ADMINISTRATIVE REPORT

Title: Bus Electrification Program – Transition to Zero-Emission Technology Evaluation Report

Critical Path: Standing Policy Committee on Infrastructure Renewal and Public Works

AUTHORIZATION

Author	Department Head	CFO	CAO
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EXECUTIVE SUMMARY

The ***Transition to Zero-Emission: Technical Evaluation*** is the main deliverable of the Bus Electrification Study and includes an overview of all types of zero-emission buses and associated fueling / charging infrastructure, establishes guidelines for comparing technologies, evaluates greenhouse gas emissions and environmental and social impact of zero-emission buses, provides a comparison of heavy-duty zero-emission buses to Transit's current diesel buses, reviews the financial implications associated with transitioning to a zero-emission fleet, reviews funding and financing models available to support this transition, and provides an implementation strategy for beginning the transition to zero-emission.

Transit intends to launch a Transition to Zero-Emission Bus Program for the purpose of planning and managing the various projects and sub-projects that will be created by the transition to zero-emission, with the Transition Fleet Project being the first project. The goal of the program would be to set the direction for establishing a zero-emission fleet and following through on initiatives subject to securing funding sources and Council approval.

The Transition Fleet Project would involve a mixed test fleet of 16 buses, including a mix of propulsion systems and vehicle lengths. This will provide Transit with the ability to collect data to assist with planning and decisions before determining the next step in electrification. This direction will require a higher initial investment and does not produce the highest operational savings for the initial test fleet, however focusing on short-term savings with the test fleet would result in a missed opportunity to achieve significant savings when fleet-wide electrification is pursued. The total project cost is estimated to be $38.3 million, based on a completed Class 3 estimate. There are no anticipated impacts to the operating budget with the test fleet as savings in fuels costs and bus maintenance will offset the increased maintenance costs resulting from new infrastructure.

Replacing the existing Transit Bus Replacement Program with the proposed Transition to Zero-Emission Bus Program will help to ensure a smooth transition to a zero-emission fleet. Including the initial purchase of 16 Zero-Emission Buses (ZEBs), Transit can reach its goal of purchasing 100 to 110 ZEBs by the end of 2027 with an estimated budget of $280.4 million, based on a completed Class 4 estimate. There may be some flexibility within this budget to adjust the

quantity of buses, the propulsion mix, or the refuelling infrastructure based on the outcome of the trial or the evolution of ZEB technology.

The existing Transit Bus Replacement Program has a projected 7-year cost of $160.6 million. This program is funded through a combination of Federal, Provincial, and City financing, with the City's contribution being approximately 55% or $88.4 million. If Winnipeg's application to the Investing in Canada Program (ICIP) is successful, the City's expected contribution towards the new $280.4 million Transition to Zero-Emission Bus Program would be approximately 28% or $78.4 million. This would result in an incremental savings of $10 million, while at the same time freeing Federal Gas Tax contributions for other Transit projects. Long-term impacts on the operating budget are still being analyzed.

Construction of a replacement for North Garage as a purpose-built zero-emission facility is needed to support future zero-emission bus fleet purchases by the time the first 100-110 buses are delivered. If this new zero-emission garage is not completed by 2027, electrical service constraints at Brandon Garage or Fort Rouge Garage would restrict any future expansion of the zero-emission bus fleet. Transit's North Garage replacement has been identified as a priority infrastructure project by the Department. Based on a previously completed Class 4 estimate, this project is estimated to cost $210.9 million, excluding any future costs associated with purchasing and installing charging or fueling equipment.

Based on the projected rate of transition to zero-emission, the renewed targets in support of climate change mitigation include:

- 30% zero-emission fleet by 2030 (210 of 700 buses)
- 100% zero-emission fleet by 2050.

The Transit Department has identified this as a priority project and will recommend it be included as part of its application for funding under the Investing in Canada Infrastructure Program. This will be put forward for consideration concurrent with the Winnipeg Transit Master Plan report and will be subject to Council approval.

RECOMMENDATIONS

1. That this report be received as information.

REASON FOR THE REPORT

On October 15, 2020, the Winnipeg Public Service provided a verbal update on electrification of the transit fleet to the Standing Policy Committee on Infrastructure Renewal and Public Works (SPC-IRPW), advising that the technical evaluation report and Class 3 cost estimate would be completed by the end of the year and presented in early 2021.

IMPLICATIONS OF THE RECOMMENDATIONS

There are no implications of the recommendation as the report is to be received as information.

HISTORY/DISCUSSION

As early as 2009, the Transit Department was asked to evaluate electric propulsion as a way of managing operating costs against the rising cost of diesel fuel, and to actively lower greenhouse gas (GHG) emissions. At that time, on-wire trolleybuses were the only commercially available electric propulsion system. It was concluded that converting the fleet to trolleybuses was cost prohibitive, not only with respect to the purchase of the buses themselves, but also the need to install and maintain the network of overhead wires. The limits imposed by the trolley electrical infrastructure on the design of the transit route network and on the flexibility to interline buses, would introduce inefficiencies resulting in a larger overall transit fleet, increase operating costs, and decrease service reliability.

Off-wire electric bus technology began to accelerate shortly after this time, and in 2014 Winnipeg had the opportunity to join a larger consortium in a demonstration project to evaluate the viability of battery-electric bus technology. As Winnipeg Transit's contribution to the project, four leased New Flyer Xcelsior battery-electric buses were operated over a 4-year period on Route 20 Watt-Academy, and charged at the Winnipeg Richardson International Airport. The project allowed all of the partners involved to learn key lessons about the construction, operation, and maintenance of battery-electric buses. Unfortunately, the prototype technology used on these buses was not adequate for long term operation in Transit's fleet, and at the conclusion of the demonstration in 2018, the buses were retired and returned to the manufacturer, who owned them throughout the project.

While the demonstration project was ongoing, the Manitoba Government and the City of Winnipeg established a joint task force to examine the potential for broadly implementing electric buses beyond the initial demonstration project. Their 2016 report concluded that in addition to reduction in GHG and other pollutants, that electric buses have also proven to be quieter and cheaper to operate than their diesel counterparts. While the capital costs for purchasing electric buses are still significantly higher than that of diesel, it is expected that decreased maintenance and low energy rates in Manitoba will result in the lifecycle cost reaching near parity over a 12 to 18-year period. The expectation of significant lifecycle cost savings has not yet been proven by full-life validation.

Concerns were raised by the task force regarding the lack of information on costs, and the complexity associated with large-scale integration of electric buses and infrastructure into existing transit operations. Based on these concerns, it was recommended that electrification be pursued in a staged approach; first deploying 12 to 20 electric buses, increasing to 120 to 200 buses, then full fleet electrification.

At the conclusion of the demonstration project, a significant number of barriers to large scale transit electrification still remained. Uncertainty with regard to the systemic changes needed to transform Transit from a diesel bus operator to a zero-emission bus operator remains, as implementing new technology would require fundamental changes to route planning, scheduling, fuelling, parking, dispatching, service, and maintenance.

With a target of working towards a larger deployment of electric buses, Transit recommended first purchasing and operating a small fleet of 12-20 zero-emission buses. A Bus Electrification Study was launched to evaluate the current state of zero-emission buses and assess the lifecycle cost, performance, and safety of both the buses and their associated refueling infrastructure.

On January 8, 2019, the SPC-IRPW approved the report entitled 'Outline of Steps Toward the Large Scale Deployment of Battery Electric Buses' and referred the creation of a detailed study to provide Class 3 cost estimates for the purchase of 12-20 battery-electric buses and associated charging infrastructure to the 2019 budget review process for consideration. This recommendation was subsequently approved in the 2019 budget.

The report entitled ***Transition to Zero-Emission: Technical Evaluation Report, attached,*** as well as the Class 3 estimate for purchasing and operating a fleet of zero-emission buses completed in conjunction with this report make up two of the three deliverables associated with the Electric Bus Study. It is intended to provide a framework for Winnipeg Transit to evaluate currently available zero-emission technology and support future decisions on transit electrification, including bus technology fleet mix; electric fleet ramp-up rate; route planning / dispatching strategy; fuelling / charging infrastructure planning; facilities upgrades; maintenance planning; human resources / training requirements; charging locations; funding availability; and an economic benefits analysis.

Transition to Zero-Emission Technical Evaluation Report

The attached report is the main deliverable of the Bus Electrification Study and includes an overview of all in-scope zero-emission buses and associated fueling / charging infrastructure, establishes guidelines for comparing technologies, evaluates greenhouse gas emissions and environmental and social impact of zero-emission buses, provides a comparison of heavy-duty zero-emission buses to Transit's current diesel buses, reviews the financial implications associated with transitioning to a zero-emission fleet, reviews funding and financing models available to support this transition, and provides an implementation strategy for beginning the transition to zero-emission. The report was developed through extensive research and engagement with transit agencies, industry, non-profit organizations, post secondary institutions, as well as work across Winnipeg Transit and other City departments.

The data used in support of this evaluation was based on the state of Winnipeg Transit's operations in the Fall of 2019. The COVID-19 pandemic has had a significant impact on Transit's overall operations in 2020, with public health orders and reduced ridership levels necessitating reductions to service. Operational data from pre-COVID levels of service will be used throughout the report nonetheless as it is expected that transit service will return to these levels in the future, and that using levels of service during the COVID-19 pandemic would result in an underestimation of necessary resources in the long term.

Report Structure

The Transition to Zero-emission Technology Report is organized into 11 sections

	Topic	Purpose
Part 1	Introduction	Introduces the report and provides an outline guide to the document.
Part 2	Background and Context	Highlights the context of this report, including a history and profile of the City of Winnipeg, a brief overview of the local impacts the City can expect as a result of introducing zero-emission buses, as well as a brief overview of Winnipeg Transit operations.

Part 3	Overview of Zero-emission Bus Technology	Provides insights into the types of zero-emission buses available in the North American market, and summarizes the pros and cons of long-range battery-electric, on-route rapid-charge battery-electric, and fuel cell battery-electric buses.
Part 4	Overview of Charging Infrastructure	Summarizes the pros and cons of various refueling models available for zero-emission bus charging, including on-route conductive charging, on-route inductive charging, plug-in depot charging, overhead depot charging, and on-board hydrogen charging.
Part 5	Considerations for integrating zero-emission buses	Outlines items to consider when comparing technologies such as battery characteristics, range and performance limitations, energy management requirements, and safety.
Part 6	Greenhouse Gas Emissions and Environmental Impact	Evaluates the upstream and downstream impact of zero-emission buses on global greenhouse gas emissions, as well as the environmental and social implications associated with their supply chain.
Part 7	Comparison of Zero-emission Bus Technologies by Manufacture	Compares heavy-duty zero-emission buses to Transit's current Xcelsior diesel buses based on physical dimensions, weight, performance, noise, energy consumption, and safety.
Part 8	Financial Implications of Fleet Electrification	Outlines the expected capital, operational and indirect costs associated with launching a fleet of 12-20 zero-emission buses. Costs associated with full fleet adoption of zero-emission buses are also included for consideration.
Part 9	Funding Zero-emission Buses and Charging Infrastructure	Outlines of the various financing models and funding programs available that target zero-emission buses and refueling infrastructure.
Part 10	Conclusions	Provides recommendations and costing for establishing a test fleet of sixteen zero-emission buses and discusses options for further expansion of Transit's zero-emission fleet.
Part 11	Reference	A list of references cited in the report.

Summary of Results

Zero-Emission Bus (ZEB) is the common industry term for all buses that produce no tailpipe emissions. This definition currently includes various forms of buses with electrical propulsion systems, including standard battery-electric buses (BEB), fuel cell battery-electric buses (FC-BEB), fuel cell-electric buses (FCEB), and trolleybuses.

Fuel cell-electric buses and Trolleybuses rely predominantly on alternative energy sources as the main power supply and include only a very small battery pack as secondary power. Due to technology limitations, high purchase price, and a limited number of manufacturers producing these types of buses it was determined that both were outside the scope of this study. Only the three remaining types of zero-emission buses, including long-range battery-electric, on-route rapid-charge battery-electric, and fuel cell battery-electric (battery-dominant), were considered in scope for this study.

The main body of the ***Transition to Zero-Emission: Technology Evaluation Report*** is predominantly divided into 3 sections, with Parts 2 through 7 constituting the majority of the

technical evaluation, Parts 8 and 9 focusing on the financial implications of transitioning to zero-emission buses, and Part 10 discussing recommendations on a potential test fleet mix and future considerations for broader expansion of zero-emission transit beyond the first 12-20 buses.

Under the technical evaluation section, a review of all available zero-emission buses, including heavy-duty, medium-duty, double decker, and bi-articulated buses was completed, but the detailed technology evaluation was restricted to just heavy-duty zero-emission buses. Each type of in scope zero-emission bus and their associated fueling strategies was then reviewed in detail with the pros and cons of each summarized. Beyond the larger decision on buses and refueling infrastructure there are a number of other items that should be considered when comparing technologies. Topics, including battery characteristics, range and performance limitations, energy management requirements and safety, are discussed in detail. Broader discussions on the global impact that each type of zero emission bus has on greenhouse gas emissions and secondary toxicity factors are also included. The technical portion of the report concludes with a comparison of each manufacturers available zero-emission battery bus technology compared to Transit's current Xcelsior diesel buses based on Physical Dimensions, weight, performance, noise and safety.

The financial implications of transitioning Winnipeg Transit's diesel fleet to zero-emission buses constitutes a significant portion of the report. Fleet costs were estimated based on expected capital, operational, and indirect costs, such as training and public engagement costs associated with each type of zero-emission bus using various refueling strategies. Analyses for each propulsion system were completed both for a small test fleet comprised of eight 40-foot and eight 60-foot buses, as well as for the large-scale deployment of zero-emission buses with a fleet mix of 92% 40-foot and 8% 60-foot buses, which closely align to Transit's current fleet mix. The total fleet size of each technology used in the large-scale evaluation was adjusted based on technology limitations, such as range and charging or fueling time.

When evaluated based on a small-scale deployment, battery-electric buses have clear economic advantages over fuel-cell battery-electric buses. However, when evaluated based on a large-scale deployment and considering the technology constraints of both the buses and the refueling infrastructure, strictly from a cost perspective there is no one technology that had a clear advantage over the others. With economies of scale, the purchase price of both battery-electric and fuel cell battery-electric buses are expected to be similar, so performance, infrastructure, and operational advantages will be the main drivers to separate the two technologies.

Battery-electric buses have the advantage of lower maintenance and predictable fueling cost; however, complexities associated with scaling charging infrastructure, including power management, energy storage, back-up generation, equipment maintenance, and charger management will drive significant operational changes which may necessitate significant additional investment.

Fuel cell battery-electric buses have superior range, predictable mid-life overhaul cost, low large-scale infrastructure cost, and would drive no significant operational changes; however, the cost of hydrogen could be a barrier to unlocking maximum savings. If low-cost delivered hydrogen could be sourced, the potential lifetime savings from fuel cell battery-electric buses could be on par with, or better than, battery-electric buses. If Transit is restricted to producing hydrogen fuel on-site, operational savings are likely to be only moderately better than diesel buses.

In the conclusions section, many items are considered beyond just the buses themselves. Operational considerations, including garage layout, depot management software limitations, and available hydro electrical service, influenced decisions on the zero-emission bus fleet. As it is not immediately clear which technology is the best solution for large-scale electrification, and more than one technology may need to be deployed, it is recommended that Transit include more than one technology in the next phase of electrification. This should include both a mix of propulsion systems as well as a mix of vehicle lengths.

Establishing a test fleet which includes a mix of propulsion systems as well as a mix of vehicle lengths will provide Transit with the ability to collect data to assist with planning and decisions before determining the following step in electrification. This direction will require a higher initial investment and does not produce the highest operational savings for the test fleet, but as the intent of the program is to study and collect data for long-term decision making rather than to maximize short-term savings, taking a mixed fleet approach best fits this requirement. Focusing on short-term savings with the test fleet would result in a missed opportunity to achieve significant savings when fleet-wide electrification is pursued.

As Winnipeg Transit previously collected significant amounts of data on the performance and operation of on-route rapid-charge battery-electric buses during its four-year battery-electric bus demonstration, there is no need to further evaluate this technology. Additional information on the performance of long-range battery-electric buses, fuel cell battery-electric buses and 60-foot zero-emission buses is still necessary to fully evaluate the systemic changes required to transform Transit from a diesel bus operator to a zero-emission bus operator. Including the following mix of buses would support this evaluation:

- Four 40-foot long-range BEBs with approximately 440 kWh of Capacity
- Four 60-foot long-range BEBs with approximately 466 kWh of Capacity
- Four 40-foot FC-BEBs
- Four 60-foot FC-BEBs

While both Brandon Garage and Fort Rouge Garage have the potential to support a small-scale deployment of zero-emission buses, Brandon Garage is the preferred location to support a small-scale deployment of zero-emission buses because it is the newest facility, and has the greater ability to expand electric grid capacity up to the levels necessary for supporting a zero-emission test fleet. Without significant time and investment, selecting Brandon Garage as a zero-emission garage will restrict future expansion of the zero-emission fleet at Fort Rouge Garage due to electrical service limitations imposed by Manitoba Hydro’s existing local area infrastructure.

A Class 3 estimate of the proposed mixed test fleet of 16 buses operated out of Brandon Garage concluded that the total cost of the Transition Fleet Project is expected to be approximately $38.3 million. There are, however, many programs available that can help offset some of the capital costs associated with zero-emission buses and infrastructure. The Investing in Canada Infrastructure Program (ICIP) - Public Transit Infrastructure Stream (PTIS) appears to be the program that offers the greatest benefit. Under ICIP-PTIS the maximum federal contribution would be 40% of eligible expenses and the provincial contribution would be 33.3% of eligible expenses. This would reduce the City’s contribution towards the project to approximately $11.4 million.

Transit currently intends to utilize the zero-emission test fleet to offset mileage that would have otherwise been completed by the same number of diesel buses. Any bus related operational savings associated with maintaining or fueling a zero-emission bus will likely be offset by additional infrastructure maintenance costs associated with maintaining a combination of depot plug-in charging and fueling using on-site produced hydrogen. As such, a mixed test fleet of zero-emission buses is not projected to impact annual operating cost. Operating costs are expected to fluctuate yearly based on actual electricity pricing, maintenance requirements of buses, chargers, and refueling infrastructure, and repair and overhaul needs. It is likely that any cumulative savings will be negated by costs associated with mid-life overhaul such as battery replacement and fuel cell refurbishment. These costs may not be incurred until years 9 to 12. The true operating costs of zero-emission buses will need to be evaluated as the buses are operated in regular service over several years, as small fluctuations in cost of diesel fuel or electricity could either improve or negate any potential savings. There may be opportunities for Transit to refine their energy management strategies and improve savings as they become more familiar with the performance and operation of the buses and refueling infrastructure.

Manitoba's energy mix is 99% renewable which creates a unique opportunity for Transit to potentially operate both battery-electric and fuel-cell battery-electric buses from renewable sources at costs significantly lower than other cities in North America. The decision on which technology best suits Winnipeg will be highly dependent on the results of Transit's zero-emission bus trial.

The test fleet should operate for a minimum of 18-24 months to allow Transit sufficient time to collect and review data to understand the true costs and challenges of each technology. The results of this trial, combined with the results from the earlier battery-electric bus demonstration, would be used to consider the systemic changes required to transform Transit from a diesel bus operator to a zero-emission bus operator, and to provide insight on fleet mix for future bus procurements.

After testing is complete, Winnipeg Transit will be well positioned to begin purchasing zero-emission buses as part of its Transit Bus Replacement Program. Transit would gradually retire diesel buses from service, initially procuring 18 zero-emission buses and associated refueling infrastructure for its fleet each year, and eventually transitioning to full zero-emission fleet replacement of 30-35 buses annually once transit operations are fully aligned to support the new technology. Based on the current status of fleet electrification at Winnipeg Transit, a 40% zero-emission fleet can be achieved by 2032, just two years behind the 2030 target, but the transition to a 100% zero-emission fleet would be completed several years ahead of the 2050 target. Purchasing any diesel buses after 2030 or accelerating the transition to zero-emission buses, or could result in the early retirement of diesel buses that have not yet reached the end of their estimated 18-20 year normal service life.

Transitioning Winnipeg Transit from a diesel bus operator to a zero-emission bus operator will not be as easy as simply replacing a diesel bus with a zero-emission bus. It will require a systemic change to operations throughout the entire organization, and will require significant amounts of planning over the course of several years to implement. It is recommended that Transit consider launching a Transition to Zero-Emission Bus Program for the purpose of planning and managing the various projects and sub-projects that will be created by the transition to zero-emission, with the Transition Fleet Project being the first project delivered under this program. The goal of the program would be to set the direction for establishing a zero-emission fleet and following through on initiatives subject to securing funding sources and Council approval.

Electrical service constraints at the Brandon Garage and Fort Rouge Garage will require Transit to make a decision regarding fleet mix for future zero-emission bus procurements, but the transition to zero-emission is purposely planned to be gradual to allow Transit sufficient time to plan and adjust its zero-emission roll-out strategy based on data collected from the test fleet. A targeted fleet mix of approximately 70% long-range BEBs and 30% FC-BEBs is initially recommended, but there are options available for accommodating a different fleet mixture of zero-emission buses, if the results of the zero-emission bus trial may produce a strong preference for one technology over the other.

Regardless of which technology is ultimately selected, transitioning from diesel to zero-emission buses will occur as diesel buses reach the end of their useful lives. Charging or refueling infrastructure purchases will also need to be aligned with bus procurements. The current diesel bus fleet will need to be replaced with a combination of both diesel and zero-emission buses to allow operations to transition more smoothly. Replacing the existing Bus Replacement Program with the proposed Transition to Zero-Emission Bus Program will help to ensure a smooth transition to a zero-emission fleet. Including the initial 16 zero-emission buses, Transit can reach its goal of purchasing 100 to 110 zero-emission buses by the end of 2027 with an estimated budget of $280.4 million, based on a completed Class 4 estimate. There may be some flexibility within this budget to adjust the quantity and length of buses, the propulsion mix, or the refuelling infrastructure based on the outcome of the trial or the evolution of ZEB technology.

The existing Bus Replacement Program has a projected 7-year cost of $160.6 million (2021 Adopted Budget plus 6 year forecast). This program is funded through a combination of Federal, Provincial, and City financing, with the City's contribution being approximately 55% or $88.4 million. If Winnipeg's application to the Investing in Canada Program (ICIP) is successful, the City's expected contribution towards the new $280.4 million Transition to Zero-Emission Bus Program would be approximately 28% or $78.4 million, and the Federal and Provincial Governments would finance the remaining 72% or $202.0 million. This would result in an incremental savings of $10.0 million, while at the same time freeing Federal Gas Tax contributions for other transit projects. The long-term impact, if any, on the operating budget as a result of the transition to zero-emission buses is still being analyzed.

Construction of a replacement for North Garage as a purpose-built zero-emission facility is needed to support future zero-emission bus fleet purchases by the time the first 100-110 buses are delivered. If this new zero-emission garage is not completed by 2027, electrical service constraints at Brandon Garage or Fort Rouge Garage would restrict any future expansion of the zero-emission bus fleet. This may have long-term operational and cost implications. Transit's North Garage replacement has been identified as a priority infrastructure project by Winnipeg Transit. Based on a previously completed Class 4 estimate, this project is estimated to cost $210.9 million, excluding any future costs associated with purchasing and installing charging or fueling equipment. There are potentially significant savings from designing a transit garage with future consideration for zero-emission bus charging and hydrogen fueling infrastructure, rather than retro-fitting a garage designed diesel buses, both from a capital and operations perspective as well as a planning and project management perspective.

Based on projected rate of transition, if fleet replacement with zero-emission buses begins in 2024 as planned, by 2030 Transit's fleet is expected to be 30% zero-emission (210 of 700 buses), which is under the current target of 40% (280 of 700 buses). However, the entire fleet would be zero-emission by 2047, more than three years ahead of schedule.

The Winnipeg Transit Master Plan is proposing significant route network changes that could affect fleet size and fleet mix going forward. Efficiency improvements may not require Transit to expand its fleet at the same rate as it does today. Replacing 40-foot buses with 60-foot buses is one such way that service could be improved without directly increasing fleet size. As such, it may be possible for Transit to reach the target of 100% zero-emission sooner than shown without the early retirement of diesel buses. Much of this will be determined by the actual efficiency gains and ridership increases realized under the Winnipeg Transit Master Plan.

Next Steps

1. The Transit Department will recommend this project be included as part of its application for funding under the Investing in Canada Infrastructure Program. This will be put forward for consideration concurrent with the Winnipeg Transit Master Plan report and will be subject to Council approval.
2. The Transit Department will prepare a detailed transition plan outlining approaches to network integration, facility updates, maintenance requirements, and expected training considerations to phase out diesel buses and shift Transit to a battery electric fleet. The plan will include starting with a small test fleet and then scaling upwards by purchasing only battery electric buses beyond 2030. Specifically:
    i. Develop plan to evaluate performance of Transit's zero-emission test fleet.
        - Data Collection Plan
        - Key Performance Indicators
        - Reporting Structure
    ii. Develop a class 4 cost estimate of costs associated with expanding Transit's zero-emission fleet beyond the initial test fleet deployment.
        - Fleet mix
        - Purchasing schedule
        - Infrastructure evaluation
        - Electrical power assessment
        - Training plans

FINANCIAL IMPACT

Financial Impact Statement

Date: January 13, 2021

Project Name:

Bus Electrification Program – Transition to Zero-Emission Technology Evaluation Report

COMMENTS:

There is no financial impact as this report is for information only.

However transitioning to a zero-emission fleet will require significant capital investment and may have an impact on the operating budget as well. Securing funding and developing class 4 cost estimates are identified as next steps in advancing this program.

original signed by
Laurie Fisher, CPA, CA
Manager of Finance & Administration

CONSULTATION

This Report has been prepared in consultation with:

n/a

OURWINNIPEG POLICY ALIGNMENT

Transportation Master Plan (2011)

Key Strategic Goal Five:
A transportation system that is financially sustainable.

Key Strategic Goal Six:
A transportation system that reduces its greenhouse gas emissions footprint and meets or surpasses climate change and emissions reduction goals set by the City and the Province.

WINNIPEG CLIMATE ACTION PLAN ALIGNMENT

Winnipeg's Climate Action Plan (May 2018)

Strategic Opportunity #3:
Advancing Sustainable Transportation – Increasing Mobility Options and Shift to Zero Emission Vehicles
Key Direction 3.7 - Utilize Zero Emission Buses

Strategic Opportunity #4:
Facilitate Compact, Complete Development and Increase Density
Key Direction 4.1 - Increase Strategic Infill Development that Provides Access to and Capitalizes on Existing and Planned Corridors with Frequent Transit Service
Key Direction 4.4 - Support Redevelopment of Former Commercial and Industrial Lands into Active Use

Strategic Opportunity #5:
Low Carbon and Energy Efficient Buildings
Key Direction 5.1 - Increase Energy Performance of Existing Buildings
Key Direction 5.2 - Increase Energy Performance of New Buildings

SUBMITTED BY

Department: Transit
Division: Service Development
Prepared by: Erin Cooke, Project Manager, Bus Electrification Program
Date: January 14, 2021

Attachments:

Transition to Zero-Emission: Technical Evaluation Report


ZEB technology
assessment - 2021-0