

Holistic evaluation of components and systems for electrified vehicles – Life cycle assessment as a decisive factor in the innovation and development process?

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- » Sustainability in the Automotive Value Chain
- » Life Cycle Assessment of a Battery Case
- » E₂P fka's Approach to Assess Sustainability holistically
- » Holistic Evaluation of an Electric Drive System
- » Project Preview: Potential of Aluminium Application in Battery Cases
- » Conclusion

Several efficiency measures are not or not fully accounted in current CO_2 legislation – e.g. EV efficiency improvements





- Currently: pure orientation on <u>tailpipe emissions</u> in international legislation
- > Perspective: Legislation addresses further measures as well as production and recycling phase



- Monitor the CO₂ emissions of the full vehicle lifecycle, including production and recycling
- Perspectively integrate LCA (or elements thereof) into legislation to ensure a comprehensive CO₂ reduction

In the medium-term, life cycle assessment could be a game changer for technological decisions



	Life cycle perspective				
	Production	Use	Recycling		
-	Production location				
Iniras	Factory energy concept	Infrastructure embedding			
1)	Vehicle concept	Driver behavior incentives	2 nd life concepts		
5	Vehicle targets, e.g. range				
2	Battery dimensioning	Battery dimensioning	Design for recyclability		
	Battery type	Drivetrain efficiency, e.g. thermal managemen	t Recvcling concepts		
	Joining technologies	Charging efficiency			
	Choice of production tech	noloav			

Lightweight design

The number of options / decisions increases significantly, when LCA is the baseline of legislation.

- » However, a full LCA is a very complex task
- Most probably, legislation could start with a reduced approach including predefined values, e.g. energy efficiency of material production
- » Further undefined factors include the methodology, e.g. credit approach

Component

CREATING IDEAS & DRIVING INNOVATIONS

Choice of material

OEM are outpacing the legislator in decarbonization, putting tremendous pressure on suppliers

Measures in the supply chain (examples)



Mercedes-Benz announced to strive a carbonneutral car production in Europe 2022, all plants by 2039. Transparency on CO_2 footprint and CO_2 as an award criteria in the supply chain.



Volkswagen announced to introduce a mandatory environmental ranking system for their suppliers, which requires full transparency about lifecycle emissions

	BMW GROUP]	
		Mer Automotive Bueni Embri & Co. KE - Popfuch: 17983 Baki sfänger / Recipient	
	Burr AD, 2019 Marchae		
	An die Geschäftsführung unserer Lieferanten		
		n of Carbon Emissions in the Supply Chain	04.02.2
		or Madam,	Maxdensi Look Ma
Breich		he still present COVID-19 pandemic, there is another challenge of global importance must not forget: Fulfilling the sustainability targets that are required to limit global in line with the Paris Agreement.	Astanola disabaja fikija; vd
hilling Zechen Pre Nachstri von		ear 2030 the European Commission has announced to strive for a reduction of green- is emissions to at least 55 % below 1990 levels. Many key players in the automotive	
Att Platender Taleton	BMW Group, Einkauf und Lieferantennetzwerk	have already realized the need for change by defining their own sustainability s. Schaeffler Automotive Technologies takes responsibility in this regard: By 2030 we are then exercises to change and the second s	
E-Mai Deture	14. Januar 2021	ways to significantly reduce our product related and our supply chain related emissions 0. For the latter, we need your full support.	
Therra	Nachhaltigkeit beginnt bei der BMW Group in der Lieferkette	are specific, we kindly request you:	
	Sehr geehrte Damen und Herren,	se provide the amount of carbon emissions (Product Carbon Footprint) of your products I quotations, starting today. It will be mandatory to fill in the CO ₂ -data in SupplyOn when	
Firma Bayeniche	der Kampf gegen den Klimawandel und der Umgang mit Ressourcen entscheiden über die Zukunft unserer Gesellschaft und damit auch über die BMW Group. Daher rücken wirkünftig noch stärker die Thermen Nachhaltigkeit und Ressourcenschonung im Szentrum unserer	mitting your offer. Please calculate on a cradie-to-Schaeffler-gate basis in line with 14067. rm us about the sustainability activities in your company. With respect to existing busi-	
Motorer Werke Action gesetlichten Postanschrift BMN: AC BC/HE Munchen	Unternehmensausrichtung und übernehmen Verantwortung, Neben dem von uns bereits eingeschlagenen konsequenten Weg zur Einhaltung von Menschenrechten und Umweltstandards in der Lieferkette, haben wir uns darüber hinaus sehr klar dem Pariser	a Are you already capable to calculate the Carbon Footprint of the products you are reing to Schaeffler? If so, please share the results with us. If not, please present us your imap.	
Hausanschrift Philadeng 130 Hausanschrift Fanichungt- und	Klimaabkommen verpflichtet und bis zum Jahr 2030 ambitionierte CO; Ziele gesetzt. Diese umfassen den gesamten Lebenszyklus unserer Fahrzeuge: von der Lieferkette, über die Produktion bis hin zur Nutzungsphase beim Kunden.	is know your sustainability goals. Which specific measures are you planning to imple- t in order to reduce greenhouse gas emissions? We expect suppliers to work on a te- son of CO-emissions by at least 10 % until end of the year 2023 compared to the cur-	
Provationarietnam (F-2) Sincentralie 1-47 Tolefon Zierinale + 28 80 382-2	Die steigende E-Mobilität führt in der Lieferkette mit ihren teils sehr energieintensiven Komponenten zunächst zu mehr CO ₂ Emissionen pro Fahrzeug. Ohne unsere Maßnahmen hätter uni einen Anstina um auf GBE CO-Emissionen in des kommendens site. In hätter sollte des steinen sollter in des sollter sollter sollter sollter sollter auf des commendens site.	level. We are looking for measures that reduce the $CO_2\text{-emissions}$, not mitigating emissive offset certificates.	
Fax +49 09 382-70-25858 Internet www.browgroup.com	Tread woll are the international your case you are used to be a compared to the international provided that the second se	Its of carbon emissions in our industry are steel and plastic granulates. Changes in the real production processes have been started, but their implementation will take time. e, to achieve significant reductions of carbon emissions in the next years, all of us must	
Bankkonto Drutote Bank IBAN DEIGS 70070 0157 6946 00 BIC DEUTDEMMOO	alle reaching alle constante dei gesinnen chancie positioneren. Diese volteiterfolle errechen wir jedoch nur mit Ihrer Unterstützung.	In harder to reduce our internal emissions. Based on our calculations, we request our to reduce 80 % of their current direct CO ₂ -emissions – resulting from production, en- sumption and transportation – by the year 2030.	
Versitzender des Aufsichtsrats Notort Reithofer Verstand	wir die bewir Gutalend Optimierungen und Effizienzmale Volafigerleit in unsetern Froduktionsheitzweit setzen wir fortlaufend Optimierungen und Effizienzmaßnahmen um. So beziehen wir z.B. seit 2020 unseren kompletten Fremdstrombedarf aus erneuerbaren Energiequellen und stellen ab 2033 alle umserens Bisederen CO-osevellt.		
Otier Ziger, Verstaander Nien Nedelikene Pieter Nota Nichtis Peter Pieter Nota Pieter Nota Pieter Weber Pieter Weber	. zuz i ane unisere suariuotte GU2-heutral.		
Sitz und Registergericht			

Conclusion

Sustainability, esp. CO₂ footprint becomes as a decisive factor in the automotive value chain Suppliers have to consider CO₂ in technology strategies

Deeper look on the LCA roles along the value chain





Emission reduction targets, including life cycle approach in future potentially

- Demand for sustainability incl. (limited) willingness-to-pay
- 1st Tier is made responsible for the further LCA management of the value chain
- Further integration task and monitoring of own LCA footprint
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LCA analysis of production layout and component designs

-Key Questions-

- » How to adapt own processes to lower CO₂ emission?
- » How to actively integrate LCA into development and innovation processes?





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Technology strategy with E_2^P : Step-by-step approach to determine lifecycle indicators, costs and performance





Holistic E₂P approach allows to efficiently analyze the <u>E</u>conomical and Ecological effects of a particular Performance modification.





- Holistic performance indicator (Cost and Technology)
- ⇒ Neutral analysis for internal and external use





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Potential of Aluminium Application in Battery Cases

- The **target** of the study is to understand general requirements and boundary conditions for the development of battery housings in electric vehicles, and, on this basis, **outline the potential for the application of aluminium** by performing a technical, ecological and economical assessment.
- » A comparative study between aluminium and steel shall present the advantages and possible challenges of aluminium.
- » An existing CAD model, reengineered based on the design of the structural parts of the Volkswagen ID.3 aluminum battery case will be used as a reference.
 - WP1 Identification and systematisation of requirements
 - WP2 Research on current steel concepts
 - WP3 Virtual assessment of case concepts
 - WP4 Holistic assessment of concepts
 - WP5 Comparative study and documentation





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Conclusion - Holistic evaluation of components and systems for electrified vehicles



Life cycle assessment as a decisive factor in the innovation and development process?

Automotive Value Chain







- » Legislation is beginning to reflect LCA aspects
- » OEMs force sustainability, esp. CO₂ footprint becomes a decisive factor in the automotive value chain and suppliers have to consider CO₂ in technology strategies
- » LCA thinking needs to be implemented into the product development process
- Solely focus on view on the GWP over the entire life cycle neglects performance and economic boundary conditions
- » Consequently, a holistic approach is needed in the innovation and development process

» E₂P helps to evaluate technology options already in the concept phase and therefore enables comprehensive technology strategies to comply with the changing decision factors in supplier awards fka GmbH Steinbachstr. 7 52074 Aachen Germany

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Specialist Sustainability Assessment

