Electric School Buses

In collaboration with
Earth Rangers Teens

ER Teens
An Earth Rangers program

Introduction

Objectives:

- To educate on how diesel school buses impact air pollution and our health
- To educate on ESBs as a better alternative

My name is Audrey He.
I am 15 years old, and have been dedicated to helping the environment since I was little.
You can find me on LinkedIn.

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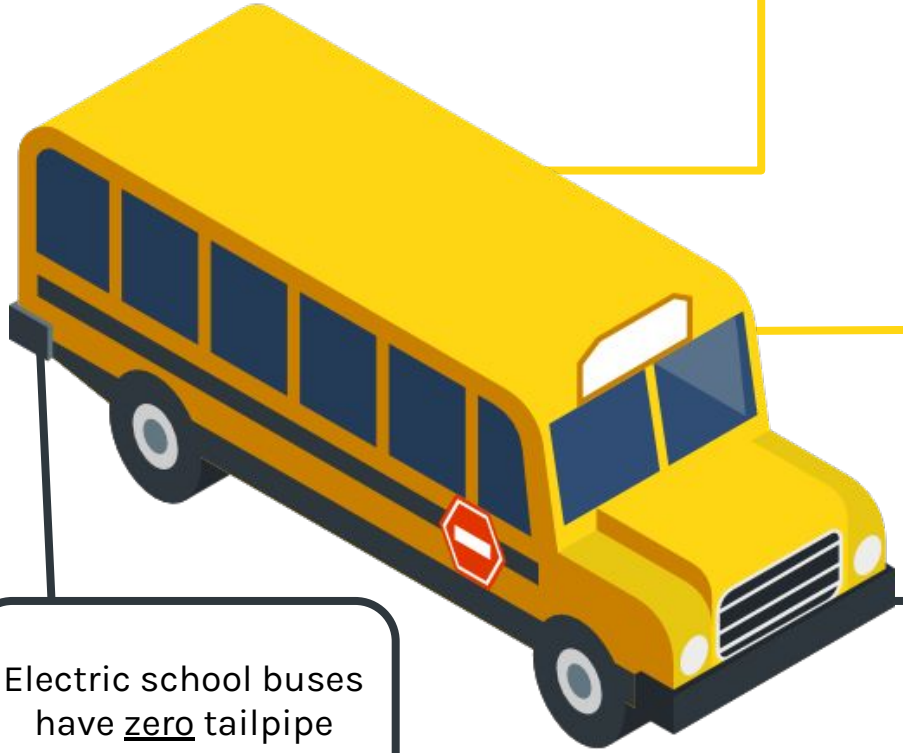
What are ESBs?

Electric school buses are school buses that are powered by a battery pack (usually lithium-ion) which powers the motor.

Diesel school buses emit around 300,000 tonnes of GHGs per year

School buses transport more than 833,000 students every day in Ontario

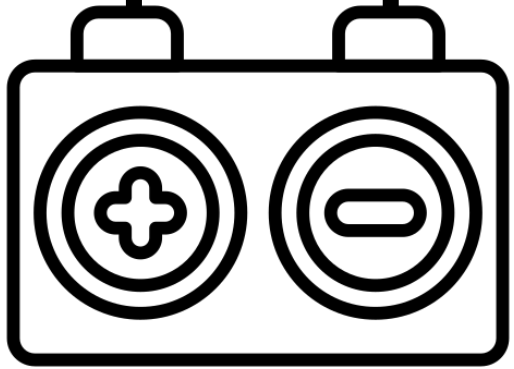


Electric school buses have zero tailpipe emissions

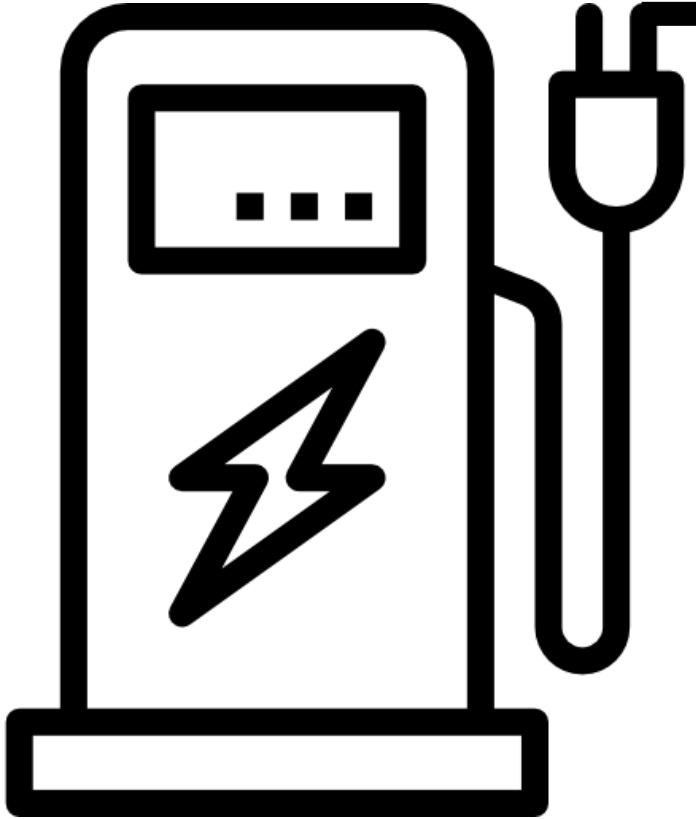
Electric school buses reduce GHGs 2-4x compared to diesel buses

An ESB gets its electricity from a power grid and stores it in a battery, which can be recharged

In a diesel bus, the motor works with an accelerator. In an EV, the electric motor works as both a motor and an accelerator



This is possible as the AC signal can be easily increased and/or decreased



For the driver, there would be basically no difference except for charging

ESBs should have a standard receptacle, which allows them to charge with a Level 2 charger.

The average time it takes them to achieve a full charge is 6-8 hours, but it can be decreased to 2-3 hours with a DC Fast Charge station.

Charging Options

Level 2

208/240V AC
19.2 kW max
Less expensive
Usually used

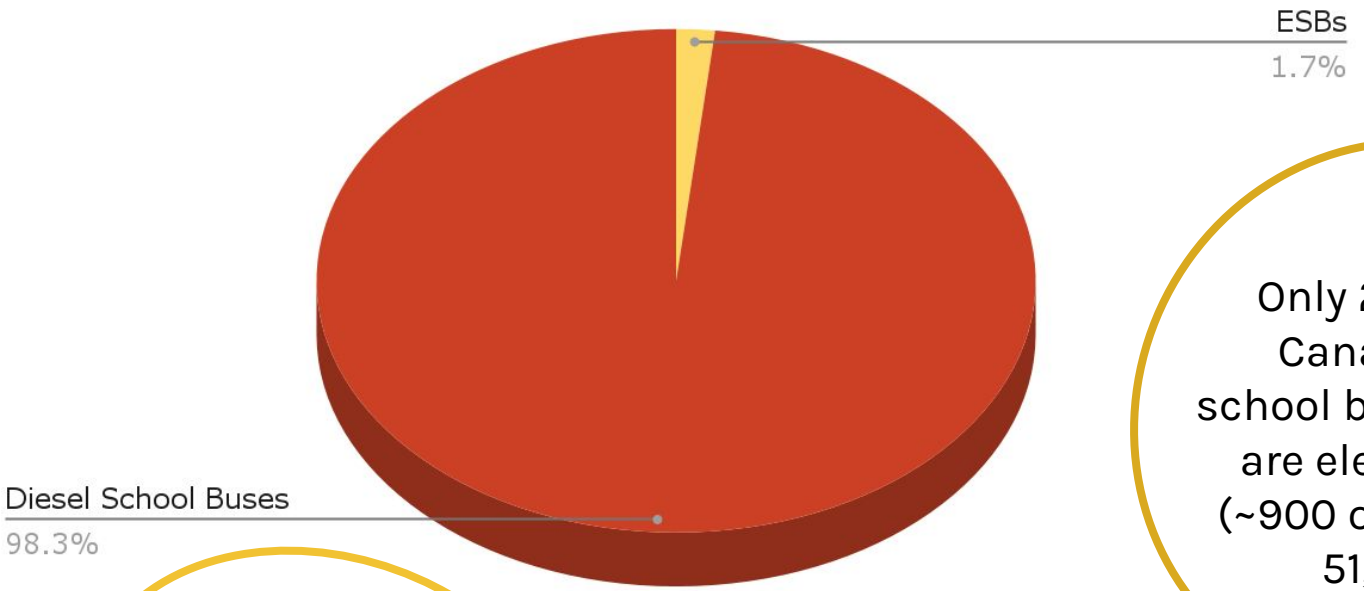
DC Fast Charging

200-600V AC
90 kW max
Expensive due to more equipment

DC Fast Charging can be twice as fast as it converts AC to DC in the charging station which feeds power to the battery directly.

Electrifying Canada's bus fleet could prevent **1.17 million tonnes** of GHG emissions annually

ESBs compared to Diesel School Buses in Canada



Only 2% of Canada's school buses are electric (~900 out of 51,000)

Only 1% of Ontario's school buses are electric

Retrofits/Repowers

Removing the bus's internal combustion engine that runs on a fossil fuel and replacing it with an electric drive system

Becomes fully electric, so there are also no tailpipe emissions

If the bus is relatively young, the price of a battery replacement should be considered

Excluding the costs of buying a bus, retrofitting costs around $110,000-180,000

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Comparing Electric to Diesel

- Environmental Impact
- Economic Impact
- General Usability

Despite all the benefits of electric school buses, they also have their set of challenges:

- Lithium-ion batteries create fires that are hard to control
- Will need additional training

However, electric school buses have a 1/38,000 chance of catching on fire compared to diesel's 1/1,300 chance

Environmental Impact

Diesel

- Increases risk of lung cancer
- Worsens **asthma, bronchitis and pneumonia** and can cause asthma in young children
- A child riding in a bus is **4x** more exposed to the level of diesel exhaust than someone riding in a car ahead of it
- Exposure is higher at the back of the bus with windows closed
- They produce nitrogen oxides, which can cause respiratory and heart diseases

Electric

- Zero tailpipe emissions
- Electrifying Canada's bus fleet could prevent 1.17 million tonnes of GHG emissions annually
- If lithium batteries are improperly disposed they can cause environmental harm
- Mining can cause groundwater depletion and soil contamination
- Electric school buses reduce GHGs **2-4x** compared to diesel buses

Economic Impact

Diesel

- For the standard bus, they can cost around $140,000 – $160,000
- Diesel school buses generally cost **twice as much** as electric school buses in maintenance and repair costs per mile ($0.29 v.s. $0.57 for Type C)
- Diesel school buses can cost around $250,000 less than electric school buses (specifically for Type C)

Electric

- For the standard bus, they can cost around $320,000 to $440,000
- An ESB can save around **$6,000** per year on operational expenditures compared to diesel school buses
- It is estimated that the upfront costs will decrease as battery costs decline
- They have the potential to create jobs in the green energy sector

General Usability

Diesel

- From looking at different companies (e.x. Gregory Poole, Thomas Built Buses) the average range is around 160-320 kilometers
  - 100 to 200 miles
- Can fit a maximum of 70 students per bus in Ontario due to safety concerns

Electric

- The range is around 160 and 240 kilometers
  - 100 to 150 miles
- Quieter and smoother performance
- School bus capacity is approximately the same as diesel school buses
- Can reduce absences
  - Students were 5-10% less likely to miss school, and students with severe asthma were 15-20% less likely

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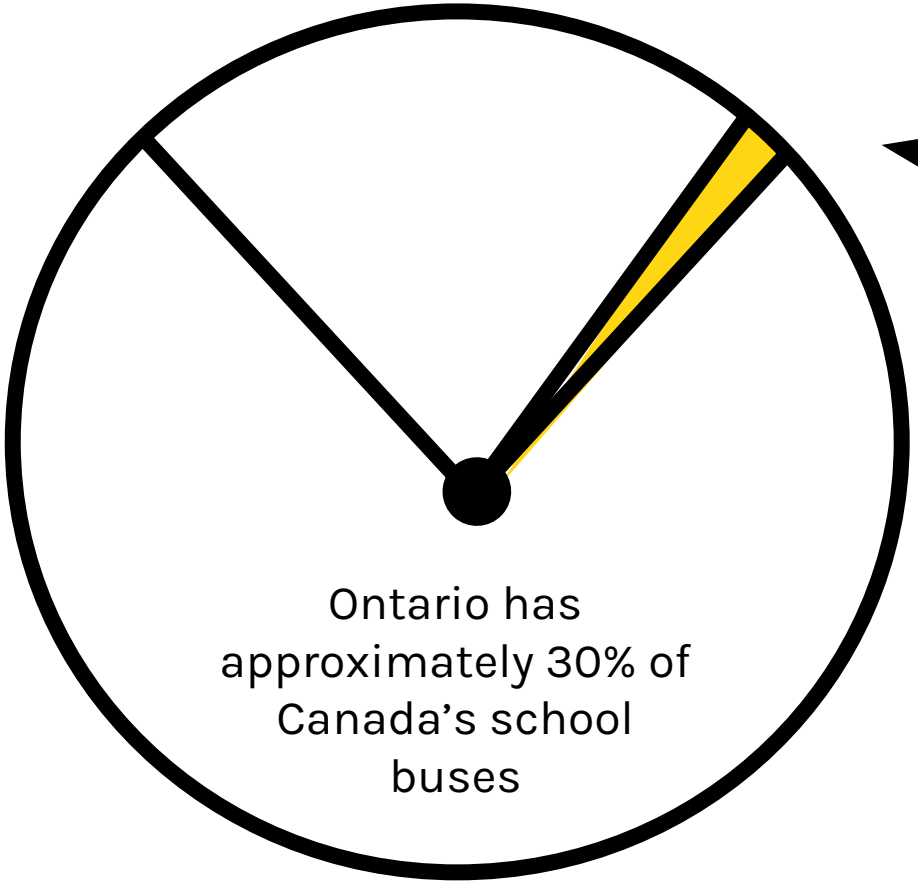
Ontario's Progress

How Ontario is doing compared to other provinces.



- Out of Ontario's ~21,000 school buses, only 1% is electric

Ontario doesn't have any mandates regarding ESBS (that I'm aware of)

PEI has the most electric school buses in Canada, with 25% of it's fleet being electric

Quebec aims to electrify 65% of its school bus fleet by 2030 and offers subsidies.

BC has the CleanBC Go Electric School Bus Program and the Zero Emission Transit Fund which covers a majority of the funds.

Thank you for listening!

Additional thanks to Earth Ranger Teens and Clean Air Hamilton for support.

For additional information and resources, check out my Instagram: @esb.iont

Resources

Icons: Flaticon.com

Pollution Probe: An Electric School Bus Strategy for Ontario

https://www.pollutionprobe.org/wp-content/uploads/2023/10/School-Bus-Report_Ontario_Oct18.pdf

Electric School Bus Initiative: FAQ

https://electricschoolbusinitiative.org/frequently-asked-questions-faqs

Canadian Electric School Bus Alliance: Recommendations Report

https://eschoolbusalliance.ca/recommendations-report/

Gregory Poole: Electric School Bus Guide

https://www.gregorypoole.com/electric-bus-guide/#common

Thomas Built Buses

https://thomasbuiltbuses.com/resources/articles/top-considerations-regarding-electric-school-bus-batteries-and-charging-infrastructure/

Electric School Bus Initiative: Charging 101

https://electricschoolbusinitiative.org/sites/default/files/2022-10/ESB-101-Print-10.4.pdf

World Resources Institution: What to Know About Electric Bus Repowers

https://www.wri.org/insights/repowering-electric-school-buses

Electric School Bus Initiative: Value Chain

https://electricschoolbusinitiative.org/value-chain

Gregory Poole: School Bus Costs

World Resources Institute: Total Cost of Ownership for Electric Buses

https://files.wri.org/d8/s3fs-public/2023-02/recommended-total-cost-ownership-esb-summary-methods-data.pdf?VersionId=dFh.syMjwVcYF9cBpomUkK5_hepMvyIB&_gl=1*z9n2ub*_gcl_au*MTA3MTkyNDE0My4xNzI0OTY2NTc0LjE3MzEwNDA1ODkuMTcyNDk3MjQ5Mi4xNzI0OTcyNDky

Student Transportation Services of Central Ontario: FAQ

https://www.stsco.ca/faq.asp

Electric School Bus Initiative: All About Electric School Bus Battery Safety

https://electricschoolbusinitiative.org/all-about-electric-school-bus-battery-safety

CESBA: Electrifying Canada's School Bus Fleet

https://eschoolbusalliance.ca/electrifying-canada-school-bus-fleet/

Mobility Network: Electrifying Ontario's School Bus Fleet

https://www.mobilitynetwork.utoronto.ca/electrifying-ontarios-school-bus-fleet-health-benefits-economic-implications-logistic-challenges-and-community-engagement-december-2023/