

Life-Cycle Assessment (LCA) study based on AECC-IPA demonstrator vehicles

UNECE A-LCA IWG meeting • 18 October 2024 • Geneva



AECC is now the Association for Emissions Control and Climate

- AECC is expanding its scope and activities
 - Air quality and climate requirements
 - Mobile and stationary emissions sources
 - Sustainable components and systems, including
 - Catalysts
 - Filters
 - Adsorbers
 - Fuel cells
 - Electrolysers
- AECC offers Full and Associated Membership as of 2025
- AECC is listed in EU Transparency Register (# 78711786419-61) and has consultative status with the UN Economic and Social Council (ECOSOC)

The logo for EMITEC TECHNOLOGIES, featuring the word "EMITEC" in a bold, blue, italicized font above the word "TECHNOLOGIES" in a smaller, blue, sans-serif font.The logo for Johnson Matthey, featuring the letters "JM" in a blue font followed by the text "Johnson Matthey" and the tagline "Inspiring science, enhancing life" in a smaller blue font.The logo for NGK, featuring a stylized blue hand icon above the letters "NGK" in a bold, blue, sans-serif font.The logo for umicore, featuring the word "umicore" in a blue, sans-serif font with a green circular icon to the right.

LCA study by Joanneum Research

- Conducted together by AECC and IPA (International Platinum Group Metals Association)
- This presentation is a first summary of the study, dissemination of full results is foreseen in 2025
- Objective
 - Extending the Well-to-Wheel CO₂ emissions data of AECC-IPA [LDV](#) and [HDV](#) demonstrators
 - Understand impact of LCA methodology choices under consideration by UNECE and EU



LCA study by Joanneum Research

➤ Scope

➤ Level 1-2 LCA study

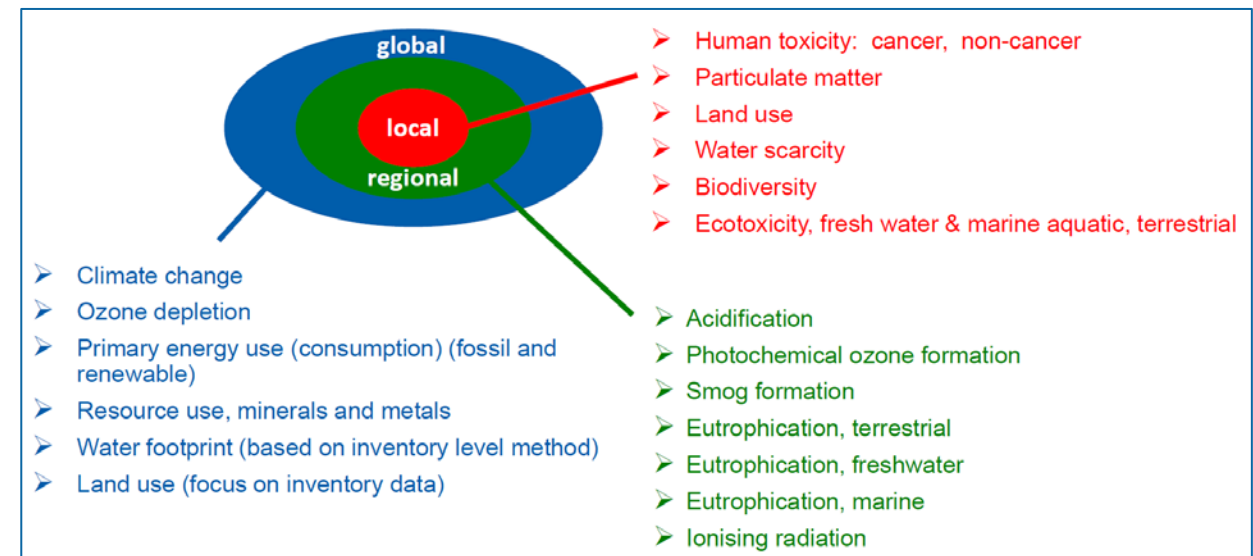
	Purpose	Degree of freedom	vehicle model	supply chain model
Level 1	strategy	multiple approaches possible	generic	generic
Level 2	strategy	multiple approaches possible	BOM & MDS	generic
Level 3	reporting	single fixed approach	BOM & MDS	partly specific
Level 4	reporting	single fixed approach	BOM & MDS	mainly specific

BOM bill of material, MDS material data system

Information from UNECE A-LCA IWG meeting 26-27 Sept 2024

➤ Impact categories investigated

- Global Warming Potential (GWP – CO_{2eq}/km)
 - Including impact of CO₂, CH₄ and N₂O
- Primary Energy Demand (PED – kWh/km)
- Several additional impact categories possible



LCA study by Joanneum Research

➤ Scope

➤ Vehicles

- Passenger cars, based on GreenNCAP vehicles representative for AECC demonstrators
- Trucks, based on IEA Task 46 vehicle representative for AECC demonstrator

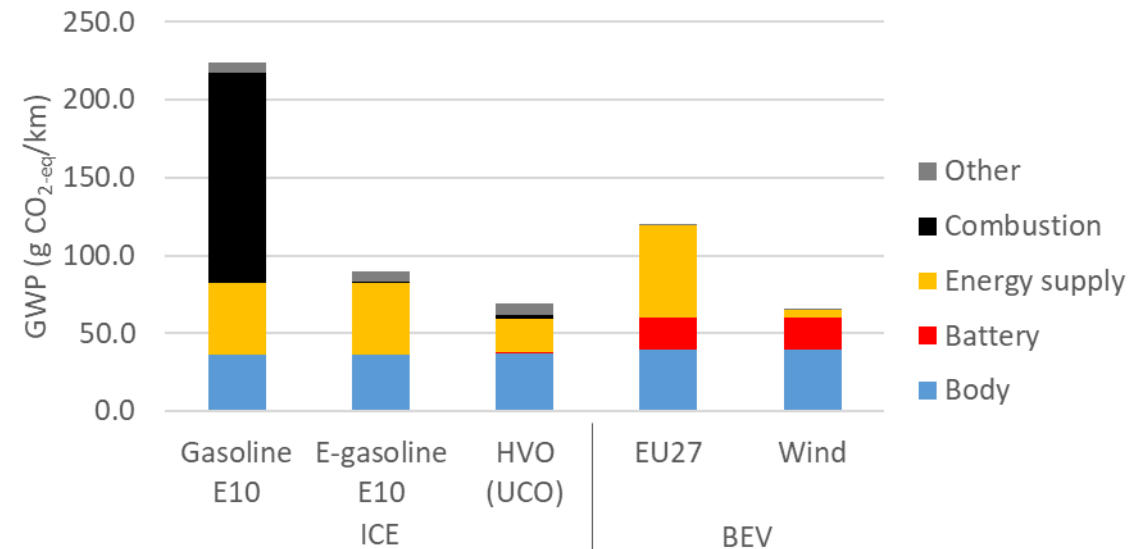
➤ Powertrains

➤ Energy sources

Powertrain	Energy sources		Cars	Trucks
	Current	100% Renewable		
ICE	B7 diesel	HVO UCO (Used Cooking Oil)	X	X
ICE	Gasoline E10	E-gasoline E10 (wind and Direct Air Capture)	X	
PHEV	Gasoline E10	E-gasoline E10 (wind and Direct Air Capture)	X	
BEV	EU27	Wind	X	X
H ₂ ICE	-	Wind electrolysis		X
H ₂ FCEV	-	Wind electrolysis		X

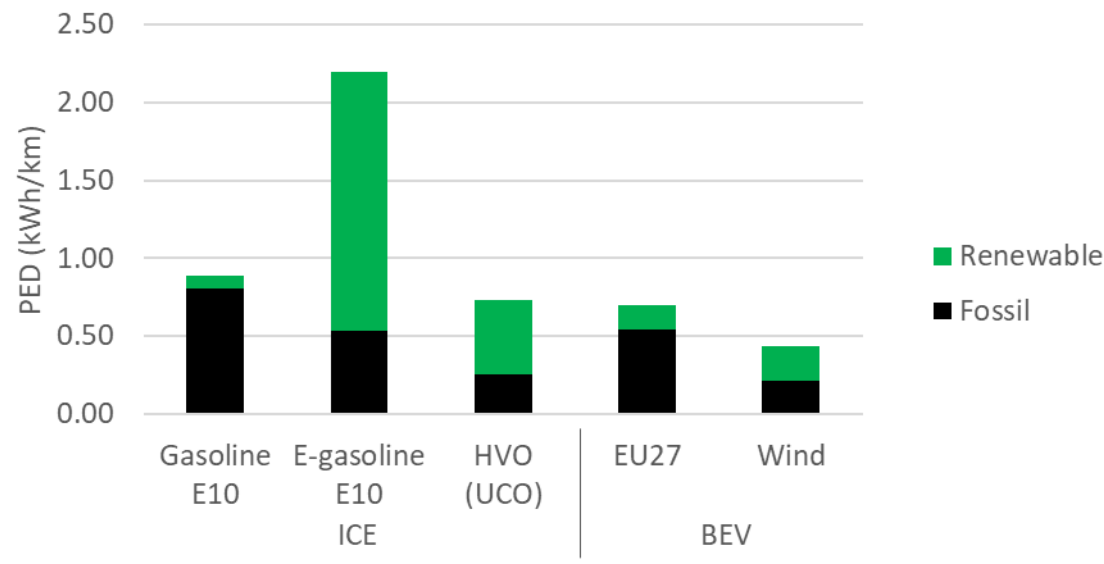
All LDV powertrains have similarly low GHG emissions

- When operated on renewable electricity/fuel
- ICE and BEV have similar emissions for production of vehicle body
 - Emissions of battery production are additionally significant for BEV
- Remaining ICE emissions are mainly from fuel supply and combustion
 - Combustion becomes net-zero in case of e-fuel or HVO (UCO)
- Remaining BEV emissions are from electricity supply



Mixed picture for Primary Energy Demand

- Primary Energy Demand (PED) represents the amount of energy needed to drive a km
- BEV on wind and ICE on HVO (UCO) have the lowest PED from those powertrain options that are relying on renewables sources
- ICE on e-gasoline has higher PED
 - Requiring a higher amount of renewable energy sources
 - But fuel can be energy carrier of renewable energy sources elsewhere in the world

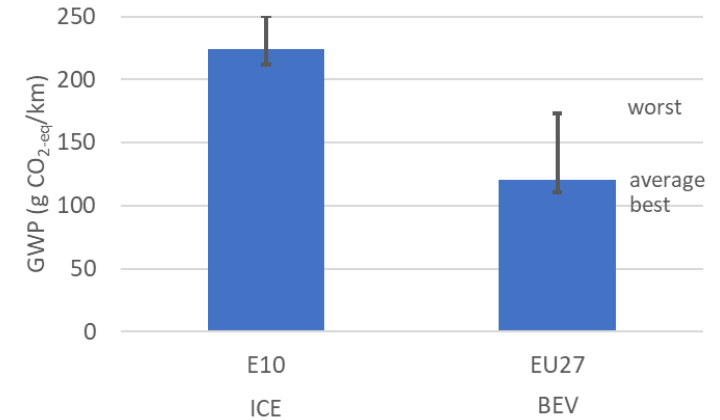


Need for transparent reporting

➤ Significant impact from base characteristics

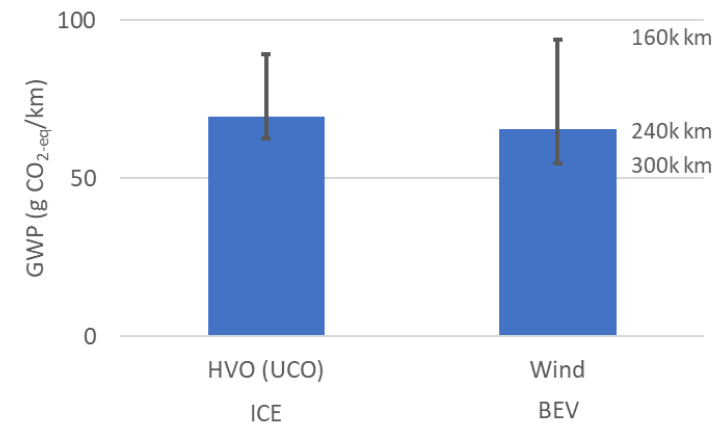
- Powertrain energy consumption
- Vehicle mileage (km) definition
- Others
 - Vehicle weight
 - Powertrain battery capacity
 - Energy/fuel emission factors

Impact of energy consumption



Range according to GreenNCAP measurements

Impact of vehicle mileage



Methodologies under investigation

- Levelling concept 1 - 4
- Additional GHG species (next to CO₂, CH₄ and N₂O)
 - Focus on global warming potential of H₂
 - Gaseous storage and transportation
 - Liquid storage and transportation
- Allocation of emissions in case of co-products, e.g. biofuels
 - System expansion
 - Energy allocation
- End-of-Life modelling
 - Substitution of primary material
 - Circular Footprint Formula
- Relevance of infrastructure

Summary and outlook

- First presentation of the study, dissemination of full results is foreseen in 2025
 - Only 2 out of many impact categories investigated
 - Results show no “Zero-GHG emissions” vehicle, but all powertrains show similarly low GHG emissions when further developing technologies for biofuels, e-fuels, renewable electricity and hydrogen
 - ICE on ‘HVO from UCO’ and BEV on ‘wind’ have lowest Primary Energy Demand
 - ICE on H₂/e-fuels and FCEV have higher Primary Energy Demand, but can be energy carriers for renewable energy sources elsewhere in the world
- LCA methodologies
 - Transparent reporting is needed for base characteristics of vehicle, powertrain and energy/fuels
 - Analysis will be done for list of LCA methodologies under consideration

THANK YOU

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