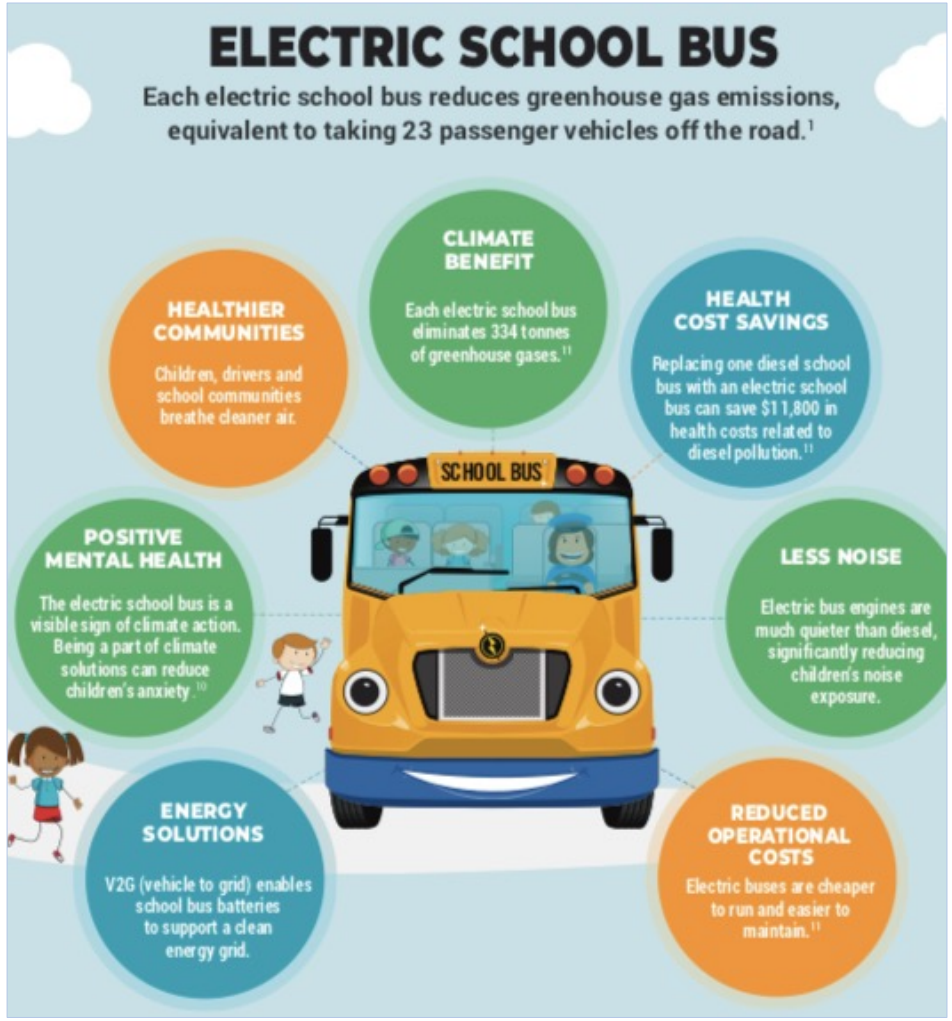

It’s time to invest in school bus electrification in Canada – for our children’s health today and for their future!
canadian partnership for children's health & environment
partenariat canadien pour la sante des enfants et l'environnement
Pollution Probe
Mobility Futures Lab

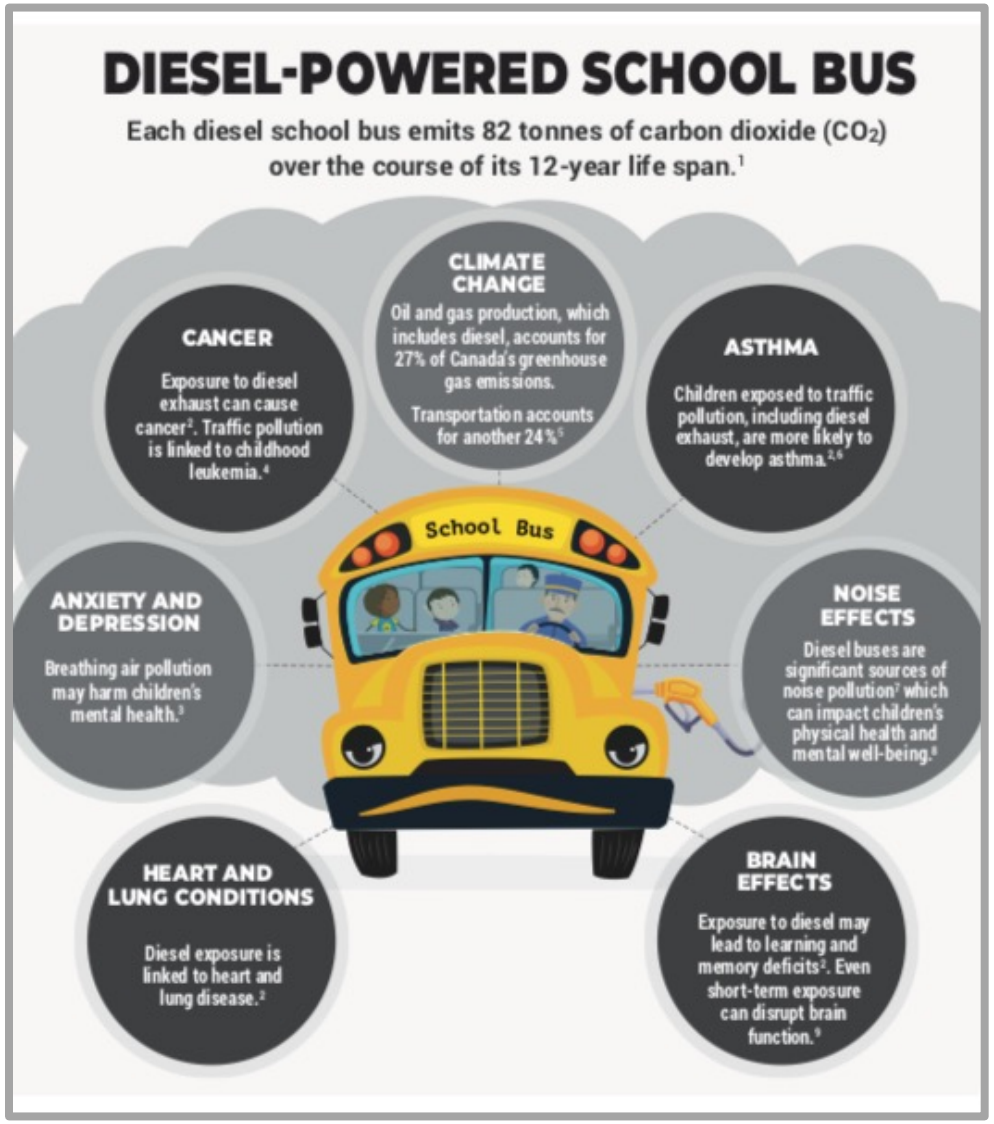
Purpose of this Slide Deck Presentation

- To provide you (our education, transportation and health sector partners) with the facts relating to the child-health benefits of Electric School Buses (ESBs) and address health and safety concerns, to help in your efforts to advocate to decision-makers and other stakeholders for provincial and national policies to support Electric School Bus deployment.

The Evidence – The Child Health Case for Electric School Buses



Healthy Environments for Learning Day 2023. Electric School Buses . https://healthyenvironmentforkids.ca/held/2023-campaign-school-bus-electrification/



While the iconic yellow school bus is a symbol of childhood, education and community, it is also a source of harmful emissions that cause serious human health impacts and contribute to climate change.

Hazardous particles and gases from diesel exhaust:

- Fine particulate matter ($PM_{2.5}$)
- Nitrogen oxides (NOx)
- Carbon monoxide
- Polycyclic aromatic hydrocarbons
- Volatile organic compounds
- Ground level ozone

Healthy Environments for Learning Day 2023. Electric School Buses . https://healthyenvironmentforkids.ca/held/2023-campaign-school-bus-electrification/

Steiner et al. 2016

Investing in ESBs for Cleaner Air and Better Child-Health Outcomes

- Pollution from diesel-powered school buses harms children's health.
- With annual emissions from Ontario diesel school buses estimated to be over 200,000 kg of nitrogen oxides and over 8,000 kg of particulate matter, along with other air pollutants, eliminating these harmful pollutants can have significant physical and mental health benefits for children.

Pollution Probe, The Delphi Group, the Canadian Partnership for Children's Health and Environment.2023

The Child Health Evidence – Physical Health

- **Exposure to diesel exhaust** is linked to multiple physical and mental health effects.
- Children are **more susceptible** to the harmful impacts of air pollution because their bodies, brains and lungs are still developing
- Children have **greater exposure** to air pollutants:
  - They breathe more air per kilogram of body weight
  - They spend more time being active outdoors
  - They are closer to the ground, where vehicle emissions are concentrated

Every year, in Canada, exposure to diesel exhaust is estimated to cause 170,000 asthma symptom days and 3,000 child acute bronchitis symptom days.

Health Canada 2016; Canadian Partnership for Children's Health and Environment 2023

Health Effects of Diesel Exhaust

- **Respiratory Effects** – reduced lung function, inflammation of the airways, asthma, chronic obstructive pulmonary disease
- **Cardiovascular Effects** – heart disease, arrhythmia, stroke
- **Cancer** – diesel exhaust is a human carcinogen – lung and bladder cancer in adults, childhood leukemia
- **Central Nervous System** – neurodegenerative diseases
- **Immunological Effects** – increased sensitivity to environmental allergens
- **Reproductive & Developmental Effects** – cognitive development, brain function, neurodevelopmental disorders e.g. autism spectrum disorder

Health Canada 2016. Human Health Risk Assessment for Diesel Exhaust

Health Effects Institute 2022. Systematic Review and Meta-analysis of Selected Health Effects of Long-Term Exposure to Traffic-Related Air Pollution

The Child Health Evidence – Academic Performance and Learning

- Emerging evidence suggests that exposure to **diesel exhaust*** can impede brain function and learning.
- A study of school age children's exposure to **traffic-related air pollution*** showed slower response times in children with greater exposure to pollutants in diesel exhaust.
- Another study showed that exposure to traffic-related air pollution* was negatively associated with educational attainment.
- Improvements in school attendance, educational performance, and outdoor air pollution have been observed when older diesel school buses were replaced with new, lower emitting buses.

***Diesel exhaust** is a significant contributor to traffic-related air pollution (TRAP)

Sunyer et al., 2017; Mizen et al., 2020; Adar et al., 2024

The Child Health Evidence – Mental Health

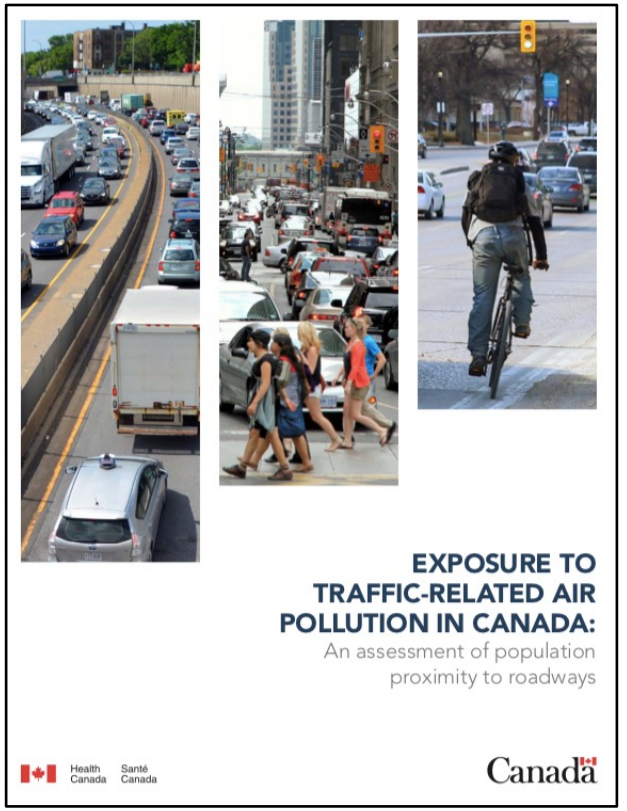
- Air pollution increases the risk of **poor mental health** outcomes in children and adolescents.
- Exposure to traffic pollution has been linked to depression and anxiety symptoms.
- One meta-analysis of data from multiple studies found a link between ambient air pollution and depression. More specifically, a 10ug/m^3 increase in $PM_{2.5}$ corresponded to a 7% increased risk of depression.

An estimated 1.2 million children and youth in Canada experience mental health challenges. (Canadian Paediatric Society, 2023)

Xie et al., 2023; Wang et al., 2024; Zundel et al., 2022; Borroni et al., 2022

The Child Health Evidence – Health Inequities

- Some children are at even greater risk from exposure to traffic-related air pollution including diesel emissions due to inequities.
- People in socioeconomically disadvantaged neighbourhoods experience elevated exposure to ultra-fine particulate pollution.
- With almost half of all schools in Canada within 200 m of high traffic roadways, children may have higher exposure to air pollution both at home and at school.



Exposure to Traffic-Related Air Pollution in Canada: An Assessment of Population Proximity to Roadways. Health Canada 2022

The Health Evidence – Health Care Cost Savings

- Reducing $PM_{2.5}$ and NOx by an equivalent number of tonnes to that emitted by all school buses in Ontario is estimated to provide over **$7.2 million in health benefits every year.**

- Replacing the average diesel bus in the U.S. fleet in 2017 with an electric bus has been estimated to yield **climate benefits of $40,400/bus, and health benefits of $43,800/bus**, with the health benefits accruing from fewer deaths and fewer new childhood asthma cases as a result of reduced exposure to $PM_{2.5}$.

Health Canada 2022; Choma et al., 2024

The Health Evidence – Climate Action

- Electrification of school transportation is an important part of Canada's plan to reduce greenhouse gas (GHG) emissions from the transportation sector which accounts for 25% of Canada's GHG emissions.
- Collectively, these measures will also significantly reduce traffic-related air pollution and associated health costs which Health Canada estimates to be $9.5 billion per year.
- Thus, health cost savings achieved with improved air quality through a switch to electric school buses helps offset their costs.

Health Canada 2022. Health of Canadians in a Changing Climate https://changingclimate.ca/health-in-a-changing-climate/

A Green Economy for our Kids

- In addition to climate and health benefits, Electric School Buses provide opportunities for economic development and are part of the green economy future for our children.

- Electrification of school buses also enables schools and school districts to model sustainable practices and climate action for students and families!

Principles for a Green Energy Transition 2023; Pollution Probe, The Delphi Group, the Canadian Partnership for Children's Health and Environment 2023

The Child Health Evidence – Healthy Communities

- Electric school buses are part of a healthy, active, sustainable and equitable transportation system!
- Optimal child health benefits are achieved when transportation policies prioritize health, equity and sustainability.
- Promoting active transportation, public transit, equitable access to safe mobility for all users, and vehicle electrification including electric school buses, is part of a winning transportation solution for children of all ages.

Pollution Probe, The Delphi Group, the Canadian Partnership for Children's Health and Environment 2023; Dominish et al., 2024; ICCT 2024; Green Communities Canada 2024; CPCHE 2022

Addressing Health and Safety Concerns of Vehicle Electrification

Health Harms

Claim: *"Kids have been riding diesel school buses for generations, and it hasn't harmed them."*

Fact: Exposure to diesel exhaust causes ~ 170,000 asthma symptom days and 3,000 child acute bronchitis symptom days every year in Canada.

Health Canada's Human Health Risk Assessment for Diesel Exhaust:

- Children and asthmatics, can be at greater risk of adverse respiratory effects.
- Increased risk of chronic respiratory symptoms, such as wheeze, in infants and children.
- Increased risk of asthma development in children with diesel exhaust exposure.

Health Canada 2016; Pollution Probe, The Delphi Group, the Canadian Partnership for Children's Health and Environment 2023; Equiterre 2024

Either/or - $

Concern: *"Dwindling budgets means that school boards must prioritize spending on educational programs and performance outcomes."*

Fact: Investing in Electric School Buses is part of the solution to help children succeed academically.

- Exposure to diesel exhaust causes approximately 170,000 asthma symptom days and 3,000 child acute bronchitis symptom days every year in Canada.
- Asthma is a leading cause of school absenteeism in Canada.
- Reducing reliance on diesel school buses can help reduce asthma symptom days, reduce school absenteeism and improve academic performance.

Health Canada 2016; Asthma Canada; Statistics Canada 2010; Magda et al., 2025

Safety – Fire Hazards

Concern: *"I've heard that ESBs are more likely to catch fire than diesel buses!"*

Fact: Electric School Buses are less likely to catch fire than diesel buses

- Fire incidents are orders of magnitude lower for EVs compared to Internal Combustion Engine (ICE) vehicles e.g., gasoline, diesel:
  - 0.9 to 1.2 fire incidents per 10,000 EVs compared to 7.3 per 10,000 for ICE vehicles (US). RWTH Aachen University
  - Likelihood of fires: EVs: 1 in 30,550 EVs; ICE: 1 in 1,294 (Sweden). EPRI
- *"Electric school bus fires spark misinformation about low-emission vehicle safety."* AFP Fact Check. Oct 2025
- *"5 Reasons Why Electric Buses Are Safer from Fire."* CESBA. July 2025

PEM 2023; EPRI 2023; AFP 2025; CESBA 2025

Cost

Concern: *“ESBs are cost-prohibitive.”*

Fact: Electric School Buses still have higher upfront costs, but the gap is shrinking as battery prices fall and operational savings increase. Incentives also reduce this difference.

- Pollution Probe (2023) found that, with incentives, total cost of ownership can be about 21 percent lower than diesel. Equiterre reports nearly $202,000 in fuel and maintenance savings over twelve years.
- Costs are moving in the right direction, and fleets rarely transition all at once. Starting with a few buses allows operators to capture early savings and build experience as costs continue to decline.

Pollution Probe 2023; Equiterre 2024

Greenhouse Gas Pollution

Claim: *"Over their lifespan, ESBs emit more carbon pollution than diesel."*

Fact: Electric School Buses provide a promising opportunity to address the climate change impacts associated with fossil fuel-powered school buses.

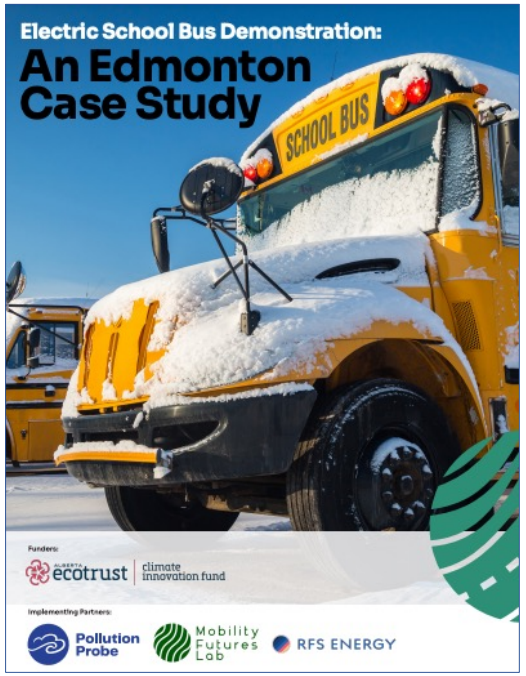
- One diesel school bus emits roughly 82 tonnes of carbon dioxide (CO_2) over its 12-year expected lifespan. Electric vehicles have no tailpipe emissions.
- Electrification of just 30% of the Ontario school bus fleet by 2042 could reduce CO_2 emissions by over half a million tonnes.

Reliability in Winter

Claim: *"ESBs are not practical in Canadian cold-weather climates."*

Fact: Electric School Buses have been shown to run reliably across all seasons in Canada.

- *"Edmonton Case Study Confirms Electric School Buses are Ready for Canadian Winters."* Pollution Probe 2025
- *"Misleading claims about weather, electric vehicles spread online."* AFP Fact Check. 2023.



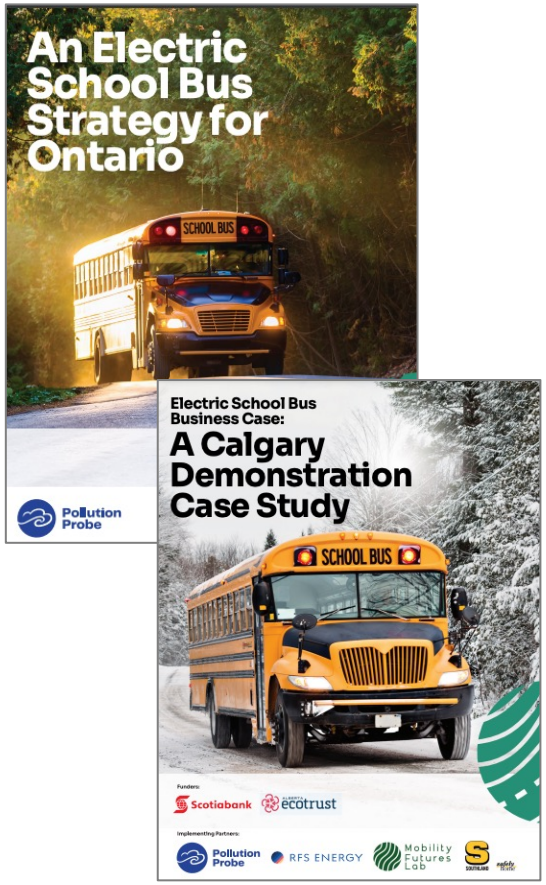
Pollution Probe 2025; AFP 2023

Range Anxiety

Concern: *"ESBs don't have sufficient range for travel distance requirements across all routes in Canada."*

Fact: Battery performance has improved significantly in the past decade, and electric school buses can now meet the daily range requirements of many routes

- Most standard routes can be completed on a single overnight charge, especially in moderate temperatures.
- Mid-day charging can extend range where available, though it may require operational changes. Rural routes remain more challenging, but a large share of routes are already feasible today.



Pollution Probe, The Delphi Group, the Canadian Partnership for Children's Health and Environment 2023; Pollution Probe 2023

References

- Canadian Partnership for Children's Health and Environment. Healthy Environments for Learning Day 2023. Electric School Buses . https://healthyenvironmentforkids.ca/held/2023-campaign-school-bus-electrification/
- Health Canada 2016. Human Health Risk Assessment for Diesel Exhaust. https://publications.gc.ca/collections/collection_2016/sc-hc/H129-60-2016-eng.pdf
- Health Effects Institute 2022. Health Effects Institute. HEI Panel on the Health Effects of Long-Term Exposure to Traffic-Related Air Pollution. 2022. Systematic Review and Meta-analysis of Selected Health Effects of Long-Term Exposure to Traffic-Related Air Pollution. Special Report 23. Boston, MA:Health Effects Institute. https://www.healtheffects.org/system/files/hei-special-report-23_6.pdf
- Sunyer,Jordi;Suades-González,Elisabet;García-Esteban,Raquel;Rivas,Ioar;Pujol,Jesús; Alvarez-Pedrerol, Mar; Forns, Joan; Querol, Xavier; Basagaña, Xavier. Traffic-related Air Pollution and Attention in Primary School Children, Epidemiology: March 2017 - Volume 28 - Issue 2 - p 181-189 doi: 10.1097/EDE.0000000000000603 https://pmc.ncbi.nlm.nih.gov/articles/PMC5287434/
- Amy Mizen, Jane Lyons, Ai Milojevic, Ruth Doherty, Paul Wilkinson, David Carruthers, Ashley Akbari, Iain Lake, Gwyneth A. Davies, Mohammad Al Sallakh, Richard Fry, Lorraine Dearden, Sarah E Rodgers. Impact of air pollution on educational attainment for respiratory health treated students: A cross sectional data linkage study, Health & Place, Volume 63,2020,102355,ISSN 1353-8292, https://doi.org/10.1016/j.healthplace.2020.102355.
- Adar SD, Pedde M, Hirth R, Szpiro A. 2024. Assessing the National Health, Education, and Air Quality Benefits of the United States Environmental Protection Agency's School Bus Rebate Program: A Randomized Controlled Trial Design. Research Report 221. Boston, MA: Health Effects Institute. https://www.healtheffects.org/sites/default/files/adar-rr-221-report.pdf
- Hongsheng Xie, Yuan Cao, Jiafeng Li, Yichen Lyu, Neil Roberts, Zhiyun Jia, Affective disorder and brain alterations in children and adolescents exposed to outdoor air pollution, Journal of Affective Disorders, Volume 331, 2023, Pages 413-424, ISSN 0165-0327, https://doi.org/10.1016/j.jad.2023.03.082.
- Xue Wang, Yibo Wu, Yifei Chen, Jiayi Xu, Qian Gao, Shuang Zang, Traffic-related pollution and symptoms of depression and anxiety among Chinese adults: A population-based study, Journal of Affective Disorders, Volume 352, 2024, Pages 101-109, ISSN 0165-0327, https://doi.org/10.1016/j.jad.2024.02.046.
- Zundel CG, Ryan P, Brokamp C, Heeter A, Huang Y, Strawn JR, Marusak HA. Air pollution, depressive and anxiety disorders, and brain effects: A systematic review. Neurotoxicology. 2022 Dec;93:272-300. doi: 10.1016/j.neuro.2022.10.011. Epub 2022 Oct 21. PMID: 36280190; PMCID: PMC10015654. https://pubmed.ncbi.nlm.nih.gov/36280190/

References

- Elisa Borroni, Angela Cecilia Pesatori, Valentina Bollati, Massimiliano Buoli, Michele Carugno, Air pollution exposure and depression: A comprehensive updated systematic review and meta-analysis, Environmental Pollution,Volume 292, Part A, 2022, 118245, ISSN 0269-7491, https://doi.org/10.1016/j.envpol.2021.118245. (https://www.sciencedirect.com/science/article/pii/S0269749121018273)
- Health Canada 2022. Exposure to Traffic-Related Air Pollution in Canada: An Assessment of Population Proximity to Roadways. https://publications.gc.ca/collections/collection_2022/sc-hc/H144-99-2022-eng.pdf
- Health Canada. 2022. Health Benefits per Tonne of Air Pollutant Emissions Reduction https://publications.gc.ca/collections/collection_2022/sc-hc/H144-111-2022-eng.pdf
- Choma EF, Robinson LA, Nadeau KC. Adopting electric school buses in the United States: Health and climate benefits. Proc Natl Acad Sci U S A. 2024 May 28;121(22):e2320338121. doi: 10.1073/pnas.2320338121. Epub 2024 May 20. PMID: 38768355; PMCID: PMC11145267. https://www.pnas.org/doi/10.1073/pnas.2320338121
- Health Canada 2022. Health of Canadians in a Changing Climate https://changingclimate.ca/health-in-a-changing-climate/
- Pollution Probe, The Delphi Group, the Canadian Partnership for Children's Health and Environment. An Electric School Bus Strategy for Ontario. 2023. https://www.pollutionprobe.org/an-electric-school-bus-strategy-for-ontario/
- Equiterre Fact Sheet 2024: https://www.equiterre.org/en/resources/8-faussetes-quon-entend-sur-les-autobus-scolaires-electriques
- Magda Mubarak Merghani, Ragaa Gasim Ahmed Mohmmed, Khaled Mohammed Al-Sayaghi, Nawal Saad M. Alshamrani, Eltayeb Mohammed Awadalkareem, Hassan Shaaib, Ahmed Alharbi, Athbah AlKabi, Sumayah Faqihi, Adil Abdalla, Hammad Ali Fadlalmola, Asthma-related school absenteeism: Prevalence, disparities, and the need for comprehensive management: A systematic review and meta-analysis, Dialogues in Health, Volume 7, 2025, 100239, ISSN 2772-6533, https://doi.org/10.1016/j.dialog.2025.100239.
- Asthma Canada. Asthma in Schools. https://asthma.ca/get-help/asthma-in-children/asthma-at-school/
- Statistics Canada. 2010. https://www150.statcan.gc.ca/n1/en/pub/82-003-x/2010004/article/11363-eng.pdf?st=8y-SHcdp
- PEM of RWTH Aachen University, 1st edition, EN, 2023, ISBN: 978-3-947920-40-2 https://www.pem.rwth-aachen.de/global/show_document.asp?id=aaaaaaaacclpluf
- EPRI. 2023. Technology Innovation Spotlight: Lithium Ion Battery Fires in the News https://www.epri.com/research/products/000000003002028411
- AFP Fact Check. Oct 2025. Electric school bus fires spark misinformation about low-emission vehicle safety https://factcheck.afp.com/doc.afp.com.77Z88CQ

References

- Canadian Electric School Bus Alliance (CESBA). July 2025. 5 Reasons Why Electric Buses Are Safer from Fire https://eschoolbusalliance.ca/5-reasons-why-electric-buses-are-safer-from-fire/
- Pollution Probe. 2023. Calgary School Bus Report Business Case https://www.pollutionprobe.org/electric-school-bus-operational-assessment-a-calgary-demonstration-case-study/
- Pollution Probe. 2025 New Edmonton Case Study Confirms Electric School Buses are Ready for Canadian Winters https://www.pollutionprobe.org/transportation/ https://www.pollutionprobe.org/electric-school-bus-demonstration-an-edmonton-case-study/
- AFP Fact Check. Dec 2023. Misleading claims about weather, electric vehicles spread online https://factcheck.afp.com/doc.afp.com.32FT9B2
- Dominish, E. Brydges, T. Florin, N. (2024). Minimizing Mining Impacts on the Road to Zero Emissions Transport. Prepared for Earthworks by the Institute for Sustainable Futures, University of Technology Sydney. https://www.uts.edu.au/sites/default/files/2024-07/ISF%20UTS%20Earthworks_Minimizing%20mining%20impacts.pdf
- The International Council on Clean Transportation (ICCT). 2024. Electrifying road transport with less mining. A global and regional batter material outlook. https://theicct.org/wp-content/uploads/2024/12/ID-206-%E2%80%93-Battery-outlook_report_final.pdf *and*…ICCT PPT Dec 17, 2024 - Electrifying Global Road Transport with Less Mining. Policy Insights of the EU and U.S. https://theicct.org/wp-content/uploads/2024/12/ICCT-Webinar-Battery-Minerals-Outlook-17_12_2024_clean-1.pdf
- Canadian Partnership for Children's Health and Environment. (CPCHE). Active and Sustainable Transportation. https://healthyenvironmentforkids.ca/active-and-sustainable-transportation/
- Mundorf N, Redding CA, Bao S. Sustainable Transportation and Health. Int J Environ Res Public Health. 2018 Mar 18;15(3):542. doi: 10.3390/ijerph15030542. PMID: 29562630; PMCID: PMC5877087. https://pmc.ncbi.nlm.nih.gov/articles/PMC5877087/
- Green Communities Canada. School Travel Planning. [accessed Nov. 20, 2024] https://greencommunitiescanada.org/programs/school-travel-planning/
- Green Communities Canada. School Streets. [accessed Nov. 20, 2024] https://greencommunitiescanada.org/programs/school-streets/
- Canadian Partnership for Children's Health and Environment. (CPCHE). 2022. Child Care Resource Hub and Checklist for Healthy and Sustainable Child Care Environments/Sustainability and Climate Action/Active and Sustainable Transportation. https://healthyenvironmentforkids.ca/active-and-sustainable-transportation/
- Pollution Probe Strategic Plan. 2022. https://www.pollutionprobe.org/strategic-plan-2022/