Zero-Emission Vehicles & Low-Carbon Driving

Exploring Zero-Emission Vehicles

In an effort to reduce the greenhouse gas emissions released within the transportation sector, many have started focusing on zero-emission vehicles (ZEV). ZEVs are vehicles that use electrical energy to power the motor, which allows them to operate without producing any air pollutants.

Types of Zero-Emission Vehicles

There are three different types of zero-emission vehicles (ZEV):

- Battery electric vehicles (BEV)
- Plug-in hybrid electric vehicles (PHEV)
- Fuel cell electric vehicles (FCEV)

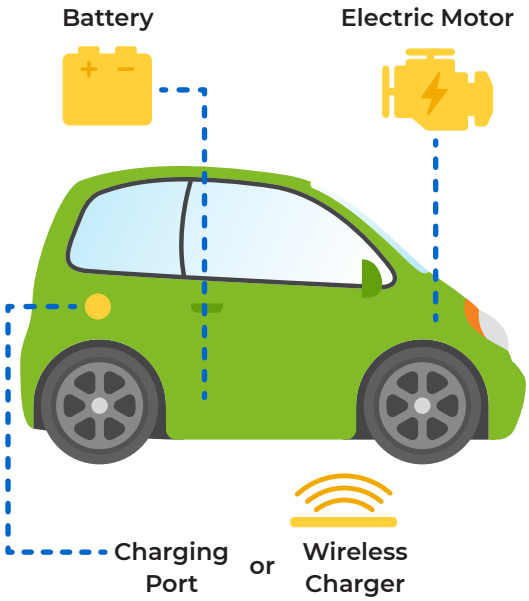
Did you know?

Almost three-quarters (71.8%)

of all new zero-emission vehicles registered in Canada were battery-electric vehicles in 2020.[1]

Battery electric vehicle (BEV)

- A battery electric vehicle is 100% powered by electricity. It contains a high-capacity rechargeable battery pack instead of a gasoline engine.
- In a BEV, a person can drive from 150-500 km on a single charge. While driving, the vehicle does not generate any harmful tailpipe emissions or air pollutant hazards that are typically caused by gasoline-powered vehicles.
- The battery can be charged externally by connecting to the local grid electricity or internally through regenerative braking (the braking mechanism converts mechanical energy into electric energy).
- Charging a BEV can release greenhouse gas emissions and air pollutants. The amount that is released is dependent on the local grid's mix of energy sources (for more information, please see The Environmental Impacts of Driving Resource).



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1. Zero-emission vehicles in Canada, 2020. Statistics Canada.

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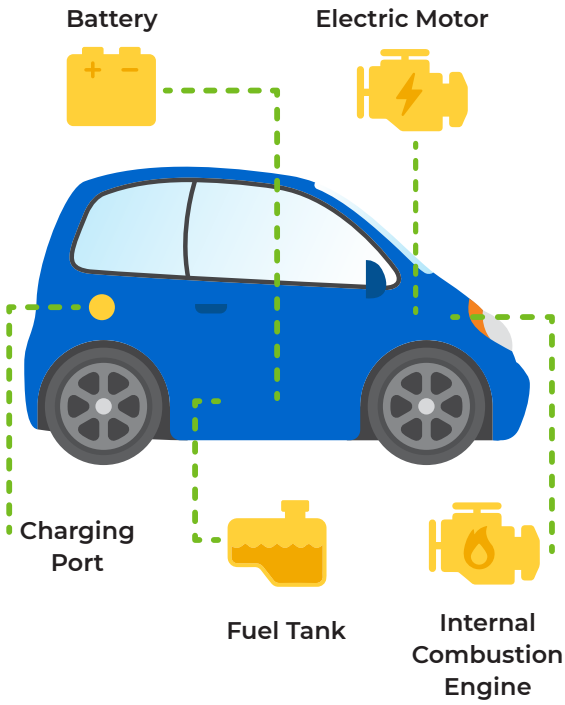
Plug-in hybrid electric vehicle (PHEV)

- A plug-in hybrid vehicle uses both a battery-powered electric motor along with a gasoline engine (internal combustion engine) to power the car.
- The battery can support shorter driving distances ranging from 20-80 km, depending on the vehicle. After this, the gasoline engine takes over until the car is plugged in again in order to recharge. A PHEV can use the gasoline engine for an additional 500-900 km of driving distance, depending on the vehicle and based on a full tank of gas.
- A PHEV can often rely on the battery-powered electric motor and produce no tailpipe emissions for short-distance, daily driving.

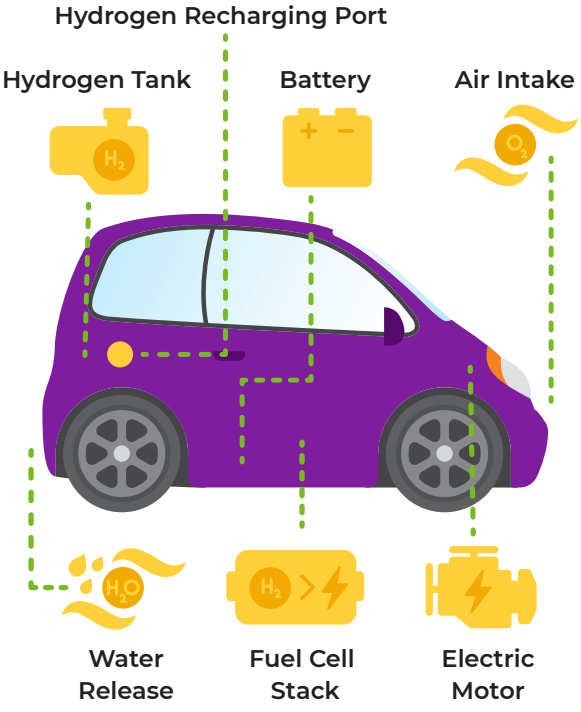


Did you know?

Some jurisdictions believe that PHEVs should be considered zero-emission vehicles only if they meet a minimum all-electric range requirement (e.g., Quebec and California have proposed a minimum cut-off of 80 km).

Fuel cell electric vehicle (FCEV)

- A fuel cell electric vehicle combines hydrogen gas stored in the vehicle with oxygen from the air to create electricity that powers the vehicle's electric motor.
- This vehicle does not emit any greenhouse gases, but instead releases H_2O that leaves the vehicle's tailpipe as a combination of steam and distilled water.
- To fuel a hydrogen FCEV, visit a public hydrogen dispenser station and fill up the tank, similar to how you would fill up a gas-powered vehicle. A hydrogen FCEV can run for approximately 450 km on one full tank.



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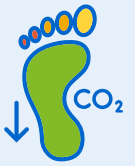
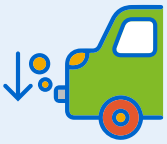
Benefits and Opportunities

Benefits



Lower carbon footprint - A study done in 2018 showed that on average a medium-size zero-emission vehicle emits about 60% less CO_2-equivalent emissions per kilometer than does its internal combustion engine vehicle (ICEV) counterpart.[2]

- When charged using 80% renewable energy, EVs can reduce greenhouse gas emissions by 85%.[2]
- Jurisdictions with more carbon-intensive grids will still have a net greenhouse gas reduction benefit by shifting from internal combustion engine vehicles to zero-emission vehicles.

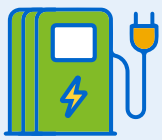


Less pollution - The absence of an internal combustion engine means less noise pollution and zero air pollution for the local environment.

Ease of charging - A zero-emission vehicle can charge at home and on average, it costs half as much to charge a ZEV than it does to fuel an ICEV.

Opportunities

Lowering costs of ZEVs - Zero-emission vehicles are currently more expensive than internal combustion engine vehicles. The cost difference is dependent on the battery size or fuel cell technology.



Increasing public charging stations - Sufficient charging infrastructure across road networks is required for public adoption of ZEVs. It is also important that charging locations are accessible and convenient.

Good News!

- With the growing need for zero-emission vehicles, several organizations are doing their part to facilitate the movement. One example is RechargÉco, a Jour de la Terre and IGA initiative, that is establishing 100 direct current fast charging stations at IGA partner sites across Quebec and New Brunswick.

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2. The Future of Electric Vehicles and Material Resources. The Sustainable Cycles (SCYCLE) Programme and The International Environmental Technology Centre of the United Nations Environment Programme (UNEP-IETC). 2020.

Opportunities

Increasing renewable energy sources - Zero-emission vehicles are only truly zero-emission if the electricity that charges them is as well. The increasing use of ZEVs calls for an increase in renewable energy sources.

Improving lithium extraction methods - Materials used in lithium-ion batteries require significant amounts of energy to extract. Lithium is extracted from either rock or water. Currently, the majority of demand for lithium-ion batteries has come from the consumer electronics sector but it is anticipated that by 2030, approximately 85% of demand will be from ZEVs.[3]

- Geological availability is not necessarily a concern, but the environmental impacts of extracting lithium and other required metals (e.g., cobalt, copper, and nickel) are an important consideration. Impacts include greenhouse gas emissions emissions, water and soil pollutants, and stress on water resources.

Sources

- Achieving a Zero-Emission Future for Light Duty Vehicles (Clean Energy Canada)
- Electric Cars and Batteries: How will the world produce enough? (nature.com)
- Home Charging (Plug'N Drive)
- Guide to EV Charging (Pollution Probe and The Delphi Group)
- Zero-Emission Vehicles in Canada, 2020 (Statistics Canada)
- The Future of Electric Vehicles and Material Resources (UNEP Canada)

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3. The Future of Electric Vehicles and Material Resources. The Sustainable Cycles (SCYCLE) Programme and The International Environmental Technology Centre of the United Nations Environment Programme (UNEP-IETC). 2020.