and Electric (BGE), according to the power demand required by the new equipment. MDOT MTA will need to apply for this new service with BGE. During this application process, BGE will review the available capacity on the overhead or underground circuits near the location and will present the available alternatives and options for installing the new service. Installation plans will be site dependent.

MDOT MTA is evaluating alternate energy systems, such as solar energy and microgrids, to ensure that it will have the resilient power supply needed to maintain 24/7 transit operations. MDOT MTA will collaborate with BGE and the Maryland Public Service Commission (PSC) to determine innovative solutions that are appropriate for this purpose. Alternative energy systems will allow MDOT to benefit from cost savings and will enable MDOT to have reliable power during times of the year when the local utility is straining to supply power to its customers (e.g., during the summer).

5 Overhead pantograph charger is depicted.

While hydrogen fueling infrastructure will not be used for initial ZEB facility conversions between 2025 and 2030, MDOT MTA is initiating a study of optimal hydrogen fuel storage, delivery, and generation methods for its operating facilities to continue evaluating future opportunities for this technology.

6 State Employee Transition Plan

MDOT MTA plans to maintain its current workforce throughout the transition to a ZEB fleet through a training and retraining program. This program is currently under development and draws upon best practices from large transit agencies that have been operating BEBs, industry groups, and vehicle manufacturers. Training and Standard Operating Procedure (SOP) development is a significant investment within the overall fleet transition plan, as the new fleet will impact thousands of employees and multiple departments within MDOT MTA.

Maintenance activities will change to some degree, as some components of conventional buses and ZEBs differ (e.g., oil changes are not necessary for BEBs). Additionally, these vehicles will require new maintenance functions and training, such as high-voltage safety education. MDOT MTA will build upon its existing experience, staff, and training programs for high-voltage catenary from Light Rail operations to create a training program and implement best practices within MDOT MTA Bus Operations.

7 Estimate of Carbon Dioxide Reduction

Transitioning MDOT MTA's bus fleet to ZEBs with an assumed 50 percent conversion to BEBs by 2030 will avoid an estimated 500 million pounds of carbon dioxide over the lifecycle of BEB operations. This calculation was developed based on current grid power supply assumptions and projected a partial transition to renewable sources by the existing utility provider.

Upstream emissions include considerations of diesel production through conventional petroleum refining and supply to the region for diesel buses, and for the production of electricity, based on current grid power for battery electric buses.[6]

Tailpipe emissions include estimates of CO_2, NO_X, SO_X, PM_{10}, $PM_{2.5}$ and VOC for clean diesel vehicles, as well as PM_{10} and $PM_{2.5}$ emissions attributed to brake and tire wear. For BEB emissions, PM_{10} and $PM_{2.5}$ attributed to brake and tire wear were considered.

Emissions data was derived from the U.S. Department of Energy's Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) model, the Argonne National Laboratory's Greenhouse Gases, Regulated Emissions and Energy Use in Transportation (GREET) model, and the EPA MOVES 2014b model. Emissions were compared and refined to incorporate actual operational experience from comparable transit agencies. Resulting per unit emissions values were applied to MDOT MTA's fleet and operating environment with considerations of average vehicle efficiency and annual miles.

8 Financial Analysis

MDOT MTA conducted a lifecycle cost analysis (LCA) to compare MDOT MTA's capital and operating expenses for fleet acquisition, operation, and maintenance associated with vehicles purchased between 2023 and 2030. The LCA compares two "Build" scenarios,[7] in which MDOT MTA operates a ZEB fleet consisting of 70 or 77 BEB deliveries per year, and a "No-Build" scenario[8] that assumes the existing diesel bus fleet will be replaced by 70 similar models each year.

Lifecycle cost analysis inputs include current data from the existing MDOT MTA clean diesel fleet, such as annual mileage levels, fuel costs and fuel economy, and replacement dates for the active fleet. For replacement ZEB options (e.g., active data for ZEBs that MDOT MTA has not yet operated), data from peer transit agencies and industry-wide research was applied to MDOT MTA's assumed fleet and operating conditions.

Overall, the cost analysis shows that the full lifecycle cash cost of a transition to BEB is higher than continuing operations of clean diesel buses. While operating costs savings are anticipated for a BEB conversion, the high capital costs of BEB's, batteries, and their charging infrastructure may offset the

6 Maryland State Law (Md. Code, Public Utilities Sec. 7-703) and MDOT MTA 2020 Sustainability Report
7 Both "Build" scenarios include the delivery of 7 BEB pilot buses in 2023.
8 Does not include the delivery of 7 BEB pilot buses in 2023.

savings. However, the operating cost benefits are highly dependent on factors that are continually evolving as BEBs deploy in transit services.

Analysis provided in this documentation should be considered a conservative assessment of BEB costs, as the industry in North America is still small and in preliminary stages of development. Production costs may decrease as production increases to meet future demand and economies of scale are achieved. However, cost reductions may be offset by reductions in tax breaks, grant programs, discounts, and incentives that are available for BEB acquisition and associated charging infrastructure. Additionally, MDOT MTA will continue to monitor supply chain challenges that have significantly delayed vehicle and component production. For example, parts delays, such as microchips, may impact vehicle delivery timeframes and pricing.

The range of BEB models available for varying operating and climate conditions continues to evolve. The costs for batteries may decline with continued development of more efficient technology and lower production costs resulting from economies of scale. Some potential future cost reductions, however, may be offset (or more than offset) through increases in the cost of acquiring the primary battery components, specifically lithium or other alternative materials.

The cost of diesel fuel and electricity also have a strong impact on the lifecycle benefits of BEBs. While utility prices are historically less volatile than diesel prices, there is still the potential for utility price fluctuations, specifically increases to cover the cost of capital investments and rehabilitation.

Projected costs per year for all scenarios evaluated are presented in Table 4 in 2020 dollars and Table *5* in Year of Expenditure (YOE) dollars.

Table 4: Preliminary Projected Costs for in 2020 $ for Buses Purchased 2023-2030

2021-2041 Fleet Replacement Cost Comparison[9] (2020 $ million)		**Build (BEB)[10]**	**No-Build (Clean Diesel)[11]**
Capital	Vehicle Purchase Price	$343-375	$177
	Modifications & Contingency	$8-9	$22
	Charging/Fueling Infrastructure	$105-109	$0
	Total Capital Costs	*$455-493*	*$198*
Operating	Vehicle Maintenance	$62-65	$108
	Tire Replacement Cost	$6	$5
	Vehicle Fuel Costs[12]	$19-28	$50
	Charging/Fueling Infrastructure	$0.2-0.3	$0
	Total Operating Costs	*$88-99*	*$163*
Disposal	Battery Disposal	$0	$0
	Bus Disposal	$1	$1
	Total Disposal Costs	*$1*	*$1*
	Total Cash Costs	**$544-593**	**$362**
	Total Cash Cost per Mile	**$2.99-3.13**	**$2.03**
Emissions	Emissions - Tailpipe	$1-2	$14
	Emissions - Refining/Utility	$0-1	$3
	Noise	$4	$5
	Total Environmental Costs	*$5-6*	*$21*
	Total Cash and Non-Cash Costs	**$550-598**	**$383**
	Total Cash and Non-Cash Costs per Mile	**$3.03-3.16**	**$2.15**
Total Mileage (million)		***182-189***	***179***

9 This analysis captures the lifecycle of capital, operating, emissions and disposal costs of all vehicles in the fleet procured from 2023 through 2030.

10 This table depicts the range of costs indicative of the four "Build" scenarios evaluated – two scenarios evaluate 70 and 77 BEB deliveries per year, and two scenarios evaluate the same delivery quantities with the added assumption that MDOT MTA will utilize 100% renewable energy sourcing of power over the duration of the analysis period. All "Build" scenarios assume that seven pilot BEBs are delivered to MDOT MTA in 2023.

11 Annual mileage for no-build scenario is lower because in the Build scenario, there are 7 more buses to account for the pilot BEBs and potential increased deadhead mileage due to limited battery range.

12 Vehicle fuel cost includes costs of delivery, consumption and demand charges (for electric buses only).

Table 5: Preliminary Projected Costs in Year of Expenditures $ for Buses Purchased 2023-2030

2021-2041 Fleet Replacement Cost Comparison[13] (YOE $ million)		Build (BEB)	No Build
Capital	Vehicle Purchase Price	$611-670	$318
	Modifications & Contingency	$14-15	$39
	Charging/Fueling Infrastructure	$157-165	$0
	Total Capital Costs	*$783-850*	*$357*
Operating	Vehicle Maintenance	$195-204	$354
	Tire Replacement Cost	$19-20	$16
	Vehicle Fuel Costs	$61-88	$161
	Charging/Fueling Infrastructure	$0.8	$0
	Total Operating Costs	*$275-312*	*$530*
Disposal	Battery Disposal	$0	$0
	Bus Disposal	$4-5	$4
	Total Disposal Costs	*$4-5*	*$4*
Total Cash Costs		**$1,062-1,167**	**$891**
Total Cash Cost per Mile		**$5.85-6.16**	**$4.99**
Environmental	Emissions - Tailpipe	$5	$45
	Emissions - Refining/Utility	$0-3	$8
	Noise	$12-13	$17
	Total Environmental Costs	*$17-20*	$70
Total Cash and Non-Cash Costs		**$1,081-1,184**	**$961**
Total Cash and Non-Cash Costs per Mile		**$5.96-6.25**	**$5.38**
Total Mileage (million)		***182-189***	***179***

13 This analysis captures the lifecycle of capital, operating, emissions and disposal costs of all vehicles in the fleet procured from 2022 through 2030.

9 Conclusion

This report describes MDOT MTA's approach to achieve zero-emissions fleet conversion goals. Initial ZEB procurements will focus on BEBs, as this technology is poised to deliver the majority of MDOT MTA's service and has been more widely used in U.S. transit service than FCEBs. Overhead pantograph chargers at MDOT MTA's bus operating divisions will be used, allowing MDOT MTA to purchase vehicles of different sizes and easily move charging infrastructure to accommodate a variety of vehicles.

Hydrogen fueling is unlikely to be feasible at several MDOT MTA facilities due to fire safety codes but remains under evaluation for divisions that have adequate space and host service blocks that may exceed BEB range.

MDOT MTA is commencing a seven-bus BEB pilot in early 2023, which will inform the Administration's bus procurements of 70 to 77 BEBs, which will be delivered from 2025 to 2030.

MDOT MTA anticipates that it will retain its current workforce and develop a program to train and re-train staff in maintenance and operating procedures that are required for ZEBs.

Overall, the financial analysis shows that the full lifecycle cash cost of a transition to battery electric buses is higher than the continued reliance on clean diesel. While operating costs savings are anticipated for a BEB conversion, the high capital costs of BEB's, batteries and their charging infrastructure may offset the savings. However, the operating cost benefits are highly dependent on factors that are continually evolving as BEBs deploy in transit services. The transition to ZEBs will result in a large reduction of tailpipe emissions in the Baltimore region.

Zero-emissions vehicles still represent a new technology that is changing rapidly. MDOT MTA is closely following industry developments, including the experience of peer transit agencies that have begun operating ZEBs. The Administration continues research and analysis to refine its preliminary plans to scale up the ZEB fleet, and understands the need to remain flexible and adapt as needed to change to technology and market conditions. Furthermore, we are building a strong coalition of project stakeholders to ensure all aspects of the fleet transition and associated impacts are carefully considered to avoid risks during integration. MDOT MTA's primary goal is to maintain reliable service for passengers throughout the duration of the zero-emissions transition.

Appendix A: Legislative Report Requirements from S.B. 137

~~(D)~~ (E) (1) ON OR BEFORE JANUARY 1, 2022, AND EACH JANUARY 1 THEREAFTER, THE ADMINISTRATION SHALL, IN ACCORDANCE WITH § 2–1257 OF THE STATE GOVERNMENT ARTICLE, SUBMIT A REPORT TO THE SENATE BUDGET AND TAXATION COMMITTEE, THE SENATE EDUCATION, HEALTH, AND ENVIRONMENTAL AFFAIRS COMMITTEE, THE HOUSE APPROPRIATIONS COMMITTEE, AND THE HOUSE ENVIRONMENT AND TRANSPORTATION COMMITTEEON THE IMPLEMENTATION OF THIS SECTION.

(2) THE ANNUAL REPORT SHALL INCLUDE:

(I) A SCHEDULE FOR CONVERTING THE ADMINISTRATION'S STATE TRANSIT BUS FLEET TO ZERO–EMISSION BUSES ~~EXCLUSIVELY~~;

(II) AN EVALUATION OF THE CHARGING INFRASTRUCTURE NEEDED FOR THE ADMINISTRATION TO CREATE AND MAINTAIN A STATE TRANSIT BUS FLEET OF ZERO–EMISSION BUSES ~~EXCLUSIVELY~~;

(III) A PLAN FOR TRANSITIONING ANY STATE EMPLOYEES ADVERSELY AFFECTED BY THE CONVERSION FROM A DIESEL–POWERED STATE TRANSIT BUS FLEET TO A ZERO–EMISSION STATE TRANSIT BUS FLEET TO SIMILAR OR OTHER EMPLOYMENT WITHIN THE ADMINISTRATION OR DEPARTMENT THAT HAS COMMENSURATE SENIORITY, PAY, AND BENEFITS;

(IV) IN COORDINATION WITH OTHER APPROPRIATE STATE AGENCIES, AN ESTIMATE OF THE REDUCTION IN THE AMOUNT OF CARBON DIOXIDE EMISSIONS, MEASURED IN POUNDS, THAT WILL BE OBTAINED THROUGH THE USE OFZERO–EMISSION BUSES EACH YEAR UNTIL THE STATE TRANSIT BUS FLEET IS CONVERTED TO ZERO–EMISSION BUSES ~~EXCLUSIVELY~~; AND

(V) A FINANCIAL ANALYSIS:

1. OF THE PROJECTED COST OF PURCHASING, MAINTAINING, AND PROVIDING CHARGING INFRASTRUCTURE FOR THE ZERO–EMISSION STATE TRANSIT BUS FLEET EACH YEAR UNTIL THE FLEET IS CONVERTED TO ZERO–EMISSION BUSES ~~EXCLUSIVELY~~; AND

2. COMPARING THE PROJECTED COST UNDER ITEM 1 OFTHIS ITEM TO THE PROJECTED COST OF CONTINUING TO OPERATE ADIESEL–POWERED STATE TRANSIT BUS FLEET.