



WWF-Canada Technical Brief

GHG EMISSIONS REDUCTION POTENTIAL OF ALTERNATIVE TRANSPORTATION FUELS

While increasing vehicle efficiency and reducing vehicle use are important strategies for reducing greenhouse gas (GHG) emissions from personal transportation, WWF has identified that switching from fossil fuels to alternative fuels will be necessary to reach our global target of 100% renewable energy by 2050.

This technical brief has been prepared to compare the lifecycle GHG emissions from eleven potentially viable alternative fuels in order to gauge the level of emissions reductions that could come from transitioning from conventional vehicles. Working from Natural Resources Canada's (NRCAN) GHGenius model, WWF-Canada developed the outputs below.

Alternative Transportation Fuels

Fossil fuels presently account for almost all of Canada's transportation energy use. Low-carbon fuel strategies include the development and introduction of alternative fuels that have lower carbon content and generate fewer transportation GHG emissions. Natural Resource Canada identifies the following fuels as viable alternatives for petroleum –based fuels:

- Battery Electric and Hybrid Vehicles
- Biodiesels
- Ethanol

- Fuel Cells and Hydrogen
- Natural Gas, and
- Propane

Life-cycle Emissions

Life-cycle GHG emissions of alternative fuels and technologies depend on the production and usage of the unconventional fuels. NRCAN's GHGenius model accounts for the GHG emissions generated from the time a fuel is extracted, grown or produced to the time that it is utilized to produce power.

Life-cycle emissions are important to consider when discussing alternative fuels because often there are concerns that fuels that have lower tail-pipe emissions (e.g., electric, ethanol or natural gas) are misrepresented as low-emission when upstream production and transmission emissions are ignored. This technical brief aims to fairly compare all fuels by considering all emissions.

While there are upstream emissions associated with alternative fuels, there are also emissions associated with conventional fuels. This model accounts for the different types of crude oils that are used in different regions to be refined to gasoline or other types of petroleum-based fuels.

It is important to note that while this report is a national analysis of all transportation fuels, the lifecycle emissions associated with fuels will vary by province or jurisdiction due to emissions associated with different energy extraction, generation and/or transmission practices across provinces.

Default Conventional Vehicle Assumptions

A highlight of GHGenius is its ability to automatically adjust the weight and size of the alternative fuel vehicle to the weight and size of gasoline vehicle with predefined fuel efficiency in order to calculate the life-cycle GHG emissions associated with like-sized conventional and alternative fuelled vehicles.

For the purposes of this model, WWF has made the following assumption about the average fuel efficiency of conventional vehicles. According to the Environment Canada¹, the 2012 weighted average fuel efficiency of 55 per cent city driving and 45 per cent highway driving is set to be 9.3 liters per 100 kilometers.

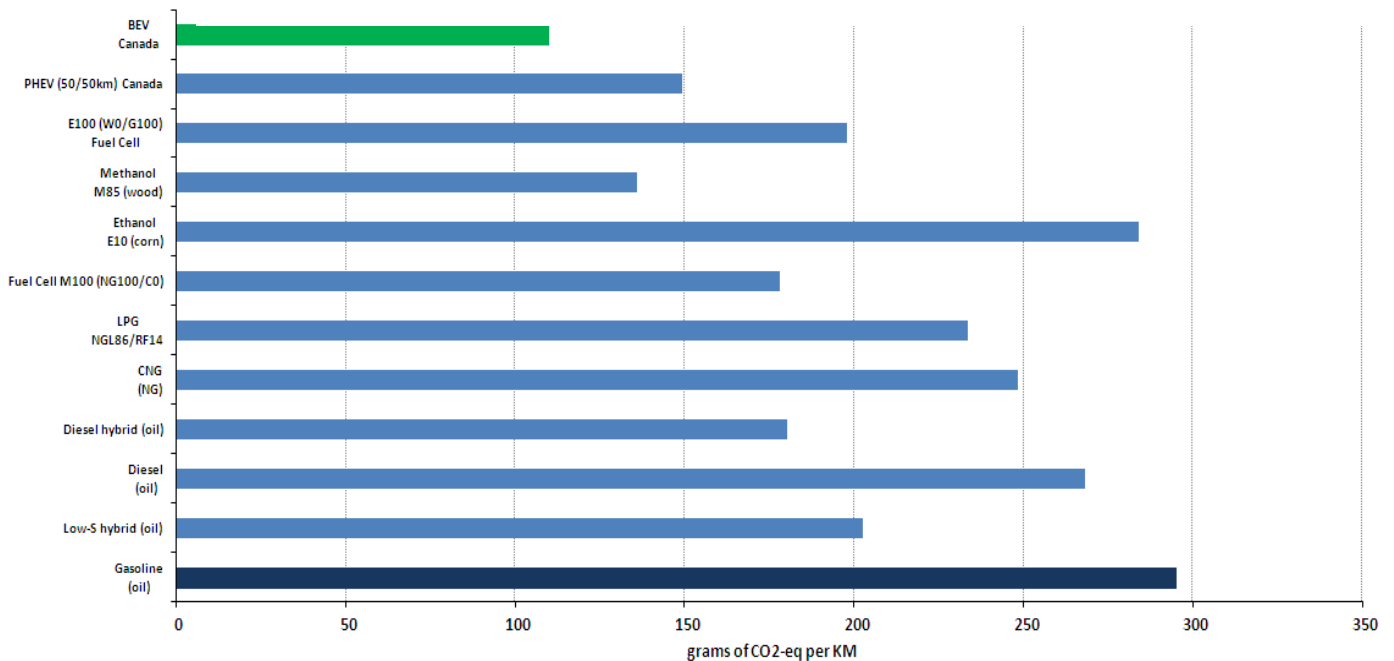
RESULTS


WWF-Canada examined 11 different alternative fuels and technologies and compared their full life-cycle GHG emissions with that of conventional gasoline engines. This process considered the breakdown of GHG emissions (grams of CO₂-equivalent per kilometre) for alternative fuels based on various fuel production, utilization and transmission activities in Canada.

Figure 1 below shows the total life-cycle GHG emissions of each alternative vehicle or technology in grams of CO₂-equivalent per kilometre travelled in Canada.

Based on the results of these comparisons, WWF-Canada has identified that in Canada, pure electric vehicles have the lowest life-cycle GHG emissions of all alternative and conventional transportation fuels. Vehicle-specific life-cycle GHGs will vary across the country, due to provincial differences in distance from conventional fuel sources and carbon-intensity of electricity grids. Future comparisons by WWF-Canada will aim to highlight the emissions-reduction potential of alternative fuels by region.

Figure 1 – A comparison of life-cycle GHG emissions of alternative transportation fuels in Canada





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 We are creating solutions to the most serious conservation challenges facing our planet, helping people and nature thrive.
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