



**The Corporation of the
City of Sault Ste. Marie**

C O U N C I L R E P O R T

July 14, 2025

TO: Mayor Matthew Shoemaker and Members of City Council
AUTHOR: Nicole Maione, Director of Community Services
DEPARTMENT: Community Development and Enterprise Services
RE: Sault Ste. Marie Transit – Roadmap to Electrification Study

Purpose

The purpose of this report is to outline the results of a comprehensive study examining the potential for electrifying the transit system, including but not limited to infrastructure requirements, greenhouse gas (GHG) emissions reduction potential, financial implications, procurement timelines as well as opportunities and challenges. It will also address alternative emission reduction options to support this shift for Sault Ste. Marie's transit system.

Background

On December 14, 2020, City Council received a presentation and report related to the Sault Ste. Marie Community Greenhouse Gas (GHG) Reduction Plan 2020-2030 and passed the following resolution:

Resolved that the report of the Climate Change Coordinator dated 2020 12 14 concerning Sault Ste. Marie Community GHG Reduction Plan 2020 – 2030 be received and that Council approve the adoption of the Sault Ste. Marie GHG Reduction Plan;

Further that Council approve the goal for greenhouse gas reduction plans of net zero emissions by 2050 and support taking a staged approach to achieve this goal, focussing on a GHG reduction target of 10% corporate and 5% community between 2020 – 2030, with an increasing scale of reduction target between 2030 and 2050;

Further that staff be directed to work to achieve the goals and actions outlined in the plan, with any municipal monetary requests referred to future budgets.

As part of 2022 budget deliberation, City Council approved \$75,000 to fund a feasibility study relating to the electrification of Transit. This was contingent on funding approvals through the Investing in Canada Infrastructure Program (ICIP) – Transit Stream. The City received notification that this was approved on July 5,

2023. A transfer payment agreement was subsequently signed on April 8, 2024, By-law 2024-38. The City's share of the project cost is 26.67%.

In alignment with the City's Community GHG Reduction Plan, the City of Sault Ste. Marie participated in a Battery Electric Bus (BEB) Joint Procurement Roadmap Study (Appendix A – SSMBEB Fleet Transition Plan Final Report) as part of Metrolinx's Joint Transit Procurement Initiative. The BEB Roadmap provided a framework for full fleet electrification for Ontario Transit Agencies, beginning with the acquisition of consulting services to develop and plan for full fleet electrification

Analysis

The BEB Feasibility Study and Fleet Transition Plan acts as a roadmap to guide the process to fully electrify Sault Ste. Marie Transit (SSM Transit). The project included three tasks:

1. Route Modelling and Schedule Optimization
2. Facility Assessment
3. Full Fleet Electrification and Transition Plan

Route Modelling and Schedule Optimization

The route modelling ran energy consumption modelling along all routes within the transit network to determine range requirements. This included a review of the existing fleet, schedule, vehicle mileage, and energy consumption. It also assessed seasonal variations, route topography, passenger loads, road speed, auxiliary HVAC loads, and battery degradation over time. This was completed for both conventional and specialized services. Schedule optimization is used to optimize the service schedule to maximize BEB operations using two charging strategies: only in-depot charging, and in-depot charging with on-route charging strategies where in-depot charging is not feasible.¹ Findings from this task were used to inform the transition strategies, including phasing and implementation approach.

Facility Assessment

The facility assessment reviewed the current state of the transit facility and evaluated the constraints and capabilities to support fleet electrification. This task included necessary facility upgrades for fleet electrification at each phase and determined the best option for in-depot charging systems. Consideration was given to the fleet breakdown; future plans for expansion or facility relocation; historical

¹ The output identifies any routes that can be electrified using in-depot charging stations only, with no modifications to the service schedule and the percentage of routes that can be electrified using in depot charging stations with modifications to the schedule to accommodate mid-day charging and percentage of routes that require high-powered opportunity charging to be electrified.

and required charging power and energy loads; evaluation of space availability; and consideration of future structural reinforcements.

Full Fleet and Electrification Transition Plan

The full fleet and electrification transition plan outlines a step-by-step process to achieve full fleet electrification by 2040. This timeline was determined based on the vehicle lifecycles and leaves additional flexibility to reach the 2050 net zero goal when considering procurement delays, funding, and vehicles that may remain in service longer than expected. This task includes determining high-level electric bus specifications, charging systems and software solutions best suited to the operation; maintenance and staff training for electric buses and infrastructure; detailed timeline for fleet electrification to include a vehicle and procurement schedule; timeline for charging; budget to include capital, construction, operating and maintenance expenses for vehicle and infrastructure; GHG emission savings; and an operational implementation plan that considers resource allocation. The plan provides information on the following six pillars, which are expanded upon in the next section of this report:

1. System Level Planning
2. Operational Planning and Deployment
3. Capacity to Implement Technology
4. Financial Planning
5. Environmental Benefits
6. Project Risks and Mitigation

1. System Level Planning

BEBs are the most common zero emission bus as they utilize the electric grid as a source of fuel, which is ~77% clean². Despite emissions savings, current technology has limited range, to fluctuate anywhere between 150 and 300 KM depending on terrain, weather, passenger load, driving style, stop frequency, HVAC systems, speed/idle time as well as battery age and degradation compared to diesel buses. In most cases, BEBs are not capable of replacing buses 1:1, therefore either additional vehicles become necessary, and/or on-route chargers (bus charging unit located at a layover point for buses) would need to be introduced.

Energy modeling for the bus fleet was completed using the Zero + model³. Modelled scenarios for conventional transit include:

- Baseline / Status Quo (diesel)

² <https://live.gridwatch.ca/home-page.html>

³ . This model is fed by GTFS data and analysis variables known to impact lifetime vehicle performance such as battery degradation, operating environment, HVAC and auxiliary power loads and the lifecycle of bus batteries. In addition, this model considers several factors such as slope and grade of routes, number of vehicle stops, traffic and ambient temperature, specific to SSM Transit

- Full BEB fleet (mixed 250kWh and 700 kWh), overnight depot charging only
- Full BEB fleet (mixed 250kWh and 700 kWh), with a combination of depot charging and on-route charging

It is important to note that 700kWh buses do not currently exist. The timeline for this technology to advance is unknown. The current battery capacity for a 40-foot bus is around 500kWh. Full transition to electric buses with current technology was not considered as it indicated that the vehicles were not able to complete most blocks with electric or diesel heating, therefore this scenario was discounted.

With depot charging alone, all of SSM Transit's large buses can be transitioned to BEB with a battery capacity of 700kWh. The fleet would need to expand by three additional buses, all BEB buses would have a diesel heater.

Modelled scenarios for specialized transit include:

- Baseline (gas)
- Full BEB fleet (157kWh), with a combination of overnight depot charging and midday charging

With depot and midday direct current fast chargers, the buses can be replaced at a 1:1 ratio. This, however, presents a challenge as Transit Operators' schedule accommodates a 30-minute mid-day break, not the 1.58 to 1.62 hours required for a bus to charge, and not all buses are able to return to the facility to charge.

Operational Planning and Development

The recommended deployment, as per the study, is broken down into three (3) steps and addresses critical fleet and infrastructure implementation needs for conventional transit. It is important to note that a timeline cannot be confirmed due to the uncertainty of when the larger battery capacity will be available, and due to Sault Ste. Marie's climate, a diesel heater is recommended for BEBs:

STEP 1

- Replace one diesel bus with one Pilot BEB (525 kWh battery)
- The BEB can be charged in the depot.

STEP 2

- Wait for future BEB technology to advance (to at least 700 kWh) (assess every two years)
- Replace nine diesel buses with nine BEBs
- All BEBs can be charged in the depot, to avoid additional capital costs and operational complexities with introducing en-route charging.

STEP 3

- Buy three new BEBs (700 kWh) along with transitioning the remainder of the fleet, where all of SSM Transit services are delivered by BEB's.

Again, focus remains on depot charging only, and the facility at 111 Huron Street will have a total of 30 dispensers installed in the bus barn and ten cabinets installed outside of the building due to space constraints on the interior.

CONSIDERATIONS FOR STEP 2 AND STEP 3:

- The strategy for STEP 2 and STEP 3, should be monitored as the BEB technology market advances.
- It should be noted that this study identifies a feasible, preferred strategy for transitioning SSM's existing transit service to BEB technology. As service needs evolve in the future, SSM may wish to consider adjusting its bus scheduling/operations to accommodate.
- Alternatively, if funding for an on-route charging station becomes available, this option could be considered in the future as well.

With the addition of electric buses, additional software programs are required. Specifically, Vehicle Monitoring Systems that provide monitoring and logging of all the vehicle data which is critical to quickly identify mechanical or hardware failures, as well as charging and energy management systems to ensure efficient scheduling of the buses.

Capacity to Implement Technology

Ontario employers have a legal obligation, under the *Occupational Health and Safety Act, R.S.O. 1990* (OHSA), to develop and implement a workplace safety program that ensures the health and safety of their workers. In addition, the Canadian Standards Association (CSA), an electrical safety standard for Canadian workplaces, provides guidelines and requirements for identifying and assessing electrical hazards.

BEBs are classified as high-voltage systems and require specialized Personal Protective Equipment (PPE) and tools. In addition to PPE and tools, there is specific training for Transit operators and mechanics. Mechanic training specific to BEBs includes the following and entails a total of 64 hours of training per mechanic:

- Electrical and Electronic Principles
- General BEB Familiarization
- Original Equipment Manufacturer (OEM) Specific Training

Charging infrastructure will also require both preventative and corrective maintenance to ensure the charging systems remain operational. It is advised that although this maintenance may be completed by a third party, it is recommended that agencies collaborate with the manufacturer to receive specialized training to ensure regulatory compliance and keep staff informed of advancements and safety protocols.

Financial Planning

Financial planning for technology and infrastructure involves a comprehensive evaluation of all associated costs, including initial capital expenditures, ongoing operating and maintenance expenses, scheduled infrastructure improvements over time, midlife rehabilitations, and eventual end-of-life replacement to ensure long-term sustainability and performance.

In summary, full transition to electrification will cost an estimated additional \$28.6M over 15 years, compared to the status quo. Average annual capital costs are estimated at \$5.2M annually, which is offset by an eventual estimated decrease in operations and maintenance costs, which are estimated to ultimately decrease due to fuel savings.

Net Present Value, 2025\$	Diesel	BEB
Life Cycle Capital Costs	\$29.2 M	\$78.0 M
Conventional Fleet	\$26.3 M	\$67.0 M
Paratransit Fleet	\$2.9 M	\$3.5 M
Related Infrastructure	-	\$7.4 M
Life Cycle O&M	\$235.8 M	\$215.6 M
Operations	\$157.8 M	\$157.0 M
Maintenance	\$45.2 M	\$42.2 M
Propulsion	\$32.8 M	\$16.4 M
Total	\$265.0 M	\$293.6 M
Difference		\$28.6 M

There are several funding options that exist to support the transition for agencies to electrify their system:

1. Investing in Canada Infrastructure Program (ICIP) – SSM Transit has capitalized on this funding, in which the City’s share is 26.67% of total eligible costs. Council has approved, through the 2022 and 2023 budget years, the purchase of two BEBs. Recently, electric bus prices have surged dramatically, with the current cost of one BEB ranging from \$1.7M to \$1.9M, plus HST. This does not include a potential tariff that is estimated to be anywhere between 3% and 20%. The charging station, which consists of a 200kW High Voltage Contactors (HVC) power cabinet that is capable of charging two heavy duty vehicles, has an estimated cost for purchase and install of \$550,000, plus HST. As a result of the increased unit costs, a modification request would need to be submitted to ICIP to adjust the allocation of buses and infrastructure to reflect current pricing, thus reducing the total number of buses the City would be able to purchase.
2. Zero Emission Transit Fund (ZETF) – This fund targets projects that enable or implement transit fleet electrification. Within a capital stream, eligible

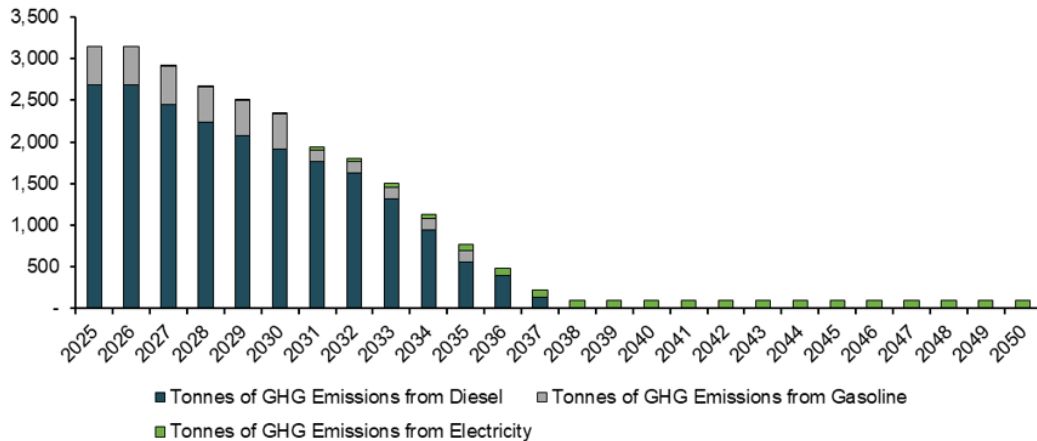
recipients can receive grants covering up to 50% of eligible capital costs for BEBs and charging infrastructure.

3. Canada Public Transit Fund (CPTF) – CPTF aims to provide predictable, long-term funding to communities with existing transit systems. It will support capital and non-capital investments. The City submitted an Expression of Interest for this funding, and for an annual allocation of \$587,555 over 10 years. This will primarily be based on a capital plan for fleet replacement.

Environmental Benefits

The primary benefit of transitioning to BEBs is reducing GHG emissions, which aligns with the City of Sault Ste. Marie Community Greenhouse Gas (GHG) Reduction Plan 2020-2030 and the Net Zero 2050 goal.

SSM Transit’s buses currently emit approximately 3,100 tonnes of GHG emissions annually. Should full transition occur, the annual GHG emissions are expected to drop dramatically to an estimated 97 tonnes annually. Details are summarized in the table below:



Project Risks and Mitigations

Electrifying a transit system presents a range of complex challenges that must be carefully addressed to ensure a successful and sustainable transition for all transit agencies.

Infrastructure improvements and modifications, such as depot upgrades and the installation of charging stations, require significant planning and investment. Internal resources may be strained due to the need for new technical expertise, staff training, and reallocation of responsibilities. It is crucial to plan well in advance to have infrastructure in place at least six months prior to BEB delivery, to ensure comprehensive testing by qualified individuals, which may include consultants.

Operational scheduling and service planning must be re-evaluated to accommodate charging times and range limitations, while collective bargaining agreements may need to be updated to reflect changes in job duties and work conditions.

Additionally, early estimates for operational costs are unknown and often underestimated, particularly as they relate to energy consumption, maintenance of high-voltage systems, and the integration of new technology. Supply chain disruptions can delay vehicle delivery and parts availability, while blackouts and limitations in grid capacity pose risks to service reliability. Ensuring interoperability between various technologies and adapting to evolving hardware and software standards adds further complexity.

The City of Edmonton experienced half of their fleet being off the road due to a variety of reasons, including the climate⁴. A BEB in Edmonton has a range of approximately 3.5 hours, as opposed to a diesel bus that can be on the road for over 20 hours a day.

Also, the adoption of new software platforms for fleet management and charging coordination may introduce unforeseen bugs and require ongoing technical support and updates.

Funding applications can be denied and timelines for approval delayed. Although several transit agencies have experienced success in applying to the ZETF, the City of Durham experienced setbacks regarding their \$33M approved ZETF funding which ultimately resulted in Council approving the purchase of diesel buses.⁵

The Sault Ste. Marie Fire Department has also provided the following pertaining to electric buses:

- Lithium-ion batteries are becoming increasingly used in just about everything, including electric vehicles. They are generally safe when stored, charged and discarded properly. However, fires can occur when they are damaged, not manufactured to proper Canadian safety standards or not charged, stored or used properly.
- From the inspection/enforcement side, the *Ontario Fire Code* is silent on any fire safety concerns and hazards associated with lithium-ion batteries at this time. This is likely because their widespread use is so new that the current code (2015) has not caught up with the technology.

⁴ <https://edmontonjournal.com/news/local-news/more-than-half-of-edmontons-60-million-electric-bus-fleet-not-roadworthy>

⁵ <https://www.durhamradionews.com/archives/190570>

- From the suppression side, storing an electric vehicle inside a building is generally safe (and recommended especially during cold weather); however, should a fire occur because of battery failure, these fires are notoriously difficult to extinguish. These batteries can experience thermal runaway, a rapid and uncontrolled heat generation that is difficult to cool and suppress using traditional methods (like water). The location of the battery also can make it very challenging to reach it and cool the individual cells. So, while they may not happen often, when they do, rapid fire spread can occur, especially where not sprinklered.

Lastly, U.S. tariffs have resulted in immediate, unplanned cost increases due to factors beyond the control of transit bus manufacturers. Through Metrolinx, the transit rolling stock contracts include provisions for price adjustments related to changes in law and regulations. Currently, there is an estimated 3% to 20% increase in costs to account for tariffs.

To mitigate risks associated with the transition to BEBs, infrastructure planning should be in place at least six months in advance of a BEB being delivered, incorporating comprehensive testing by qualified individuals, including external consultants, newly hired specialists, or through additional training of existing staff. Early adjustments to planning must account for the operational limitations of BEBs, ensuring staff are equipped with the necessary tools and training to support schedule optimization. Regular collaboration with the vehicle manufacturer will be essential to address emerging technical issues.

Early engagement with unions is also critical to outline training requirements and support a smooth workforce transition. The deployment of on-board diagnostic software will be key in monitoring vehicle health and generating alerts related to battery performance. Budget planning must be reviewed through a multi-year lens to account for replacement cycles and the local stocking of critical technological components and parts. Consideration should also be given to the impact and frequency of power outages, with the integration of charge management software to provide real-time alerts and failure notifications, supporting proactive system management.

Regarding fire safety, training for staff is recommended on recognizing the signs of thermal runaway and emergency procedures. It is also recommended to isolate BEBs as best as possible by storing them away from higher fuel loads and close to an exit.

Alternative Options

As a result of significant capital costs to purchase electric buses and infrastructure, along with the above-mentioned risks, SSM Transit reviewed alternative options from comparable communities to meet the Sault Ste. Marie Community GHG Plan 2020-2030 and net zero emissions by 2050.

Currently, Milton, Stratford and Barrie have proceeded to electrify their fleet. Milton has invested \$800,000 to transition a traditional diesel bus to electric as a pilot program and first step to electrification; Barrie has purchased two (2) fully electric buses as a pilot program; and Stratford has received a hybrid bus, with plans to move ahead with full electrification.

Other municipalities such as Belleville and North Bay have begun the transition to hybrid buses, putting all electrification plans on hold. At an estimated cost of \$1.3M, with no infrastructure requirements, hybrid buses are used as a stepping stone towards net zero. Hybrid buses can replace diesel buses at a 1:1 ratio. North Bay is showing a fuel savings of 21%. General high-level estimates show a reduction in GHG emissions ranging from 25% to 40%. The transition to hybrid buses was not included in the scope of the feasibility study, therefore it is noted that estimated savings will vary for Sault Ste. Marie. The battery charges by turning the wheels into generators when stopping, and the engine powers the batteries by generating electricity while the bus is operating, therefore there are no infrastructure requirements.

Finally, Sudbury⁶ has paused the roadmap to electrification due to high capital costs and battery range risks related to the Northern Ontario climate.

Hydrogen Pilot

The City of Sault Ste. Marie will be participating in a hydrogen fuel technology system pilot through HYG N, a Canadian owned and operated company.⁷ The pilot consists of installing a device, called an Electrolyzer, on the bus that utilizes electricity to convert water into hydrogen and oxygen gas within the device. This will then feed the engine a small amount of hydrogen with the air coming through the air intake. The small amount of hydrogen allows the engine to burn the fuel more completely, thereby releasing more energy, resulting in less unburned fuel out the exhaust. This pilot is expected to reduce fuel consumption from 10% to 20%, and with the potential of emissions being reduced up to 50% at a high estimate. HYG N will collect baseline fuel consumption and emissions data and continue emission testing monthly. The cost is \$10,000 per system. Pilots are available for \$5,000 per vehicle. The system can be purchased at the end of the pilot for the remaining \$5,000. The City of Sudbury has recently started this pilot program, and the City of Kawartha Lakes has reported the results from their pilot and showed a fuel savings of just over \$5,000 for 2024 from one 27-foot bus.

⁶ <https://www.sudbury.com/local-news/sticker-shock-sours-city-councils-appetite-for-electric-buses-10414979>

⁷ <https://www.hygnenergy.com/>

Recommended Next Steps

It is recommended that the City of Sault Ste. Marie temporarily pause the transition to full electrification due to significant capital costs, concerns about performance during the harsh winter months, uncertainty of the timeline to advance technologies to a higher battery capacity, and long-term reliability of electric buses. As previously mentioned, revisiting this in two years is recommended to assess technology and cost improvements.

In the interim, it is suggested to submit a modification request to ICIP for all approved electrification projects and amend the project scope to provide flexibility for the purchase of hybrid, diesel, and gasoline buses, in place of electric units.

Pending approval, it is recommended to purchase one hybrid bus as a trial, as this will align with corporate GHG reduction goals at a lower capital cost.

The City will continue to monitor the electrification of transit technologies and fuel cell buses powered by hydrogen for future consideration.

City staff will continue to capitalize on current ICIP funding, and future CPTP funding sources to ensure ongoing transit services through the ongoing investment in fleet replacement.

The City will also report back to Council on the outcome of the HYGX pilot, and if deemed successful, staff will submit a capital request to expand the project to additional buses.

Financial Implications

The cost of the HYGX pilot, if deemed successful will cost \$20,000 plus HST, funded from operations. This initial cost will be offset by fuel savings, estimated at 10 to 20% per unit

Strategic Plan / Policy Impact / Climate Impact

The recommendation supports the focus area of the Corporate Strategic Plan 2024-2027 in several ways:

- Within the Service Delivery focus area, it will continue to assist in delivering excellent customer service to the community.
- It will contribute to the infrastructure focus area by upgrading and maintaining existing assets by leveraging funding opportunities and ensuring energy efficiency.
- Pausing the full electrification of the transit fleet will delay net zero by 2050 emissions goals; however, it allows the City to remain responsive to evolving technology and cost trends. In the interim, the introduction of hydrogen electrolyzers and the use of hybrid buses support lower-carbon operations and provide valuable data on alternative fuels. This approach

balances climate goals with fiscal responsibility and technological readiness. Staff will continue to monitor developments to inform future zero-emission transit investments.

Recommendation

It is therefore recommended that Council take the following action:

Resolved that the report from the Director of Community Services dated July 14, 2025, concerning the Zero Emission Electrification Study be received as information, and that staff:

1. Be directed to submit modification requests to ICIP for a change of scope on applicable electrification projects to allow for the purchase of rolling fleet assets to include either hybrid or diesel/gasoline;
2. Be directed to engage with Metrolinx on the purchase of one hybrid bus, pending approval of the modification request;
3. Report back to Council on the outcome of the HYG N pilot project and put forward a budget request for 2026 that further outlines financial requirements; and
4. Be directed to revisit transit electrification technology options and cost estimates every two years, to ensure the City remains aligned with its net-zero emissions goals and is prepared to act as technologies mature and become more cost-effective.

Respectfully submitted,

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