Saskatoon Transit Full-Fleet Zero Emission Bus Implementation Plan – CUTRIC Report

ISSUE

An assessment by the Canadian Urban Transit Research and Innovation Consortium (CUTRIC) found that while full fleet conversion to zero emissions buses (ZEBs) is not financially feasible for Saskatoon Transit in the short or medium term, the study provides important insights to guide future planning and incremental steps toward transitioning the fleet to zero emissions should the fiscal and technological environment change.

RECOMMENDATION

That the Standing Police Committee on Transportation recommend to City Council:

1. That the CUTRIC Implementation Plan be considered when updating the Saskatoon Transit 10-Year Fleet Renewal Strategy;
2. That the CUTRIC Implementation Plan be submitted to Housing, Infrastructure and Communities Canada and any other relevant federal or provincial department or ministry requesting (a) removal or an exemption of the requirement for zero emissions buses for both fixed-route fleet and paratransit buses beyond the 2028-2029 and 2030-2031 timelines under the Canada Public Transit Fund (CPTF); and
   (b) requesting an amending agreement to change the battery electric buses to diesel buses in the transit fleet renewal component under the Investing in Canada Infrastructure Program (ICIP);
3. That Saskatoon Transit continue to monitor the Zero Emission Bus (ZEB) landscape for technological advances and changes in the Saskatchewan power grid which may make the transition to ZEBs more cost effective and beneficial and explore opportunities where feasible to pilot zero emissions buses on a small scale;
4. That the CUTRIC Implementation Plan be revisited and updated in five years to reflect any technological advancements in the ZEB landscape and changes in renewable energy sources powering the Saskatchewan electrical grid; and
5. That the CUTRIC Implementation Plan be considered in the next update of the City of Saskatoon (City) Climate Action Plan (previously referred to as Low Emissions Community Plan (LEC)).

BACKGROUND

City Council, at its Regular Business meeting held on August 26, 2019, approved The Low Emissions Community Plan report. The plan includes an action to electrify 100% of the transit fleet by 2030 to reduce greenhouse gas (GHG) emissions.

The Standing Policy Committee on Transportation, at its meeting held on March 7, 2022, received the Saskatoon Transit Battery Electric Bus Trial Performance Results

report for information, based on a one-year performance analysis by the Saskatchewan Research Council.

City Council, at its Regular Business meeting held on November 21, 2022, considered the Approaches to Address Saskatoon Transit's Long-Term Fleet Renewal and Funding Strategy report, and resolved, in part:

"1. That the fleet replacement strategy provided in Option 3 – The fully Accelerated Approach be approved, subject to a funding strategy for the city contributions for the ZETF program."

City Council, at its Regular Business meeting on December 20, 2023, received the Saskatoon Transit Long-Term Fleet Renewal and Funding Strategy Update report and resolved:

"1. That the updated fleet replacement strategy provided in the report of the Transportation & Construction Division dated December 5, 2023, be approved, subject to approval of funding from the federal government for the Zero Emission Transit Fund (ZETF) program."

City Council, at its Regular Business meeting held on January 29, 2025, received the Saskatoon Transit 2025 Fleet Renewal Request report that confirmed the funding application for Infrastructure Canada's Zero Emission Transit Fund was unsuccessful and resolved, in part:

"1. That the 2025 Saskatoon Transit Fleet Replacement request provided in Option 1 – Purchase Fixed Route Diesel Buses and Access Transit Gas Buses be approved, funded from $23.5 M of city contribution borrowing approved in the 2024 and 2025 budget."

Infrastructure Canada funded approximately 80% of the Saskatoon Transit Full-Fleet Zero Emission Bus Implementation Plan completed by CUTRIC under the Planning Stream of the Zero Emission Transit Fund.

DISCUSSION/ANALYSIS

Current Zero Emissions Fleet

Saskatoon Transit introduced two battery electric buses (BEBs) into fixed-route service in July 2024, along with two charging stations, following a one-year pilot in 2020. From July 2024 to March 2025, these two BEBs serviced 70% fewer kilometres than the diesel buses which entered the fleet in October 2024. Operational downtime for the BEBs was attributed to numerous calls for warranty service relating to electrical drive systems. Since March 2025, these issues have been resolved and the BEBs have been in service for comparable distances to the diesel buses.

Saskatoon Transit Full Fleet Zero Emissions Buses (ZEB) Implementation Plan

The Saskatoon Transit Full Fleet ZEB Implementation Plan (Appendix 1) assesses the economic, technological, social and environmental benefits, with the risks and constraints, for Saskatoon Transit to transition to a zero emissions fleet of buses, including projected growth buses over the study period.

The Implementation Plan includes an assessment of Saskatoon Transit's current fleet and facility electrification readiness, and an analysis of different battery electric bus (BEB) and hydrogen fuel cell electric bus (FCEB) options against the total and average energy consumption for Saskatoon Transit's current routing. Each fleet purchase strategy identifies the infrastructure needs and the impact on the fleet size necessary for ZEB conversion from diesel.

Three scenarios for ZEB fleet implementation were evaluated based on the study period from 2024-2048.

Scenario 1 – 100% Battery Electric Bus (BEB) Fleet
Scenario 1 includes converting the entire fleet to battery electric buses (including projected growth buses over the study period), upgrading the facility at Civic Operations Centre for on-site charging and building five on-route charging stations. This option would require adjustments to route scheduling or block splitting for top-up charging during the day since a single charge will not last a full day of service on all routes. Block splitting is lessening the time one bus runs from the time it leaves the garage to the time it returns and may require a replacement bus while charging to complete the route.

Scenario 2 – 100% Hydrogen Fuel Cell Electric Bus (FCEB) Fleet
Scenario 2 includes converting the entire fleet to hydrogen fuel cell electric buses (including projected growth buses over the study period), supported by hydrogen fuelling infrastructure upgrades to the facility at Civic Operations Centre.

Scenario 3 – Mixed Battery Electric Bus (BEB) and Hydrogen Fuel Cell Electric Bus (FCEB) Fleet
Scenario 3 includes converting the fleet to a mixture of battery electric buses and hydrogen fuel cell electric buses (including projected growth buses over the study period), supported by charging and hydrogen fuelling at the Civic Operations Centre. Block splitting would still be required; however, the amount would be decreased due to the inclusion of FCEB buses.

<u>Fleet Type Cost and Environmental Impact Analysis</u>
The total life cycle cost for the three scenarios analyzed and a base case with 100% diesel buses (including projected growth buses over the study period) is outlined in the Implementation Plan. This information is summarized in the table below.

	Emissions Change from Base Case (2048)	Buses in Fleet (2048)	Infrastructure Upgrades Costs	Total Life Cycle Cost (15 years)	Total Operating Cost (15 years)	Diesel Bus to ZEB Ratio
Base Case (100% Diesel)		231		$261.9 M	$181.1 M	1 to 1
Scenario 1 (100% BEB)	-10.1%	278 (BEB)	$47.7 M	$479.2 M	$221.4 M	1 to 1.26
Scenario 2 (100% FCEB)	+123% (Electrolytic) +12.4% (SMR) -24.5% (SMR with CSS) -57.7% (Wind)	298 (FCEB)	$18.2 M	$1,105.1 M	$637.6 M	1 to 1.38
Scenario 3 (Mixed BEB and FCEB)	+84.2% (Electrolytic) +8.4% (SMR) -16.8% (SMR with CSS) -39.6% (Wind)	98 (BEB) and 203 (FCEB)	$27.7M	$588.7 M	$318.4 M	1 to 1.39

This analysis shows that converting the Saskatoon Transit fleet to BEBs will provide a modest decrease in net GHG emissions (10.1%) relative to the base case scenario. Saskatchewan's power grid relies heavily on fossil fuels, so the emissions associated with charging the buses will be higher than in other provinces with more renewable energy sources, offsetting the benefits of reduced tailpipe emissions.

Scenarios 2 and 3 were analyzed using four different types of hydrogen production:

- Electrolytic – uses electricity from the local power grid to split water into hydrogen and oxygen;
- Steam Methane Reforming (SMR) – uses natural gas, steam and catalysts to create hydrogen, carbon monoxide and carbon dioxide;
- Steam Methane Reforming with Carbon Capture and Storage (SMR with CSS) – this includes the capture and storage of 80% of the carbon dioxide created through the SMR process; and,
- Electrolytic with Wind Energy – uses electricity produced from wind power to split water into hydrogen and oxygen.

Hydrogen produced from SMR, SMR with CSS and wind energy are not readily available in Saskatchewan at this time. Significant emissions reductions only occur when hydrogen is produced exclusively with renewable energy sources such as wind or through the steam methane reforming with carbon capture and storage process.

Financial cost is a significant factor noted in the Implementation Plan. Compared to the base case scenario of diesel buses, life cycle costs increase by $217.3 M for BEBs, $843.2 M for FCEBs and $326.8 M for a mixed fleet. These increases are due to the increased unit cost of BEBs and FCEBs, costs for charging infrastructure and hydrogen fueling infrastructure, and the need for additional fleet due to the decreased range and runtime compared to diesels (diesel bus to ZEB ratio).

The continued purchase of diesel buses remains the most cost-effective solution to building service capacity and reliability into the Saskatoon Transit fleet. By focusing on measures to increase ridership, through improved reliability, dependability and expanded service, such as Link (Bus Rapid Transit), the reliance on single-occupancy vehicles may decrease, resulting in less congestion and a reduction in net GHG emissions in Saskatoon.

Other Jurisdictions

Several Canadian are reviewing and/or adjusting their plans to use ZEBs.

- Winnipeg Transit is scaling back its original plans and will resume purchasing diesel buses in 2027. Prior to this switch, a total of 90 zero emissions buses, including 70 battery electric and 20 fuel cell electric buses, will be received and put in service in 2025 and 2026. While in service, these ZEBs will be analyzed to understand battery health, energy use and operating cost to help determine which technology is most effective in Winnipeg's climate. All information gathered will help determine the future steps in electrification for Winnipeg Transit[1].

- Calgary Transit is currently evaluating tenders to purchase up to 180 40-foot ZEBs to be in service starting in 2028. In addition to these purchases, Calgary Transit will continue purchasing diesel and compressed natural gas buses to maintain a diversified fleet that includes electric buses to help reduce emissions where possible[2].

- Edmonton Transit purchased 60 battery electric buses between 2016 and 2018. Significant issues with these buses have resulted in a shift back to diesel bus purchases and a pilot on the feasibility of hydrogen buses[3]. One hydrogen bus was added to Edmonton's fleet in late 2023[4].

- The City of Regina has approved spending of up to $52.2 M to purchase 20 BEBs and supporting infrastructure. Funding for this project was approved through ZETF and 50% of costs will be covered by the federal government. Buses purchased under this plan will arrive throughout 2025[5].

Government of Canada Program Funding Requirements

Under the current Investing in Canada Infrastructure Program (ICIP) Contribution Agreement with the City of Saskatoon, the requirement exists to purchase 25 40-foot ZEB's.

[1] https://www.cbc.ca/news/canada/manitoba/winnipeg-transit-unveils-first-zero-emission-fuel-cell-bus-1.7463420
[2] https://www.calgarytransit.com/plans---projects/40-foot-electric-buses.html
[3] https://edmontonjournal.com/opinion/columnists/keith-gerein-edmonton-82-million-electric-bus-failure
[4] https://www.edmonton.ca/projects_plans/transit/electric-buses
[5] https://www.regina.ca/transportation-roads-parking/transit/bus-electrification/

Capital plan funding under the Baseline Stream of the Canada Public Transit Fund (CPTF) requires the transition to Zero Emissions Bus (ZEBs) by 2028-2029 for fixed route buses, and by 2030-2031 for paratransit vehicles.

Based on the findings in the Implementation Plan, Administration does not find these requirements feasible at this time due to the substantial financial costs compared to the minimal GHG savings. Administration previously communicated with Housing, Infrastructure and Communities Canada (HICC) expressing its concerns for the CPTF zero emission bus requirement and the impacts it would have on the City of Saskatoon overall.

Given the requirements under the existing and emerging federal programs, Administration is recommending amendments to the current ICIP funding agreement and CPTF capital funding criteria to exempt the City from purchasing ZEBs in the short and medium term. Instead, the City would continue to purchase diesel-fuelled buses to update and expand its fleet.

FINANCIAL IMPLICATIONS

Financial implications of the three scenarios compared to the baseline case of diesel buses are outlined in the Implementation Plan. In summary, the base case scenario of diesel buses, provides total life cycle costs savings of $217.3 M compared to BEBs, $843.2 M compared to FCEBs and $326.8 M compared to a mixed fleet.

OTHER IMPLICATIONS

Although tailpipe emissions would decrease with the proposed ZEB strategies, the carbon intensity of the Saskatchewan power grid effectively offsets these gains. Saskatoon Transit will continue to monitor the ZEB landscape for changes to federal funding programs, technological increases in operational efficiencies and changes in the Saskatchewan power grid which may make the transition to ZEBs more beneficial.

Saskatoon's Climate Action Plan identifies 40 initiatives the City and community can take to achieve the City's emissions reductions targets. Converting the Transit fleet to ZEBs by 2030 was identified as an initiative within the Climate Action Plan. Information in the Implementation Plan provides new and additional detail to the costs and benefits in implementing this conversion and the Administration is recommending that the Implementation Plan be considered in the next update of the Climate Action Plan.

The conclusion from the CUTRIC Implementation Plan is as follows:

> *In conclusion, until the Saskatoon energy grid becomes greener, this study shows only marginal GHG reductions are achievable through substantial financial investment. Based on the multi-criteria decision making analysis in the final report, the Base Case Scenario is the data-driven recommended pathway forward for the Saskatoon Transit. Although, this may change in time if the ZEB technology and related costs improve and sustainable sources become the foundation of the City's electricity grid.*

APPENDICES

1. Saskatoon Transit Full Fleet ZEB Implementation Plan 2025

Report Approval
Written by: Mike Moellenbeck, Director of Saskatoon Transit
Approved by: Terry Schmidt, General Manager, Transportation and Construction

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