

The Regional Municipality of York

Committee of the Whole
Transportation Services
December 3, 2020

Report of the Commissioner of Transportation Services

Transit and Corporate Fleet Electrification Plans

1. Recommendations

1. Council approve the Corporate Fleet Electrification Plan, including transition of all sedans and sport utility vehicles to electric vehicles by 2030, subject to Council approval of the capital budget each year.
2. Council approve the Transit Bus Fleet Electrification Plan, including transition of the Region's bus fleet to clean electric bus technology by the Region's target of 2051, based on Scenario 1 outlined in this report. Electric bus purchases to be subject to Council approval of the capital budget each year.
3. Council authorize staff to continue to work with the Canadian Urban Transit Research and Innovation Consortium and other appropriate agencies to identify funding opportunities and submit appropriate applications to offset the increased capital costs of electric buses, as these application opportunities arise.
4. The Regional Clerk circulate this report to Members of Parliament and Members of Provincial Parliament representing York Region to reinforce the need for financial assistance for municipalities to offset the costs of increased capital requirements to electrify the transit bus fleet to meet Council's zero GHG emissions by 2051 objectives.

2. Summary

This report responds to the June 2020 Council referral of the Fleet Electrification Plan and request for additional information.

This report also seeks Council approval of the Corporate Fleet Electrification Plan and Transit Bus Fleet Electrification Plan (Scenario 1), as outlined in this report and Attachments 1 and 2.

Key Points:

- Conservation and emissions goals set in York Region's Energy Conservation and Demand Management Plan are driven by Vision 2051 and the Council-approved target to achieve net-zero carbon emissions
- Fleets are the biggest Regional contributor of greenhouse gas (GHG) emissions with 63% attributed to the corporate and transit bus fleets
- Achieving the Region's zero emissions target is not possible without electrifying the corporate and transit bus fleets
- Studies have highlighted electric propulsion systems as the preferred solution to achieve the Region's vision of zero GHG emissions by 2051
- The proposed Corporate Fleet Electrification Plan is a 10-year replacement plan identifying short, medium and long-term goals to convert sedans and SUVs to GHG emissions-free technology by 2030, with the remainder of the fleet to be converted as technology becomes available
- The proposed Transit Fleet Electrification Plan is a 30-year plan to transition the Regional transit bus fleet; an alternate Transit Bus Fleet Electrification scenario (Scenario 2) was also examined to transition the Region's transit bus fleet 10 years ahead of the Council-approved Vision 2051 objective
- Two plans have been drafted to eliminate GHG emissions generated by the corporate and transit fleets (Corporate Electrification Plan and Transit Bus Electrification Plan)
- All plans would be subject to annual capital budget approvals
- The capital costs of transitioning the Regional transit bus fleet would benefit significantly from financial assistance to offset the costs of increased capital requirements to electrify the transit bus fleet

3. BACKGROUND

The Region cannot meet its Vision 2051 goal of zero greenhouse gas emissions, or the specific targets set in the Council-approved Energy Conservation Demand Management Plan, without electrifying the corporate and transit bus fleets

The Regional Official Plan contains numerous policies relating to GHG emissions reductions. Council-approved strategic plans and documents commit the Region to reducing these emissions by 2051. Regional fleets account for 63% of total GHG emissions created by delivery of all Regional services. The Region's goal of achieving a zero emissions target cannot be met unless the fleets are electrified.

This shift to fleet electrification supports the emissions targets set out in the Energy Conservation Demand Management Plan (ECDM) which in turn supports two Vision 2051 goals – Adapting to a New Climate and Mitigating Climate Change and Creating a Healthy Environment for a Healthy Population.

January 2019, Council authorized the purchase of electric buses as part of the Pan Canadian Electric Demonstration and Integration Trial (Pan Canadian Trial)

On [January 10, 2019](#), Council approved the first steps towards the electrification of the Regional transit bus fleet based on analysis undertaken in partnership with Canadian Urban Transit Research and Innovation Consortium (CUTRIC), showing that electric bus technology is evolving rapidly and that over the lifecycle of a transit bus, operating savings of \$600K can be generated.

Participation in the testing phase of the CUTRIC-led Pan Canadian Trial over the past four months has provided staff with practical and positive, hands-on experience in commissioning, operating and maintaining electric buses and associated infrastructure.

June 2020, Council directed staff to come back and provide options to move forward with transit bus fleet electrification

On [June 11, 2020](#), staff presented the initial proposals for corporate fleet and transit bus fleet electrification to reduce GHG emissions in a Report titled Greening the Region's Transportation Services Fleet. Following consideration of the report, on June 25, 2020, Council adopted the following recommendations from the June 11, Committee of the Whole 2020 meeting:

1. Council refer the following recommendations to staff with a further report to be brought forward in fall 2020 with more detailed analysis related to the cost impacts of climate change, multi-year financial information and several options for moving forward:
 1. Council endorse the plan documented in this report for York Region Transit to transition the bus fleet from diesel to a greenhouse gas emissions-free electric propulsion system by 2051. The Plan implementation would be subject to ongoing monitoring of the electric bus technical performance, long-term cost implications and future Council budget approval
 2. Council endorse the development of a greening strategy for the non-transit fleet with staff reporting the details of the strategy in fall 2020.

This report responds to these recommendations.

4. Analysis

TRANSIT BUS FLEET

The June 2020 staff report presented Council with an electrification feasibility study outlining requirements to operate a fully electric transit bus fleet by 2051

The Feasibility Study: Asset Electrification (Feasibility Study) identified the following key findings:

- A reduction in energy costs is expected to be achieved through electrification
- An estimated savings of \$20M in energy costs is projected over the 30-year period
- A total savings of approximately \$135M is estimated over the 30-year transition period based on reductions in maintenance and energy costs. As the transition progresses, it is anticipated that:
 - Additional savings would be realized through the implementation of preferred utility rates for mass transit fleets
 - Infrastructure maintenance costs would continue to decrease as the York Region Transit fleet transitions to fully electric and diesel fueling systems are decommissioned
- On average, an electric bus has 60% fewer moving parts than a diesel bus; this is projected to reduce maintenance and parts costs by approximately 30%

Based on the updated Feasibility Study, staff are presenting an additional scenario to electrify the Region's transit bus fleet

In response to Council's June 2020 referral, staff has now also prepared a second accelerated option for consideration and updated the Feasibility Study (Attachment 1).

Scenario 1, (presented in June), would enable the Region to achieve the Council-approved GHG emissions objective of zero emissions by 2051. The additional scenario evaluated the feasibility of accelerating the transition by ten years to 2041.

This accelerated scenario would result in significant additional capital cost impacts over the next twenty years, as outlined in the Financial section.

Both options require significant capital investment. Both also require increases to asset management reserve contributions, subject to availability of tax levy in future budgets, to mitigate the risk of having insufficient reserve balances available, in future capital plans, to

fund replacement electric bus acquisitions as scheduled. Subsidies from the federal and/or provincial governments would reduce capital dollars required to achieve either scenario.

Both options require significant capital investment and an increase of contributions to reserves. Subsidies from the federal and/or provincial governments would reduce the capital dollars required to achieve either scenario.

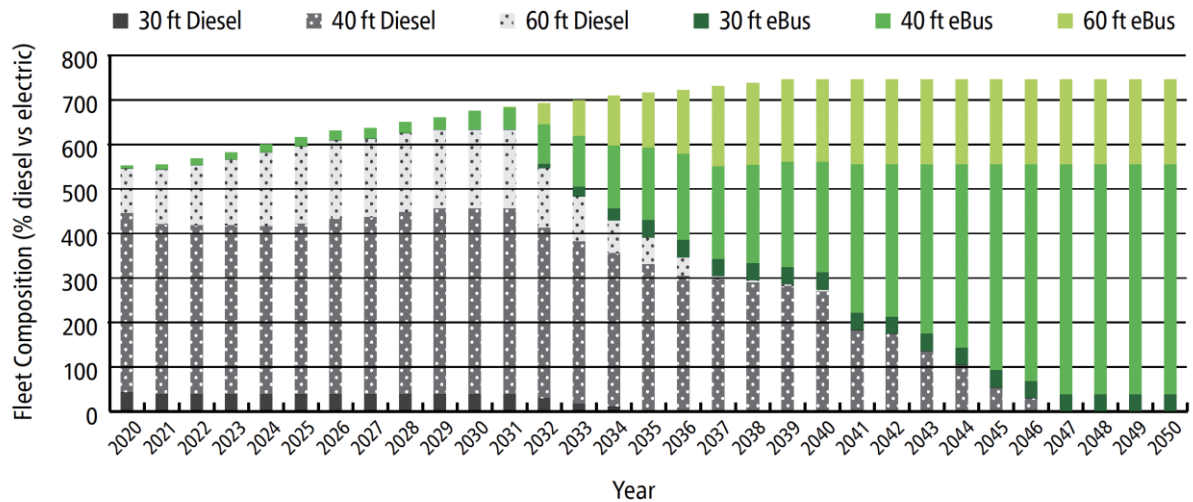
Scenario 1 – Recommended: Balanced, Complete Transition by 2051

Scenario 1 includes a phased approach to electrification with a mix of electric and diesel buses being purchased between 2021 and 2029, transitioning to exclusive purchase of electric buses by 2030. This approach was presented in June 2020 and will achieve the targets set out in Vision 2051 and the ECDM. Staff recommends this option for several reasons:

- Allows the Region to spread out capital investment over the longest time period
- Maximizes the return on investment in the current fleet
- Provides additional time to benefit from further technology enhancements, which might also reduce the cost of the program over time

The phased approach to electrification is shown in Figure 1.

Figure 1
Electrification Scenario 1 (2051)



Scenario 2 – Accelerated, Complete Transition by 2041

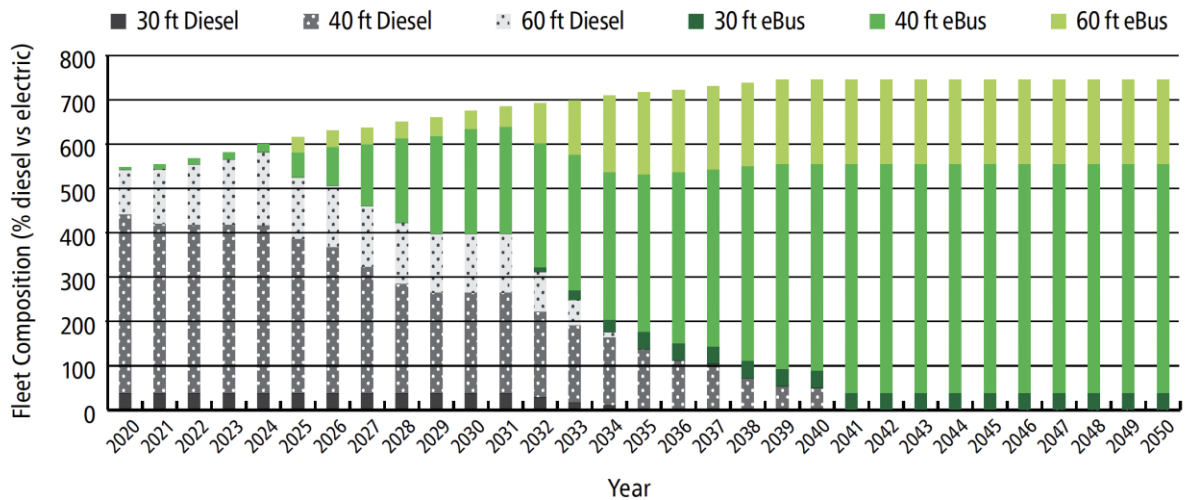
As requested by Council in June 2020, staff completed additional analyses using tools developed through the Feasibility Study to identify an accelerated scenario where transition could be completed by 2041. Scenario 2 assumes all the same costs, details and transition plans as Scenario 1.

Under Scenario 2, the window of incremental battery electric bus purchases is reduced to 2021-2024 and the purchase of only battery electric buses is advanced by five years to 2025. Considerations for this option include:

- Accelerating transition to a GHG emissions-free fleet
- Potentially realizing the benefits of further technological evolution
- Managing risks of early technology adoption while maintaining service and reliability
- Compressing the period for the Region and utility partners to obtain operational and maintenance experience, develop standards, execute applicable agreements and construct required infrastructure
- Reducing the return on past diesel bus purchases, in some cases, to accommodate acceleration (in the outer years, 40-foot bus lifecycles would gradually be reduced from 18 to 15 years)

The accelerated approach to electrification by purchasing only battery electric buses starting in 2025 is the earliest practical date the transition could be completed, as shown in Figure 2.

Figure 2
Electrification Scenario 2 (2041 - Accelerated)



A summary of emissions profiles for Scenarios 1 and 2 has been included in Attachment 2.

Although Scenario 2 would achieve zero emissions from the Region's transit bus fleet ten years sooner, the additional cost and risk to the Region is significant. The rate of technology adoption must be balanced with service reliability and risk management measures. Adopting technology too quickly could result in impacts to transit service reliability and increase operating and maintenance costs.

A high degree of reliance on securement of financial assistance from the federal or provincial governments to offset capital program cost would apply to both scenarios and could accelerate the move to implementation of aspects of Scenario 2 by addressing the higher capital cost needs, as depicted in the Financial section.

A high degree of reliance on securement of financial assistance from the federal and/or provincial governments to offset capital program costs would apply to both scenarios, but would be even more critical for Scenario 2 implementation because of the higher capital cost impacts, as depicted in the Financial section.

CORPORATE FLEET

The corporate fleet consists of sedans, sports utility vehicles (SUVs), light/medium duty pickup trucks and vans, and heavy-duty plow trucks and off-road equipment.

Conversion of Regional sedans and sport utility vehicles to electric technology has been underway since 2013

The corporate fleet is comprised of approximately 374 vehicles, 54 of which are sedans and SUVs. Most corporate fleet vehicle lifecycles are five to ten years. The shorter lifecycle gives staff the ability to right-size the corporate fleet and review conversion options of vehicles sooner.

The Region has already transitioned 8 of 9 sedans and 10 of 45 SUVs to hybrid, or plug-in hybrid, to date. The current replacement schedule will see one sedan replaced in 2024 and the balance of SUVs between 2021 and 2030.

Vehicle data is used to determine requirements for the use of each corporate vehicle to assist in replacement and new vehicle decisions. Based on vehicle use and required range, either plug-in hybrid electric or battery electric vehicles will be selected as the preferred replacement. It is important to note the availability of electric vehicles for purchase may be an obstacle for the corporate fleet electrification plan moving forward within this timeframe.

Initial infrastructure costs are also considered when purchasing electric vehicles

Staff has also conducted a review of Regional buildings where corporate vehicles are stationed. This identified additional power requirements and estimates to include future

charging stations per building. Electric vehicles, either plug-in hybrid electric or battery electric vehicle types, can charge using Level 1 (110 volt) or Level 2 (220 volt) chargers. Level 1 takes 10 to 15 hours to charge a car, depending on the vehicle, and Level 2 takes four to eight hours. Level 2 is being considered as the Regional standard. Initial one-time costs include running electrical lines and for each charger installed.

Vehicle manufacturers have received new government funding aimed at increased battery electric vehicle production in the near future

The federal and Ontario governments have recently committed to investing \$590M into battery electric vehicle production in Oakville, taking a global leadership role in development and manufacturing these. The Oakville Assembly Complex is being re-tooled and charging stations will be set up across the country. Similarly, investment in the Windsor Assembly Plant will enable at least one new battery electric vehicle model in 2025. Supporting the auto industry's transition to zero emissions vehicles, the federal government has committed to working with Unifor, Canada's leading private sector union, and other automakers to attract future "large scale" investments in zero emissions technologies.

In the absence of available electric vehicle technology for light, medium and heavy-duty vehicles, alternative fuels and technology are currently being used to reduce overall greenhouse gas emissions

Biodiesel fuel is being used as the alternative fuel source between March and October, reducing overall GHG emissions. Although electric technology is not yet available for light, medium and heavy-duty vehicles, manufacturers continue to modernize components, making vehicles more fuel efficient.

Further, with the introduction of LED lights, automatic engine shut-off technology, anti-idling policies and improved driver training, staff has been able to achieve a further reduction in GHG emissions. Gas-powered string trimmers and chainsaws are also being converted to electric.

5. Financial

TRANSIT BUS FLEET

A cost analysis to identify the capital program and operating budget outlook for Scenarios 1 and 2 for the Regional transit bus fleet has been completed

A cost analysis addressing the transit bus fleet and associated infrastructure was completed for Scenarios 1 and 2. Financial modelling was developed using 2020 dollars and does not factor inflation or any expected reduction in costs associated with demand pricing.

Building on the analysis presented to Council in June 2020, the budget impact for each transit fleet scenario has been provided for a 30-year window, from now until 2050, considering bus procurements and additional costs of required infrastructure.

Electrification of the transit bus fleet will require an estimated additional \$832M in capital funding over the next 30 years to achieve zero emissions target

To achieve the Council-approved GHG emissions-free objective by 2051, it is estimated the capital program will require an additional investment of \$832M for Scenario 1 over the next 30 years. The accelerated 2041 Scenario 2 option would increase the capital investment requirement to \$1.2B. These numbers are reflected in the last row of Table 1. These increased asset management costs would put future pressure on tax levy-funded contributions to asset management reserves.

**Table 1
Total Capital Program Impact 2020-2050**

Description	Business as Usual (\$M)	Scenario 1 2051 (\$M)	Scenario 2 2041 (\$M)
Fleet procurement	1,291	1,769	1,994
Fleet mid-life/overhaul	285	451	580
Infrastructure upgrade	0	25	25
Charging stations	0	163	202
Total capital expenditures	1,576	2,407	2,801
Incremental capital program impact over business as usual scenario	0	832	1,225

As demand for electric buses increases, it is anticipated some reduction in pricing may be realized. Staff reviewed hybrid bus technology pricing from early development to the mature technology offered today. Comparatively, battery electric and hybrid bus technology pricing are following similar trends during early development and implementation. Reductions in component pricing, such as for lithium-ion batteries, as outlined in Attachment 2, is an

example of these trends. However, it was also found that, as technology advances and improves, potential cost-savings are often offset by enhancements and new features until such time as a mature solution is available. Staff will continue to monitor electric bus price trends and update analysis for inclusion in future budget submissions.

An operating budget savings of \$135M (Scenario 1) or \$222M (Scenario 2) over the 2020-2050 timeframe is expected

An operating budget savings of \$135M and \$222M for Scenarios 1 and 2 respectively, when compared to the business as usual option, over the 30-year period from 2020-2050 is anticipated.

Table 2
Total Operating Budget Outlook Impact 2020-2050

Description	Business as Usual (\$M)	Scenario 1 (\$M)	Scenario 2 (\$M)
Fleet maintenance	723	632	572
Fleet overhaul program	62	29	22
Diesel fuel*	792	470	324
Electricity	0	301	423
Infrastructure maintenance	0	10	14
Total operating expenditures	1,576	1,442	1,355
Operating savings	0	(135)	(222)

1. Fuel cost includes federal carbon tax
2. After 2050, an approximately \$11M annual operating savings is anticipated

It must be noted, however, since many of the new buses will be purchased in the latter years, operating and maintenance cost savings will extend beyond 2050, and these must also be considered when comparing the business as usual scenario versus an electrification scenario.

As an example of the comparison of the incremental capital costs to the reduced operating and maintenance costs over the lifespan of a fleet of buses, staff calculated lifecycle costs on a fleet of 555, 40-foot buses (the number expected to be purchased by 2050). These are summarized in Table 3. This analysis shows that the additional capital investment of

electrifying 40-foot buses in Scenario 1 can be fully recovered with operating savings over an 18-year lifecycle, taking into consideration a modest electric bus price reduction. For Scenario 2, the mass conversion will start in 2025, five years earlier than Scenario 1, when a bus price may be higher, resulting in the capital investment not fully recovered over the lifecycle.

Table 3
Bus Conversion Lifecycle Analysis (40-foot buses)

Description	Business as Usual (\$M)	Scenario 1 2051 (\$M)	Scenario 2 2041 (\$M)
Fleet procurement – current price	355.2	666.0	666.0
Fleet procurement – potential electric bus price reduction	194.3	(86.6)	(67.9)
Fleet mid-life/overhaul		330.2	330.2
Total capital expenditures	549.5	909.6	928.4
Fleet maintenance	369.6	149.9	149.9
Diesel fuel	440.6		
Electricity		299.7	299.7
Total operating expenditures	810.2	449.6	449.6
Total capital and operating expenditures over 18-year lifecycle	1,359.7	1,359.2	1,377.9
Net impact vs business as usual		(0.5)	18.3

Notes:

1. This analysis does not include cost of charging stations and costs related to infrastructure.
2. A 13% reduction on bus and battery prices by 2030 (based on 1.5% reduction per year) is applied to capture a potential price reduction. This represents a conservative estimation based on the history of hybrid bus technology pricing.
3. Additional capital costs and operating savings are based on 555 40-foot buses over the 18-year lifecycle. 555 represents the total number of 40-foot buses by 2050, including 38 30-foot buses, likely to be replaced with 40-foot buses.

The 60-foot buses are not included due to limited information available with few in operation across North America. Transit agencies will need to work with bus manufacturers to address pricing, which is generally associated with demand.

- Fuel and carbon savings are based on 2022 costs and are likely to increase over the years included in the model.

The exercise is assumption-based, and as more electric bus lifecycle experience is obtained staff will update further.

Staff has estimated the cost of climate change impacts of the Regional transit bus fleet by considering the federal carbon tax as a financial proxy

In 2018, the federal government adopted carbon pollution pricing. The Federal Carbon Pricing Program is intended to promote emissions reductions and represents the environmental cost of fuel consumption. This cost can be considered as a proxy for quantifying the estimated cost of climate change.

The federal carbon tax is currently \$30 per tonne and will rise \$10 per year on April 1 each year, until it hits \$50 per tonne in 2022. This is applied to fuel at the point of purchase.

Carbon tax numbers for Scenarios 1 and 2 are summarized in Table 4 below.

**Table 4
Climate Change Cost (Federal Carbon Tax) Impact 2020-2050**

Description	Business as Usual	Scenario 1	Scenario 2
GHG Emissions (tonnes)	1,810,512	1,184,275	870,248
Carbon Tax Impact (\$M)	89.1	57.8	42.1
Carbon Tax Savings (\$M)	0	(31)	(47)

Carbon tax impact is included in the cost of fuel

While electrification does introduce significant additional capital costs, opportunities to minimize impacts on the Regional capital program are being pursued at every opportunity

Critical assistance to achieving electrification of the transit fleet to achieve Council-approved Vision 2051/ECDM targets continues to be required in the form of funding from the provincial and federal governments.

Current opportunities include leveraging the \$1.5 billion commitment from the federal government over three-years through the Canadian Infrastructure Bank Growth Plan to

accelerate the adoption of zero emissions buses and charging infrastructure. Staff are and will continue to work with the Canadian Urban Transit Research and Innovation Consortium on development of electric bus programs and funding opportunities and continue to seek all opportunities for funding through both the federal and provincial governments.

CORPORATE FLEET

Additional funding for vehicles, infrastructure and training will be required to electrify corporate sedans and sport utility vehicles over the next 10 years

Based on the current corporate fleet composition, specifically sedans and SUVs, the additional cost to transition to electric vehicles and install charging infrastructure is estimated to be \$1.3M. Electric vehicle training for staff mechanics is required in addition to other necessary training. These costs will be evaluated and included as part of the annual budget process.

Tables 5 and 6 compare the cost of 36 internal combustion engine and battery electric sedans and SUVs over a 10-year period. Fossil fuel needs and GHG emissions would be eliminated with the purchase of battery electric vehicles.

Table 5
10-Year Corporate Fleet Capital Costs

Description	Business as Usual (\$M)	Electrification (\$M)
Fleet procurement	1.3	2.0
Infrastructure upgrade	0	0.5
Charging stations	0	0.1
Total capital expenditures	1.3	2.6
Capital budget impact versus business as usual		1.3

Table 6
10-Year Corporate Fleet Operating Costs

Description	Business as Usual (\$M)	Full Electrification (\$M)
Fleet maintenance	0.25	0.06
Fuel	0.70	0
Electricity/energy	0	0.20
Total operating expenditures	0.95	0.26
Operating savings versus business as usual		(0.69)
10-year GHG emissions (tonnes)	1,600	20
Emissions costs (carbon tax)*	0.08	0

**Included in the cost of fuel*

Additional electric vehicle purchase and infrastructure costs will be included in the annual budget process

Additional electric vehicle purchase costs will be funded from departmental budgets and included in the annual budget process.

Infrastructure required as part of an electric vehicle purchase will also be discussed with the relevant departments to ensure capital funds are available prior to purchase. Fleet Services will work with each department and Property Services to identify additional infrastructure and capital costs.

Purchasing plug-in hybrid electric or battery electric vehicles will offset fuel consumption costs to each department. Fossil fuel needs and GHG emissions would be eliminated for battery electric vehicles. Fleet Services tracks fuel use reporting through the Energy Conservation and Demand Management Plan reports.

Advancements in technology and market availability of light, medium or heavy-duty vehicles will continue to be monitored

Staff will continue to monitor advancements in technology and the associated costs for light, medium and heavy-duty vehicles and report to Council when options are available.

6. Local Impact

Local municipalities will benefit from a low-carbon transportation system with reductions in greenhouse gas emissions, vehicle idling and noise pollution. These plans also support the Region's move towards a reliable, sustainable and emissions-free transportation network by 2051 along with local municipal greening strategies.

7. Conclusion

The Region's 2051 zero emissions targets can only be achieved by significant additional program investments in fleet electrification. It is anticipated that advances in technology and reductions in costs will serve to close the gap between what the Region can reasonably achieve today and what can be achieved by 2051.

This report seeks Council approval of the Corporate Fleet Electrification Plan and the Transit Bus Fleet Electrification Plan (Scenario 1) as outlined in this report and Attachments 1 and 2. These plans are subject to annual capital budget approvals. This report also requests the Regional Clerk to circulate this report to MP/MPP's and industry agencies to reinforce the need to secure additional funding for these programs.

For more information on this report, please contact Ann-Marie Carroll, General Manager Transit, at 1-877-464-9675 ext. 75677 or Joseph Petrungaro, Director Roads and Traffic Operations, at 1-877-464-9675 ext. 75220. Accessible formats or communication supports are available upon request.

Recommended by: **Paul Jankowski**
Commissioner of Transportation Services

Approved for Submission: **Bruce Macgregor**
Chief Administrative Officer

November 20, 2020
Attachments (2)
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