

THE EVALUATION MAZE

Comparison of CO₂e emissions studies for cars



ICEV
Internal combustion vehicle (traditional)



BEV
Battery-powered electric vehicle



HEV
Non-plug-in hybrid vehicle, with no use of the external electricity grid



PHEV
Plug-in hybrid vehicle - connectable to the external electricity grid

OTHER ACRONYMS USED

GCOE/KM - Grams of CO₂e equivalent/Km

GEE - Greenhouse gas

ETANOL 85 (E85) - 85% cereal ethanol blend and 15% petrol

TCO₂E - Tonnes of CO₂ equivalent

STUDIES

1 Study by The International Council on Clean Transportation - ICCT (2023)

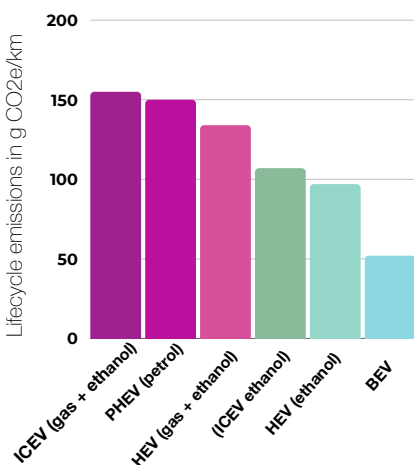
Life cycle: 288,000 km

Period: evolutionary and estimated between 2023 and 2044

Basic criteria: compact vehicles marketed in Brazil in 2023; flex-fuel engine with mixed use of petrol and ethanol. BEV - emission factor of 67 kg CO₂e per kWh. Did not evaluate ethanol PHEVs. Considers average emissions between 2023 and 2044, based on current expectations of developments in the Brazilian electricity matrix. Vehicle lifespan: 22 years or 288,000 km. Considers Indirect Land Use Change (ILUC).

Source: ICCT

Estudo: Comparison of the Life-Cycle Greenhouse Gas Emissions of Combustion Engine and Electric Passenger Cars in Brazil
<https://theicct.org/publication/comparison-of-life-cycle-ghg-emissions-of-combustion-engines-and-electric-pv-brazil-oct23/>



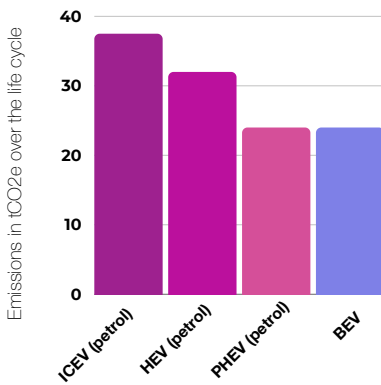
2 Study by the Association of German Engineers - VDI (2023)

Life cycle: 200,000 km

Basic criteria: vehicles marketed in Germany, in the compact class, with different technologies (BEV 62kWh battery). Average use over the period, 200,000 km life cycle. WLTP methodology (Worldwide Harmonised Light Vehicles Test Procedure) applied to all vehicles.

Source: VDI Nachrichten

Study: VDI-Analyse der CO₂-Emissionen von Pkw mit verschiedenen Antriebssystemen
<https://www.vdi-nachrichten.com/shop/vdi-analyse-der-co2-emissionen-von-pkw-mit-verschiedenen-antriebssystemen/>

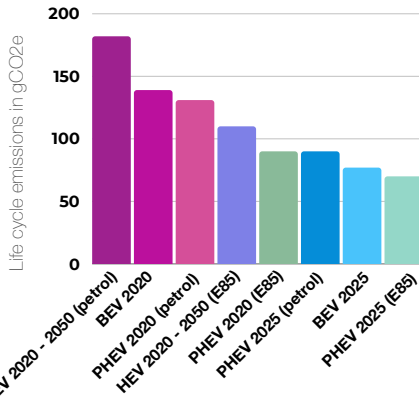


3 Study by researchers from Lund University, Sweden (2021)

Life cycle: 200.000 km

Values from 2020 and estimated for 2050

Basic criteria: ICEV - compact cars marketed in Sweden in 2020, 1.6 engine. Fuels: petrol and 85E ethanol. BEV - emission factor of 83.5 kg CO₂e per kWh. Average use over the period, 200,000 km life cycle. WLTP (Worldwide Harmonised Light Vehicles Test Procedure) methodology for hybrids.

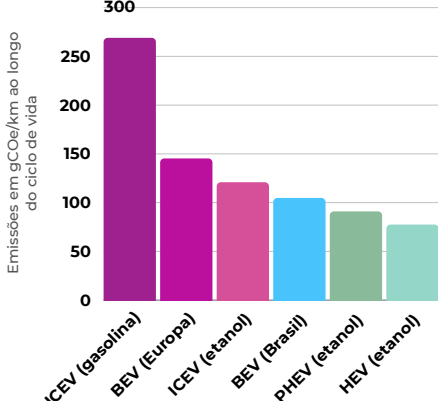


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4 Estudo elaborado por integrantes do Programa Interinstitucional de Pós-Graduação em Bioenergia da USP/ UNICAMP/UNESP (2023)

Ciclo de vida: 160.000 km

Crítérios básicos: veículos comercializados no Brasil. ICEV - combustão interna 2.0; HEV e PHEV - 1.6 e 1.8; BEV - baterias de 38,3 kWh a 64 kWh. Uso médio no período, ciclo de vida de 160.000 Km. Metodologia WLTP (Worldwide Harmonized Light Vehicles Test Procedure) utilizada para veículos híbridos plug-in.



Fonte: Science Direct

Artigo: Hybrid vigor: Why hybrids with sustainable biofuels are better than pure electric vehicles
<https://www.sciencedirect.com/science/article/abs/pii/S0973082623001102?via%3Dihub>