Level Concept Implementation in SG3

(illustration & exemplary LCA studies)

A-LCA 10th session

Brussels, 2023-10-17/18

Level concept from SG3 perspective

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling	Representativeness[2]	Supply chain modelling	OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional	generic footprint per kg of vehicle curb weight			none
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])	Global average / regional	global secondary data material footprints (incl. generic information for production processes)			none
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots	primary information for the vehicle hotspot parts	Optional: primary data for OEM's inhouse hot spot processes	primary information for the manufacturing of vehicle hotspot parts	included
				secondary information for the rest	Secondary information for the rest or average values per vehicle from OEM's Scope 1 & 2 emissions	secondary information for the rest	
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC	regional or primary data based part (& material) footprints	included	included	included

1) a column describing comparable objects to help you understand the concepts at each level, giving hints about how to access them by level and what data to find

2) data information characteristics that can be used for evaluation

3) (CDMS) Chinese Material Data System, (IMDS) International Material Data System

Granularity of possible comparison

SUPPLY CHAIN & PRODUCTION	Possible Comparison [1]
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model

1) a column describing comparable
2) data information characteristics tl
3) (CDMS) Chinese Material Data Sy

Technology-to-technology comparison

Vehicle-to-vehicle comparison

Vehicle modelling granularity as main criteria

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")

1) a column describing comparable objects to help you unde

2) data information characteristics that can be used for evalu

3) (CDMS) Chinese Material Data System, (IMDS) Internatior

Generic footprint representative for technology:
e.g. 3.5 kg CO2e / kg of vehicle weight x vehicle weight

List of weight sums of specific material types, aggregated over all parts

⬇

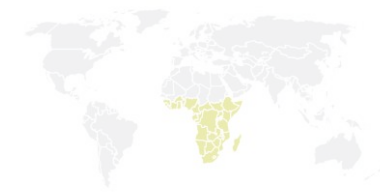List of weight sums of specific material types, part-by-part

Increasing focus of geographic representativeness / specificity

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling	Representativeness[2]
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])	Global average / regional
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC

1) a column describing comparable objects to help you understand the concepts at e

2) data information characteristics that can be used for evaluation

3) (CDMS) Chinese Material Data System, (IMDS) International Material Data Syste

Global   Regional   Individual

Modelling of supply chain / manufacturing processes as final criteria

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling	Representativeness[2]	Supply chain modelling	OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional	generic footprint per kg of vehicle curb weight			none
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])	Global average / regional	global secondary data material footprints (incl. generic information for production processes)			none
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots	primary information for the vehicle hotspot parts	Optional: primary data for OEM's inhouse hot spot processes	primary information for the manufacturing of vehicle hotspot parts	included
				secondary information for the rest	Secondary information for the rest or average values per vehicle from OEM's Scope 1 & 2 emissions	secondary information for the rest	
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC	regional or primary data based part (& material) footprints	included	included	included

1) a column describing comparable objects to help you understand the concepts at each level, giving hints about how to access them by level and what data to find

2) data information characteristics that can be used for evaluation

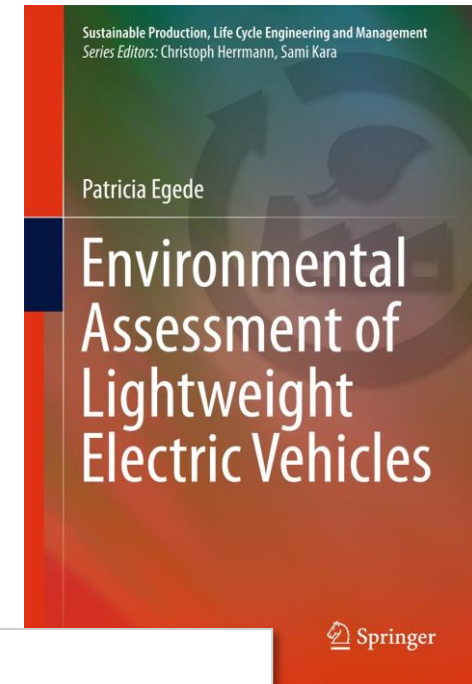3) (CDMS) Chinese Material Data System, (IMDS) International Material Data System

Exemplary studies I

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling	Representativeness[2]	Supply chain modelling	OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional	generic footprint per kg of vehicle curb weight			none
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])	Global average / regional	global secondary data material footprints (incl. generic information for production processes)			none
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots	primary information for the vehicle hotspot parts	Optional: primary data for OEM's inhouse hot spot processes	primary information for the manufacturing of vehicle hotspot parts	included
				secondary information for the rest	Secondary information for the rest or average values per vehicle from OEM's Scope 1 & 2 emissions	secondary information for the rest	
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC	regional or primary data based part (& material) footprints	included	included	included

1) a column describing comparable objects to help you understand the concepts at each level, giving hints about how to access them by level and what data to find

2) data information characteristics that can be used for evaluation

3) (CDMS) Chinese Material Data System, (IMDS) International Material Data System

Source:
https://link.springer.com/book/10.1007/978-3-319-40277-2

Sustainable Production, Life Cycle Engineering and Management
Series Editors: Christoph Herrmann, Sami Kara

Patricia Egede

Environmental Assessment of Lightweight Electric Vehicles

Springer

About this book

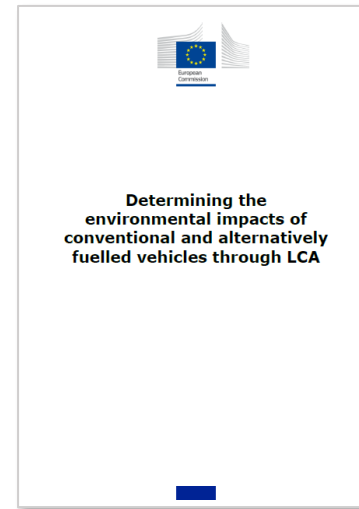This monograph adresses the challenge of the environmental assessment of leightweight electric vehicles. It poses the question whether the use of lightweight materials in electric vehicles can reduce the vehicles' environmental impact and compares the environmental performance of a lightweight electric vehicle (LEV) to other types of vehicles. The topical approach focuses on methods from life cycle assessment (LCA), and the book concludes with a comprehensive concept on the environmental assessment of LEVs. The target audience primarily comprises LCA practitioners from research institutes and industry, but it may also be beneficial for graduate students specializing in the field of environmental assessment.

Exemplary studies II

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling	Representativeness[2]	Supply chain modelling	OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional	generic footprint per kg of vehicle curb weight			none
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])	Global average / regional	global secondary data material footprints (incl. generic information for production processes)			none
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots	primary information for the vehicle hotspot parts	Optional: primary data for OEM's inhouse hot spot processes	primary information for the manufacturing of vehicle hotspot parts	included
				secondary information for the rest	Secondary information for the rest, values per vehicle, OEM's Scope emissions		
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC	regional or primary data based part (& material) footprints	included		

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Determining the environmental impacts of conventional and alternatively fuelled vehicles through LCA

Ricardo Energy & Environment — Determining the environmental impacts of conventional and alternatively fuelled vehicles through LCA | viii

Results from the application of the methodology

The implementation of the developed methodology has provided results for the study covering:

- Two **high-level scenarios** based on analysis supporting the Commission's Long-Term Strategy (Commission Communication COM(2018) 773), i.e. Baseline and a lower carbon future - Tech1.5 scenario, consistent with the EU contribution to meeting the Paris Agreement objective of keeping global temperature increase to a 1.5 °C max).
- 14 different **electricity production chains**, covering the EU28 and its individual Member States (relevant for vehicle manufacturing, and electric vehicle operation), and five other world regions (China, S. Korea, Japan, the US and the global average) (for manufacturing only).
- 60 different **liquid and gaseous fuel production chains**, covering 5 fuel categories, 21 feedstocks, and over 20 processes, plus two fuel mix/blend scenarios for each fuel category.
- 65 different generic **vehicle type/powertrain combinations**, across six light- and heavy-duty vehicle body types.
- 14 different **sensitivities** exploring the significance and impacts of key assumptions and uncertainties for the comparative analysis of different vehicles/powertrain and fuel types.

Source:
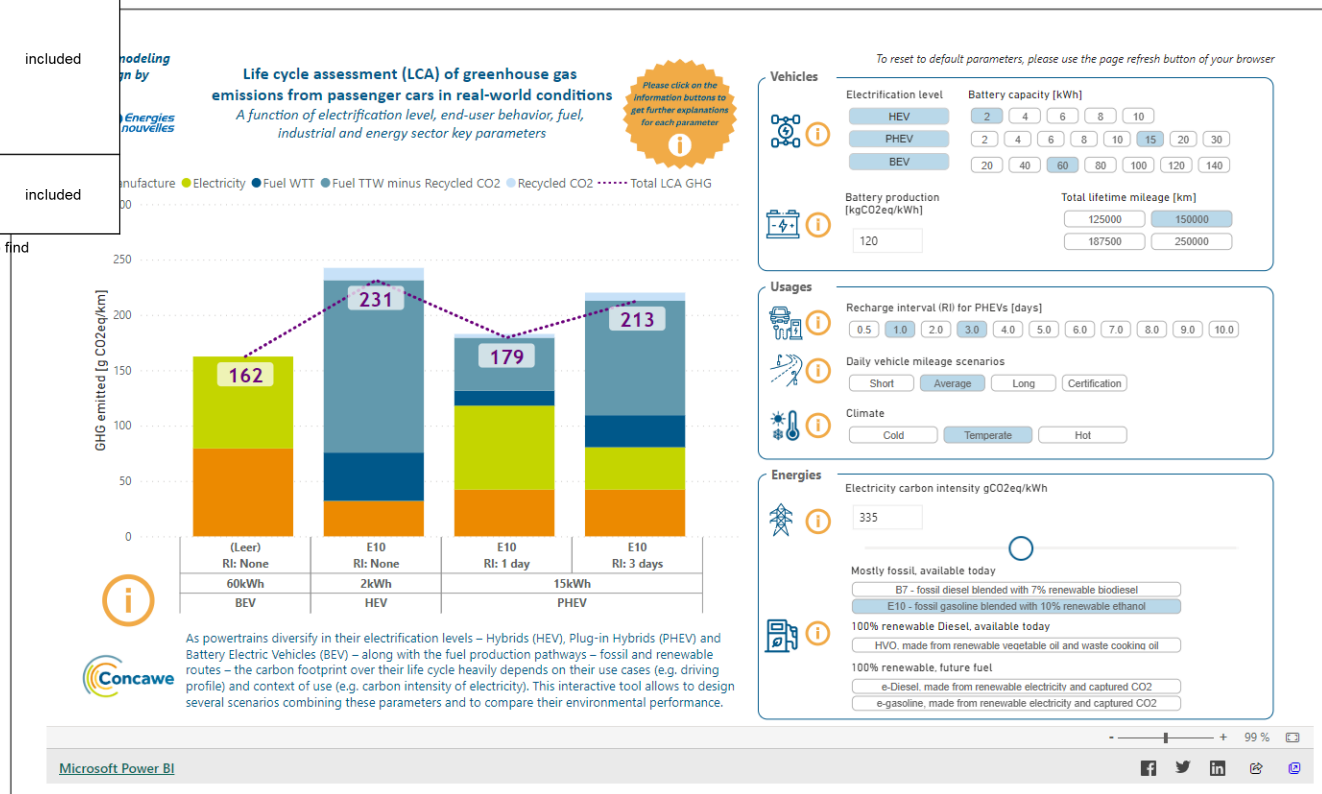https://op.europa.eu/en/publication-detail/-/publication/1f494180-bc0e-11ea-811c-01aa75ed71a1

Exemplary studies III

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling	Representativeness[2]	Supply chain modelling	OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional	generic footprint per kg of vehicle curb weight			none
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])	Global average / regional	global secondary data material footprints (incl. generic information for production processes)			none
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots	primary information for the vehicle hotspot parts	Optional: primary data for OEM's inhouse hot spot processes	primary information for the manufacturing of vehicle hotspot parts	included
				secondary information for the rest	Secondary information for the rest or average values per vehicle from OEM's Scope 1 & 2 emissions	secondary information for the rest	
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC	regional or primary data based part (& material) footprints	included	included	included

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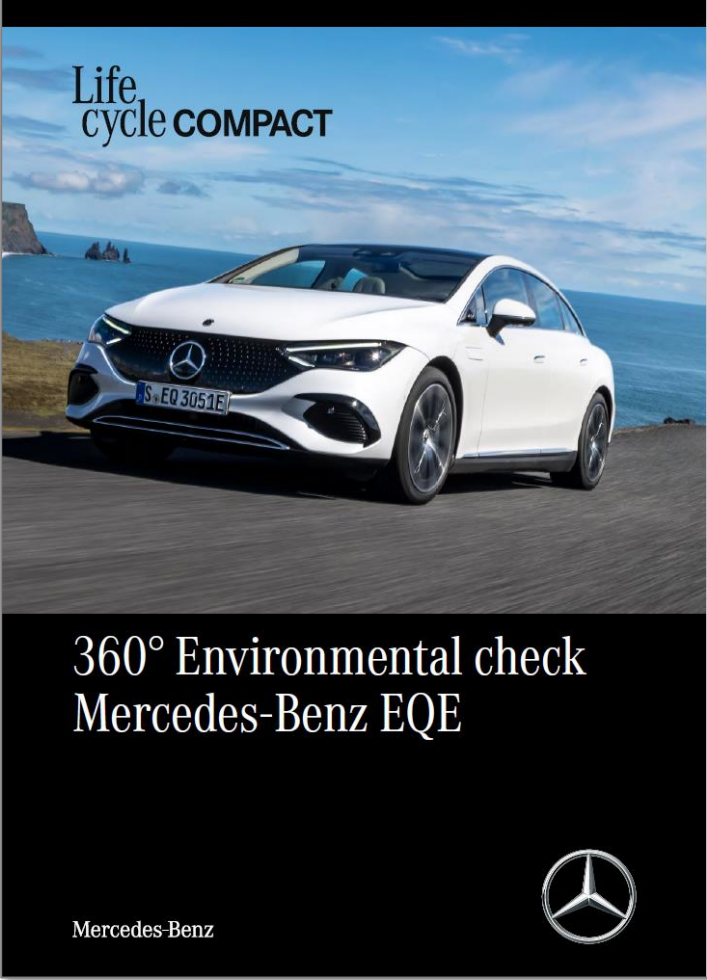https://www.carsco2comparator.eu/ for cars
https://hdvco2comparator.eu/ for trucks

Exemplary studies IV

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1)	Vehicle modelling	Representativeness[2)	Supply chain modelling	OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional	generic footprint per kg of vehicle curb weight			none
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3))	Global average / regional	global secondary data material footprints (incl. generic information for production processes)			none
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots	primary information for the vehicle hotspot parts	Optional: primary data for OEM's inhouse hot spot processes	primary information for the manufacturing of vehicle hotspot parts	included
				secondary information for the rest	Secondary information for the rest or average values per vehicle from OEM's Scope 1 & 2 emissions	secondary information for the rest	
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC	regional or primary data based part (& material) footprints	included	included	included

1) a column describing comparable objects to help you understand the concepts at each level, giving hints about how to access them by level and what data to find

2) data information characteristics that can be used for evaluation

3) (CDMS) Chinese Material Data System, (IMDS) International Material Data System

Source:
https://group.mercedes-benz.com/sustainability/environmental-check/eqe.html

Life cycle COMPACT

360° Environmental check
Mercedes-Benz EQE

Mercedes-Benz

Exemplary studies V

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling	Representativeness[2]	Supply chain modelling	OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional	generic footprint per kg of vehicle curb weight			none
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])	Global average / regional	global secondary data material footprints (incl. generic information for production processes)			none
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots	primary information for the vehicle hotspot parts	Optional: primary data for OEM's inhouse hot spot processes	primary information for the manufacturing of vehicle hotspot parts	included
				secondary information for the rest	Secondary information for the rest or average values per vehicle from OEM's Scope 1 & 2 emissions	secondary information for the rest	
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC	regional or primary data based part (& material) footprints	included	included	included

1) a column describing comparable objects to help you understand the concepts at each level, giving hints about how to access them by level and what data to find

2) data information characteristics that can be used for evaluation

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Source:
Renault Group, on demand

Renault Group

LIFECYCLE ASSESSMENT

CAPTUR E-Tech plug-in hybrid
CAPTUR 1.3 TCE EDC (1st & 2nd gen.)

Exemplary studies VI

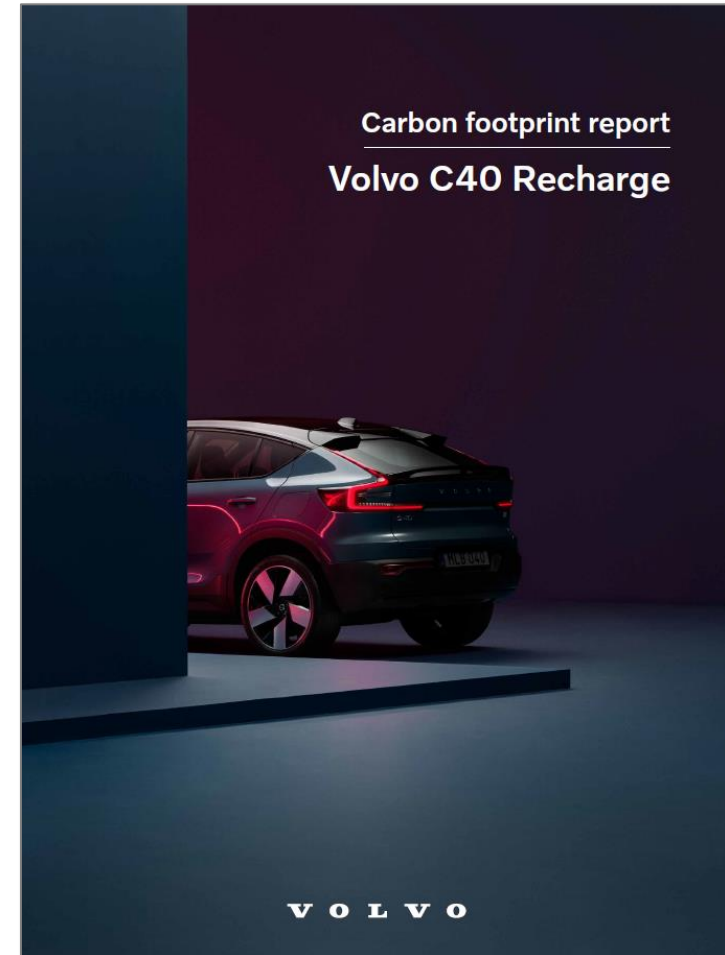| SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling	Representativeness[2]	Supply chain modelling	OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional	generic footprint per kg of vehicle curb weight			none
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])	Global average / regional	global secondary data material footprints (incl. generic information for production processes)			none
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots	primary information for the vehicle hotspot parts	Optional: primary data for OEM's inhouse hot spot processes	primary information for the manufacturing of vehicle hotspot parts	included
				secondary information for the rest	Secondary information for the rest or average values per vehicle from OEM's Scope 1 & 2 emissions	secondary information for the rest	
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC	regional or primary data based part (& material) footprints	included	included	included

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2) data information characteristics that can be used for evaluation

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Source:
https://www.volvocars.com/images/v/-/media/Market-Assets/INTL/Applications/DotCom/PDF/C40/Volvo-C40-Recharge-LCA-report.pdf

Carbon footprint report
Volvo C40 Recharge

VOLVO

Exemplary studies VII

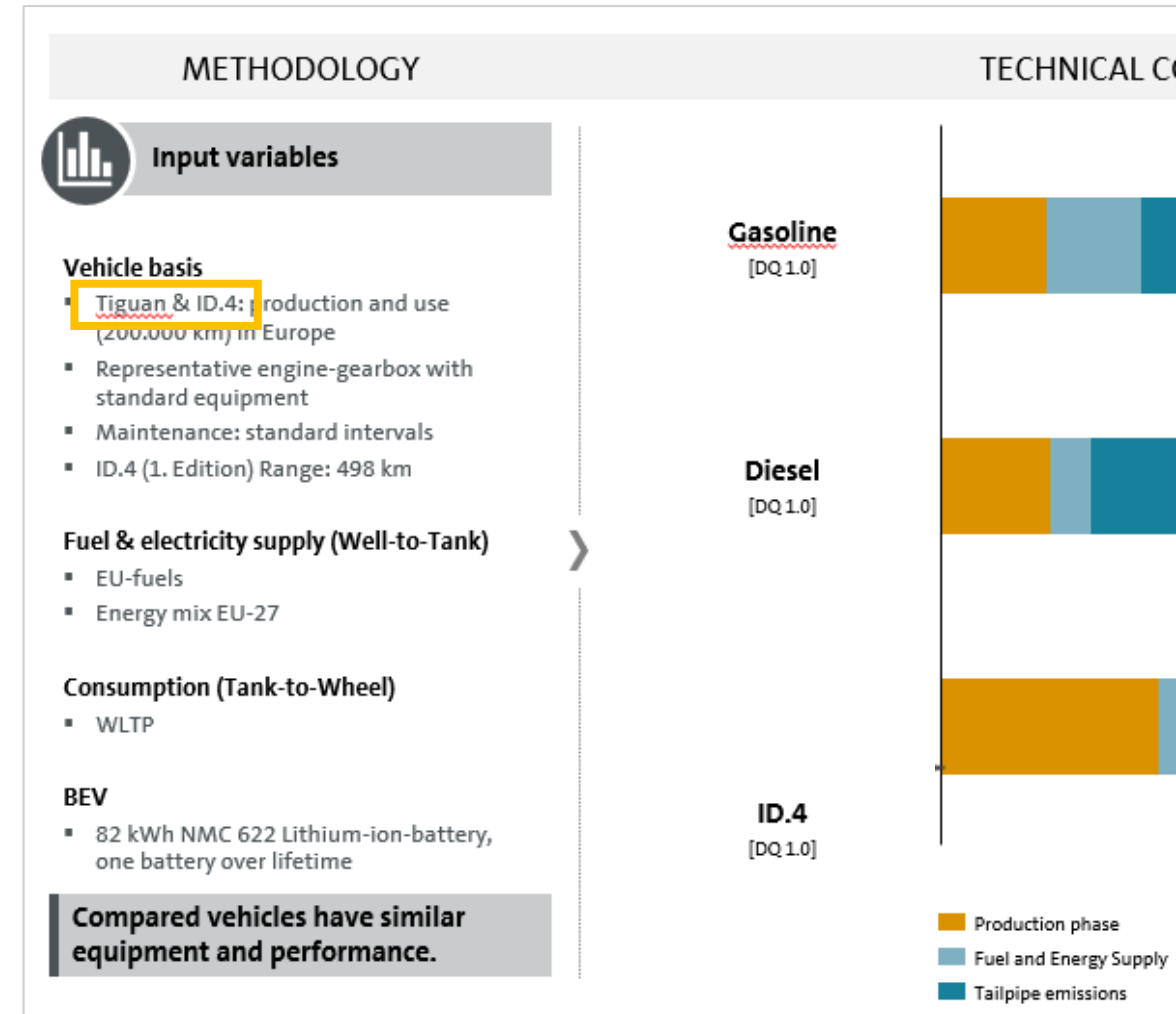| SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling	Representativeness[2]	Supply chain modelling		OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight	Global average / regional	generic footprint per kg of vehicle curb weight				none
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])	Global average / regional	global secondary data material footprints (incl. generic information for production processes)				none
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots	Regional & individual SC for hotspots	primary information for the vehicle hotspot parts	Optional: primary data for OEM's inhouse hotspot processes	primary information for the manufacturing of vehicle hotspot parts	included
				secondary information for the rest	Secondary information for the rest or average values per vehicle from OEM's Scope 1 & 2 emissions	secondary information for the rest	
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")	individual SC	regional or primary data based part (& material) footprints	included	included	included

1) a column describing comparable objects to help you understand the concepts at each level, giving hints about how to access them by level and what data to find
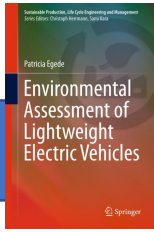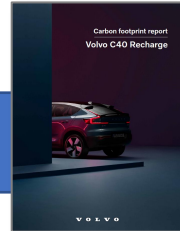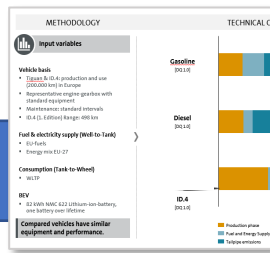2) data information characteristics that can be used for evaluation
3) (CDMS) Chinese Material Data System, (IMDS) International Material Data System

OEM internal comparison of two specific vehicle models

Source:
Volkswagen Group

METHODOLOGY | TECHNICAL C…

Input variables

Vehicle basis
- Tiguan & ID.4: production and use (200.000 km) in Europe
- Representative engine-gearbox with standard equipment
- Maintenance: standard intervals
- ID.4 (1. Edition) Range: 498 km

Fuel & electricity supply (Well-to-Tank)
- EU-fuels
- Energy mix EU-27

Consumption (Tank-to-Wheel)
- WLTP

BEV
- 82 kWh NMC 622 Lithium-ion-battery, one battery over lifetime

Compared vehicles have similar equipment and performance.

Gasoline [DQ 1.0]
Diesel [DQ 1.0]
ID.4 [DQ 1.0]

- Production phase
- Fuel and Energy Supply
- Tailpipe emissions

Exemplary studies | overview

SUPPLY CHAIN & PRODUCTION	Possible Comparison[1]	Vehicle modelling
Level 1	General concept of drivetrains (e.g. BEV vs. ICEV)	Generic material composition & average vehicle curb weight
Level 2	General concept of drivetrains (e.g. BEV vs. ICEV) based on exemplary „real" car vehicle model	BOM & Material information system (CMDS / IMDS[3])
Level 3	A representative vehicle of OEM A VS A representative vehicle of OEM B	BOM & Material information system (CMDS / IMDS) & „part-by-part" for hotspots
Level 4	e.g. OEM A's BEV model vs. OEM B's BEV model	BOM („part-by-part")

Level 1

Level 2

Level 3

Level 4

Different levels serve different purposes / applications!