Subject: Zero Emission Bus Program Update Report

File Number: ACS2024-TSD-ES-0001

Report to Transit Commission on 18 March 2024

Submitted on March 7, 2024 by Renée Amilcar, General Manager, Transit Services Department

Contact Person: Richard Holder, Director Engineering Services, Transit Services Department

613-580-2424 ext. 52033, Richard.holder@ottawa.ca

Ward: Citywide

Objet : Bilan du Programme des autobus non polluants

Numéro de dossier : ACS2024-TSD-ES-0001

Rapport présenté au Commission du transport en commun

Rapport soumis le 18 mars 2024

Soumis le 7 mars par Renée Amilcar, Directrice générale, Services de transport en commun

Personne ressource : Richard Holder, Directeur des Services du génie

613-580-2424, poste 52033, Richard.holder@ottawa.ca

Quartier : À l'échelle de la ville

REPORT RECOMMENDATION(S)

That the Transit Commission receive this report for information.

RECOMMANDATION(S) DU RAPPORT

Que la Commission du transport en commun prenne connaissance du présent rapport.

BACKGROUND

In April 2019, Council declared a climate emergency and directed staff to establish new 2030 midterm corporate and community GHG emissions reduction targets, review and update long-term GHG emissions targets and, identify concrete actions and resource implications to achieve new targets (ACS2019-CCS-ENV-0005).

In January 2020, Council approved the Climate Change Master Plan. Council committed to reducing the City's corporate GHG emissions to 2012 levels by 2040. The OC Transpo diesel-powered conventional bus fleet was identified as a major contributor of the City's corporate GHG emissions (ACS2019-PIE-EDP-0053).

In June 2021, Council approved the purchase of zero-emission conventional buses for all future fleet needs, provided they meet operational requirements and subject to funding and financial agreements (ACS2021-TSD-TS-0009).

The Zero Emission Bus (ZEB) Pilot Project was initiated to support the transition to zero-emission buses. The pilot fleet consists of four New Flyer XE40 electric buses. The buses began to arrive in Ottawa on September 17, 2021, and were placed into revenue service February 7, 2022.

As part of the pilot project, Transit Services committed to providing updates to Transit Commission based on key performance metrics. The first update was provided on May 11, 2023, via the Zero Emission Bus (ZEB) Pilot Performance and Evaluation report (ACS2023-TSD-TS-0006).

In addition, staff have committed to providing regular updates on the status of the vehicle procurement and infrastructure implementation.

DISCUSSION

Pilot Project Update Data

The Zero Emission Bus (ZEB) Pilot Project began in September 2021 with the arrival of four New Flyer XE40 electric buses, with a capacity of 525 kWh. The buses were put into service in February 2022 and, as outlined in the Zero Emission Bus (ZEB) Pilot Performance and Evaluation report (ACS2023-TSD-TS-0006), met or surpassed the range and efficiency data provided by New Flyer. The initial evaluation report included performance metrics for Mean Distance Between Failure (MDBF), availability (E-Buses and Charger Infrastructure), mileage, efficiency, diesel savings and GHG emission reductions, and maintenance and operations costs. The conclusion of the Pilot Performance and Evaluation was that the that the battery electric buses can successfully operate in revenue service in Ottawa, as an alternative to diesel buses.

Updated Key Performance Indicators (KPIs)

After two years in service, the E-Buses are approaching nearly 500,000 kilometres on the road. The E-Buses have been performing successfully on revenue service routes longer than 10 hours and driving distances exceeding 200 kilometres on a regular basis.

Mean Distance Between Failure, or MDBF, is an industry standard metric used to evaluate the performance of conventional and electric buses. It is a measure of the number of failures which place a bus out of service compared to in-service mileage, and so a high MDBF indicates greater reliability.

OC Transpo calculates MDBF as anything that takes a bus out of service. These incidents are categorized and evaluated by our reliability team to determine if they are added to our MDBF calculation. If a bus is taken out of service and no fault was found, that still counts towards the MDBF of the bus as it disrupted service. The current small size of the E-Bus fleet means there can be large MDBF fluctuations from any defects.

MDBF comparison between OC Transpo (all defects that take a bus off the road, such as damage to the bus, requires an enhanced interior clean) and Original Equipment Manufacturer (OEM) defects, as outlined in the chart below, can add to the point that fluctuations in MDBF are large with such a small fleet.

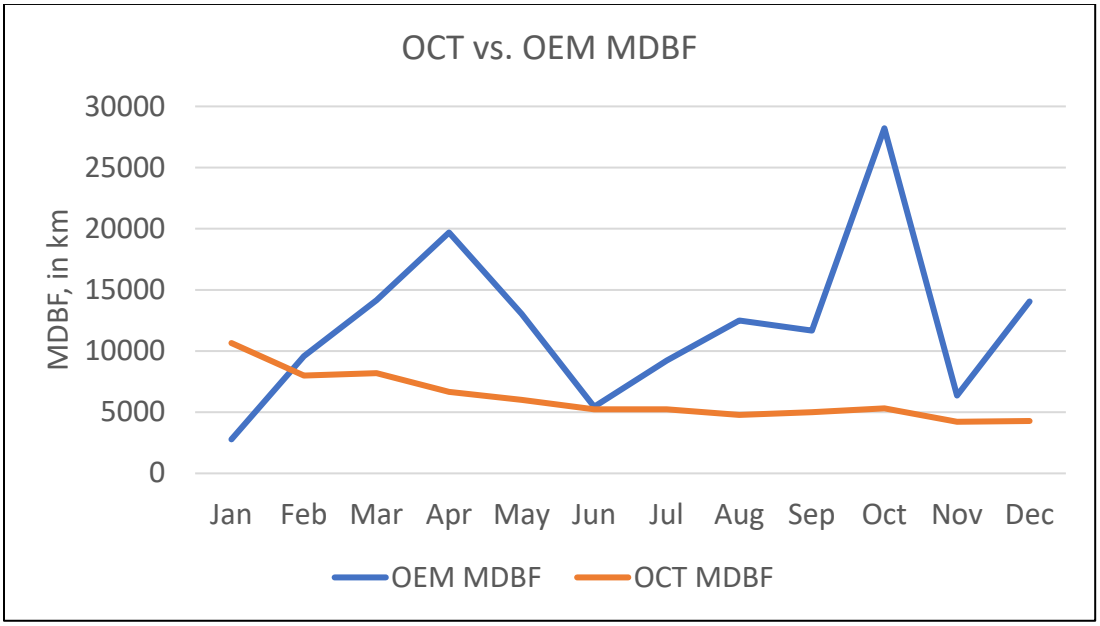

Table 1: OCT vs. OEM MDBF

The mean distance between failure average for the electric buses in 2023 was 6,100 kilometres, compared to the average conventional bus MDBF of 7,300 kilometres.

There were limited issues related to the High Voltage Propulsion system or HV batteries that have taken an E-Bus out of service. The main defects items, along with the corrective actions taken by OC Transpo, that contributed to the calculations on MDBF for the electric buses are outlined in the table below.

Defect Item	Corrective Action
A no heat programming error was identified where, at 7C, the electric heating system would turn off.	The programming error was fixed, and this issue has not been experienced since.
Operators are experiencing, at times, range anxiety, where they perceive that the vehicle needs to be returned to the garage because of the remaining battery charge. This will be a continuous issue as new bookings and new operators are trained on the E-Bus.	We continue to provide ongoing training to operators, and our training department and Transit Operations Control Centre (TOCC) have the range charts for the E-Bus to ensure that buses can fulfill the assigned sequence of trips.
The end-of-life brake sensors failing prematurely.	These sensors have since been removed from the buses by the bus manufacture. The end-of-life brake system is a redundant system that has a low reliability, and we use continuous brake pad wear sensors instead. This system will not be included in any of the new buses.

E-Bus mileage is another KPI that has been closely monitored since the buses went into service in February of 2022. In 2023, the electric buses met the mileage target of 55,000 kilometres per year.

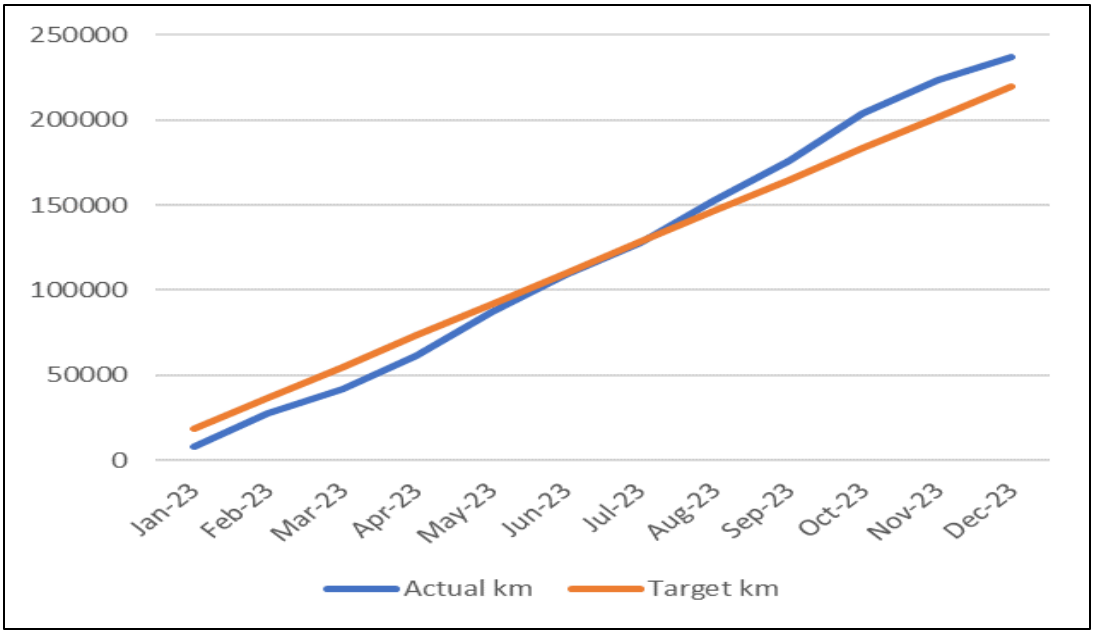

Table 2: Electric bus mileage

Additionally, Table 3 shows that the E-Buses are comparable to the average mileage of our diesel fleets. This table shows that the transition to an electric-bus fleet should not have an impact on service capacity.

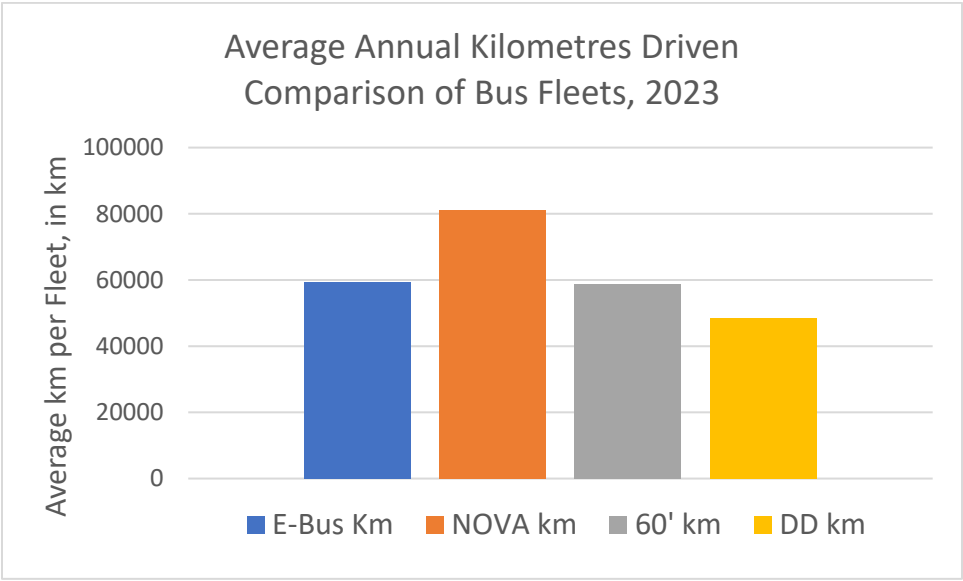

Table 3: Comparing E-Buses to Diesel Buses (mileage)

The battery electric buses used in the pilot continue to operate in revenue service fulfilling the same role as diesel buses. OC Transpo has seen a fuel saving of 25,000 litres, per bus, per year. There was a total of 2,385 charging sessions in 2023, with a charger reliability rate greater than 95 per cent.

The updated performance metrics indicate that the electric buses continue to prove their capability to perform in revenue service as an alternative to diesel buses.

Electric Bus Procurement Status Update

The Auditor General's Sprint 2 Audit of Zero-Emission Buses focused on the tendering process for 40-foot electric buses (Sprint 2 Audit ZEB Tendering). Transit Services Department (TSD) Management agreed with the recommendations within the audit and outlined a plan to address some of the recommendations through a collaborative procurement process with Toronto Transit Commission (TTC). Aligning the OC Transpo's procurement process with the RFP posted by the TTC addresses the concerns identified in the Auditor General's recommendations. By joining other transit agencies in the procurement of Zero Emission Buses, OC Transpo is able to standardize vehicle specifications and provide operations and maintenance benefits.

Additionally, a potential joint E-Bus procurement model was identified for OC Transpo in a report (ACS2021-TSD-TS-0009), approved by Council on June 23, 2021.

The implementation phase of the ZEB program began after signing of the Electrical Infrastructure Agreement, which paved the way for bus procurement.
In mid-2023, TTC contracts were shared with OC Transpo. TSD reviewed the proposals and worked with the bus manufacturers on commercial and technical amendments to align to OC Transpo's specific requirements.

Since the inception of the ZEB program, there has been a notable increase in the market price of electric buses, surpassing the original budgeted price.

On December 18, 2023, an adoption agreement was signed with New Flyer Industries to supply 51 buses to the City. To obtain the best value from the contract, 51 buses were procured with a staggered delivery schedule. OC Transpo will be receiving 22 buses in Q4 2024 and the additional 29 buses in Q4 2025.

OC Transpo is also currently working with Nova Bus to sign an adoption agreement to purchase an additional 51 buses, with a staggered delivery schedule. OC Transpo will receive four buses from Nova in Q4 2024 with the remaining 47 arriving in Ottawa in Q4 2025.

Table 4 is a visual representation of the ZEB program's planned delivery schedule.

		2024			2025						2026												2027											
		Q4			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
		O	N	D	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
40' ZEB	26 Buses	26 Buses																															
	76 Buses						76 Buses																										
	92 Buses													92 Buses																			
60' ZEB	18 Buses																			18 Buses													
	136 Buses																											136 Buses					

Table 4: E-Bus Delivery Schedule

ZEB Program Infrastructure Update

Civil Infrastructure

Civil infrastructure work is underway to prepare the facilities for the installation of electrical infrastructure and complete the necessary building lifecycle updates. This work includes the following:

- Ceiling structural reinforcements, which are required by electrical dispenser installation (the pantographs);
- Lifecycle repairs to concrete;
- Provision of new sprinkler system with increased fire fighting capacity;
- Replacement of existing floor-trench drains, catch-basins, and reconnection to existing sanitary piping;
- Replacement of existing lighting with LED lighting;
- Emergency walkway and egress improvements;
- Repair of rainfall drains and new water catch basins; and,
- Installation of high-speed, fabric roll-up doors.

Within the St. Laurent South garage, Phase 1 is scheduled for completion in April 2024. Phase 2 is currently in the design stage and is scheduled for completion in Q1 2025. When completed, the south garage will have the capacity to park and charge 143 electric buses.

The North Garage civil infrastructure project is scheduled for completion in Q4 2025. When completed, the north garage will have the capacity to park and charge 93 electric buses.

A new parking structure and servicing area covering the existing exterior bus parking lot at 1500 St. Laurent is scheduled for completion in Q4 2026. Currently in the design

stage, this new garage, on the west side of the 1500 St. Laurent property, will have the capacity to park and charge 84 electric buses when completed.

Finally, there is a high voltage maintenance bay project that will increase our capacity for electric bus maintenance. This project is scheduled for completion in Q4 2024.

Electrical Infrastructure

The Auditor General's Sprint 4 Audit of Zero-Emission focused on the electrical infrastructure design-build contract between the City and Envari. The City entered into a design-build agreement with Envari in June 2023 to establish the electrical infrastructure required to support the ZEB Program.

Since signing the agreement, the following has been completed:

- The pilot charging infrastructure has been relocated to maintain the operation of the pilot E-Buses and Transit Services are currently preparing the facility for the installation of the electrical infrastructure; and,
- The procurement of dispensers and chargers for the next batch of buses.

Currently, OC Transpo (in collaboration with Envari) is designing and preparing to install 30 dispensers and eight chargers, with target completion of Q4 2024. To go beyond 30 dispensers, the facility will need a substation and related distribution infrastructure onsite to support the additional power required for the remainder of the facility fit-up for chargers. Design of the substation is expected to begin in Q2 2024. The procurement for the long lead items listed below have been completed for the substation:

- Generators – Two 4MW generators have been procured to provide backup power to support the charging infrastructure. They are expected to arrive onsite in Q1 2025.
- Transformers – Two 44kV/13.8kV transformers have been procured to support the charging strategy proposed for the St. Laurent site. These two units are planned to arrive onsite in Q3 or Q4 2025.
- Switchgears – Two 13.8kV switchgears with eHouses, protection, and control devices have also been procured and expected to arrive in Q2 2025.

As part of the integration with the charging infrastructure, an Energy Management System (EMS) will be procured to control and optimize the charging of E-Buses. This system will balance the energy requirements for charging while reducing the electrical

peak demand and associated cost of electricity. This activity is currently in the phase of collecting the requirements.

Furthermore, TSD is working on an agreement with Hydro Ottawa to expand the system required to meet the load demands of St. Laurent garage, which will include an offsite 230kV/44kV substation and new 44kV distribution circuits to meet the demands of the charging infrastructure. This agreement has been drafted and currently in review with the City.

In parallel with the design and installation of the substation, dispensers and chargers will need to be designed and procured for the remaining parking spots at St. Laurent to achieve a total of 326 dispensers located across three garages (North Garage, South Garage, and the new building).

FINANCIAL IMPLICATIONS

There are no financial implications to receiving this report for information.

LEGAL IMPLICATIONS

There are no legal impediments to receiving this report for information.

COMMENTS BY THE WARD COUNCILLOR(S)

Citywide

CONSULTATION

TSD has provided a number of updates to Transit Commission and Council. Additionally, the funding for the ZEB Program has been approved through the budget process.

ACCESSIBILITY IMPACTS

Accessibility has been integral to the procurement process for zero-emission vehicles. Staff have considered the concerns expressed by the City's Accessibility Advisory Committee and other accessibility stakeholders about the low levels of noise produced by electric vehicles and the increased risk this poses to pedestrians, particularly those who are blind or partially sighted. Staff mitigated this risk by outfitting the City’s first four pilot battery-electric buses with an Acoustic Vehicle Alerting System (AVAS).

In 2022, staff also engaged stakeholders in two orientation sessions to familiarize them with the AVAS. These sessions involved testing the AVAS on-street in different

locations and under different scenarios, as well as identifying the other accessibility features on board the vehicle. The feedback received was positive. As a result, all future zero-emission buses will be equipped with the equivalent AVAS technology, and the same on-board accessibility features.

OC Transpo continues to monitor new developments in legislation, regulations and emerging AVAS technology, and to monitor and respond to feedback from accessibility stakeholders and customers with disabilities.

CLIMATE IMPLICATIONS

The ZEB Program is part of the City's Climate Change Master Plan. The continuous transition of the bus fleet to ZEBs continues to improve TSD's GHG emissions.

RISK MANAGEMENT IMPLICATIONS

The ZEB Pilot Program has undergone an audit by the City's Auditor General. TSD has responded to all of the Auditor General's recommendations and provided Transit Commission with regular updates. Council has approved the budget for the first procurement of zero emission buses.

RURAL IMPLICATIONS

Rural implications have been taken into consideration in the development of the ZEB Program. The City's transportation network, including light rail transit, is designed to provide options for all residents.

TERM OF COUNCIL PRIORITIES

The 2023-2026 Term of Council Priorities include:

- A city that is more connected with reliable, safe and accessible mobility options.
- A city that it is green and resilient.

DISPOSITION

Staff will continue to monitor and provide updates to Transit Commission on the performance and procurement status of the ZEBs.