ZEvRA

Zero Emission electric Vehicles enabled by haRmonised circulArity

Harmonized Circularity Assessment tool

Support material

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THE METHODOLOGY

The Harmonised Circularity Assessment developed by EURECAT is devoted to assessing circularity at the product level (intermediate and/or final) assisting in decision-making from an eco-design perspective.

The HCA-tool aggregates circular, environmental, economic and social spheres' indicators (from now CEES-indicators), to obtain a final numerical value, single-indicator, which enables products' benchmarking in a holistic way.

In essence, the HCA-tool enables the standardize evaluation and comparison of products, making it a useful decision-tool for supporting circular performance-based strategies.

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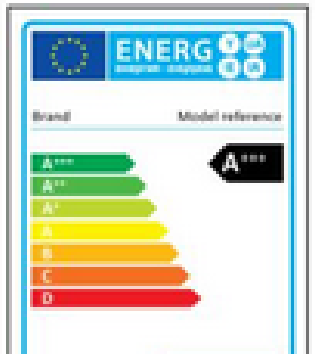
THE ASSESSMENT

The HCA-tool aggregates circular, environmental, economic and social spheres' indicators, to obtain a final numerical value, single-indicator, which enables products' benchmarking in a holistic way.

Final numeric indicator which provides **only comparative** information and not absolute values.



Useful decision-tool for supporting performance-based strategies / policies / purchase.

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THE ASSESSMENT

Single comparable result: As main "attractive" result, a single comparable value which considers all the indicators is achieved.

well received by some stakeholders
because of its simplicity
[the opposite also for the same reason]

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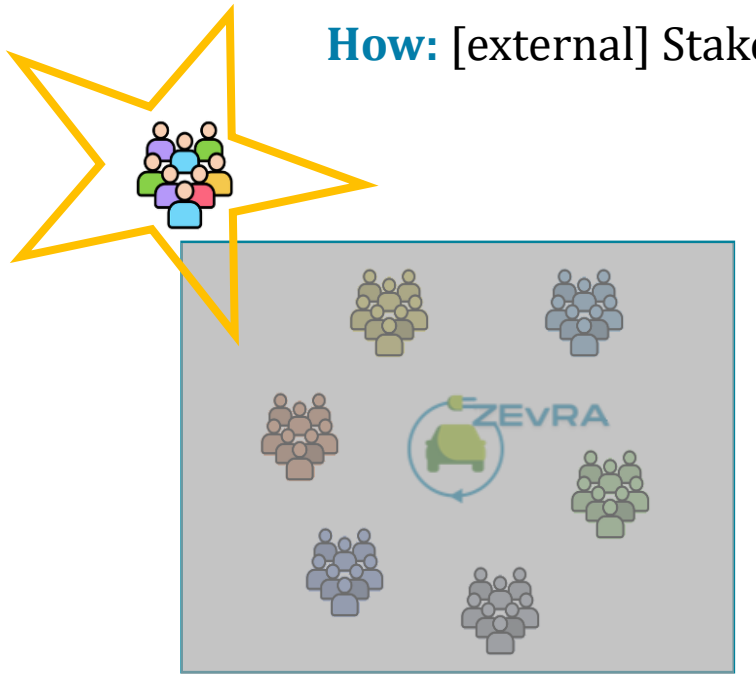
THE ASSESSMENT

Harmonised Circularity Assessment

Circular
Environmental
Economic
Social

Aim: to consider circular, environmental, economic and social product's performances to obtain holistic results allowing decision making processes and comparative assessments.

How: [external] Stakeholders' consensus rating → To look out of ZEvRA's ecosystem!



The **rating framework** of the **4** sustainability spheres & its indicators considered for the assessment remains the key step which will determine the final ranking of the intermediates/vehicle assessed.

The main objective is to capture the different "sensitivities" of the rating stakeholder sub-groups:

WEIGHT → rates sustainability spheres

IMPORTANCE → rates each of the indicators of the spheres

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CEES – Rating methodology

CEES-indicators

Rated from 1 to 3

Low Importance (LI)
Medium Importance (MI)
High Importance (HI)

CEES-spheres

Rated from 0 to 100

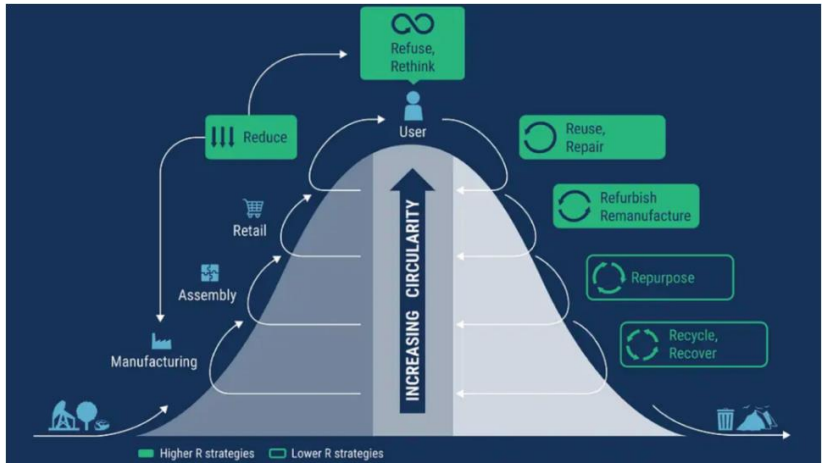
(The score of the four categories must add up to 100)

CEES-indicators considered within the HCA

9(10)R's - Framework

(R0)Refuse	Avoid harmful and unnecessary materials, elements and/or components (preventing waste at the source).
Rethink	Redesign products and processes to minimize environmental impact.
Reduce	Increase efficiency by consuming fewer resources and materials.
Reuse	Utilize products still in good condition for their original purpose.
Repair	Fix and maintain defective products to extend their usable life.
Refurbish	Restore and update old products to meet specified quality levels.
Remanufacture	Use parts from discarded products to create new ones with the same function.
Repurpose	Adapt redundant products or components for new functions.
Recycle	Process materials to create new products or resources.
(R9)Recover	Extract energy or materials from waste products.

The 9R framework implies a hierarchy of circular strategies, with higher-priority actions (like Refuse and Rethink) at the top and lower-priority actions (like Recycle and Recover) at the bottom. This ***hierarchy prioritizes strategies that minimize resource use and environmental impact****, with tighter loops being more preferred and circular*



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CEES – INDICATORS

CIRCULAR

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R9 framework	Indicators	
Refuse	Unnecessary feature reduction	**Measures the percentage reduction in non-essential features or elements/components in components/vehicle over time**[%/CorV]
Rethink	Suppliers sustainability	**% (mass-based) of component/vehicle with sustainability recognition (organizational or product level)** [%/CorV]
Reduce	Lightweighting	**% (mass-based) of weight reduction** [%/CorV]
Reuse	Reuse potential	**Nº of pieces/components designed to be incorporated** (without modifications) **into new/used component/vehicle production/repair** [Nº/CorV]
Repair	Disassembly complexity	**Disassembly depth [Nº of steps to disassemble/CorV]**
Refurbish	Refurbishment potential	**Nº of pieces/components (aimed to be) refurbished** (restore and update) **and reintroduced into the supply chain** [Nº/CorV]
Remanufacture	Remanufacturing potential	**Nº of pieces/components (aimed to be) remanufactured and reintroduced** (with the same function) **into the supply chain** [Nº/CorV]
Repurpose	Upcycled elements	**Nº of pieces/components created from or aimed to be redundant (such as surpluses not used for its original purpose)**[Nº/CorV]
Recycle	Cyclic recyclability	**% (mass balance) of recycled & recyclable material at component/vehicle** [%/CorV]
Recover	Waste-to-energy	**% (mass balance) production waste sent for energy recovery** [%/CorV]

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CEES – INDICATORS

Product Environmental Footprint (PEF)

ENVIRONMENTAL

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PEF impact category	unit	Definition
Climate Change	*kgCO2eq*	Assesses the depletion of the stratospheric ozone layer consequence of GHG emissions (CO2, CH4, NOx, CFCs, etc.)
Ozone Depletion	*KgCFC11eq*	Assesses the depletion of the stratospheric ozone layer (sun's ultraviolet radiation protection)
Human toxicity – Cancer effects	*CTUh*	Accounts for adverse health effects on humans related to cancer from toxic substance intake from air/water/soil
Human toxicity – Non-cancer effects	*CTUh*	Measures non-cancer health effects on humans from toxic substance intake from air/water/soil
Particulate Matter	*Disease incidence*	Evaluates the impact of fine particulate matter (2,5 microns) on human health (NOx and SO2 as precursors)
Ionising radiation	*kBq U235*	Assesses the health effects caused by manmade radioactive releases (nuclear energy, X-rays, etc.)
Photochemical Ozone Formation	*KgNMVOCeq*	Measures the formation of ground-level ozone, which can harm human health and vegetation (caused by VOCs, CO, Nox, etc.)
Acidification	*molH+eq*	Evaluates the increase in acidity of water and soil systems (harmful effects to ecosystems and heritage)
Eutrophication Potential - Freshwater	*KgPeq*	Assesses nutrient enrichment which could lead to overfertilization and biogeosystem inbalances in freshwater ecosystems
Eutrophication Potential - Marine	*KgNeq*	Assesses nutrient enrichment which could lead to overfertilization and biogeosystem imbalances in terrestrial ecosystems
Eutrophication Potential - Terrestrial	molNeq	Assesses nutrient enrichment which could lead to overfertilization and biogeosystem imbalances in marine ecosystems
Ecotoxicity freshwater	*CTUeq*	Assesses the toxic effects of chemicals on freshwater ecosystems (estimates the number of species affected over time and space, for each unit of chemical released)
Land use	*Pt Dimensionless*	Measures the impact of land occupation and transformation on soil quality and biodiversity considering: biotic production, erosion resistance, grounddwater regeneration and mechanical filtration.
Water Scarcity	m^3	Evaluates the consumption and scarcity of freshwater resources considering the availability or scarcity of water in the regions where the activity takes place
Resource Use - Minerals and Metals	*KgSBeq*	Assesses the depletion of mineral and metal resources (reflects the ratio between the annual production of the resource and the known global reserve that is considered)
Resource Use - Fossil	*Mj*	Measures the depletion of fossil fuel resources (MJ is an inherent energy in all fossil fuels, oil, gas, coal, etc.)

*For further information: Life Cycle Assessment & the EF methods - European Commission

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CEES – INDICATORS

ECONOMIC

Impact category	unit	Definition
Manufacturing cost	*€/CorV*	Reflects materials, components, manufacturing costs, costs related to sales, marketing, administration, and R&D, (cradle-to-gate stage) **[both components and full vehicle]**
Use costs	$€/V_{lifespan}$	Electricity cost during the use phase (200,000 Km) for SKODA Enyaq EV based on the average household electricity prices in the EU region (household electricity has been used since it represents between 70% and 75% of the total charging of the EVs in the EU region **[only applicable to full vehicle]**
Maintenance cost	*€/CorV*	Regular preventive maintenance costs for the entire life cycle (200,000 km ≈ 15 years). It considers tires, brakes (brake discs front, brake linings rear, and brake pads front), and wiper blade, and includes the labour cost and number of replacements per part over the lifespan **[not applicable to all components]**
End-of-life cost	*€/CorV*	encompass expenses related to decommissioning, disposal, and environmental remediation of an component/vehicle at the end of its use life **[both components and full vehicle]**
Environmental externalities	*€/CorV*	Costs not directly reflected in market price which represent the broader societal and ecological consequences component/vehicle life cycle on climate change. This is monetization of GHG emission [**both components and full vehicle]**

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CEES – INDICATORS

PSILCA SOCIAL

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Psilca impact category	unit	Definition
Child labour total	*%*	Percentage of children aged 5-17 engaged in child labor (both formal and informal economy) in the reference year
Frequency of forced labour	*cases*yr/1k inhab.*	Number of reported forced labor incidents annually
Goods produced by forced labour	*Nº in sector*	Count of goods known to be produced using forced labor
Safety measures	*OSHA*yr//100k emp.*	Assessment of the presence and adequacy of workplace safety measures [Occupational Safety and Health Administration]
Fatal accidents	*cases*yr/100k emp.*	Rate of work-related fatalities per 100,000 workers
Non-fatal accidents	*Cases*yr/100k emp.*	Rate of non-fatal work-related injuries per 100,000 workers
Unemployment	*%*	Percentage of population ages 15-64 in reference year
Drinking water coverage	*% inhab.*	Proportion of population with access to safe drinking water
Pollution	*DALYs*yr/1k inhab.*	Disability-Adjusted Life Years due to indoor and outdoor air and water pollution
Net migration	*‰*	Difference between immigrants and emigrants in a reference year
Contribution of the sector to economic development	*% GDP*	Sector's share in the country's total Gross Domestic Product
Promoting social responsibilty	*Nº of companies/sector*	Assessment of a sector's efforts to promote social responsibility
Anti-competitive behaviour or violation of anti-trust and monopoly legislation	*cases*yr-frame(5)/100k empl.*	Number of reported incidents of anti-competitive practices annually

converted to

medium risk hours

*For further information: openLCA Nexus: The source for LCA data sets

ZEvRA

Zero Emission electric Vehicles enabled by haRmonised circulArity

Lets rate!

https://forms.office.com/e/5hZcU7pZWP

Thanks

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Centro Tecnológico

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