中国汽车技术研究中心有限公司
China Automotive Technology and Research Center Co., Ltd.

Exemplary research cases of the different levels and Hotspot analysis

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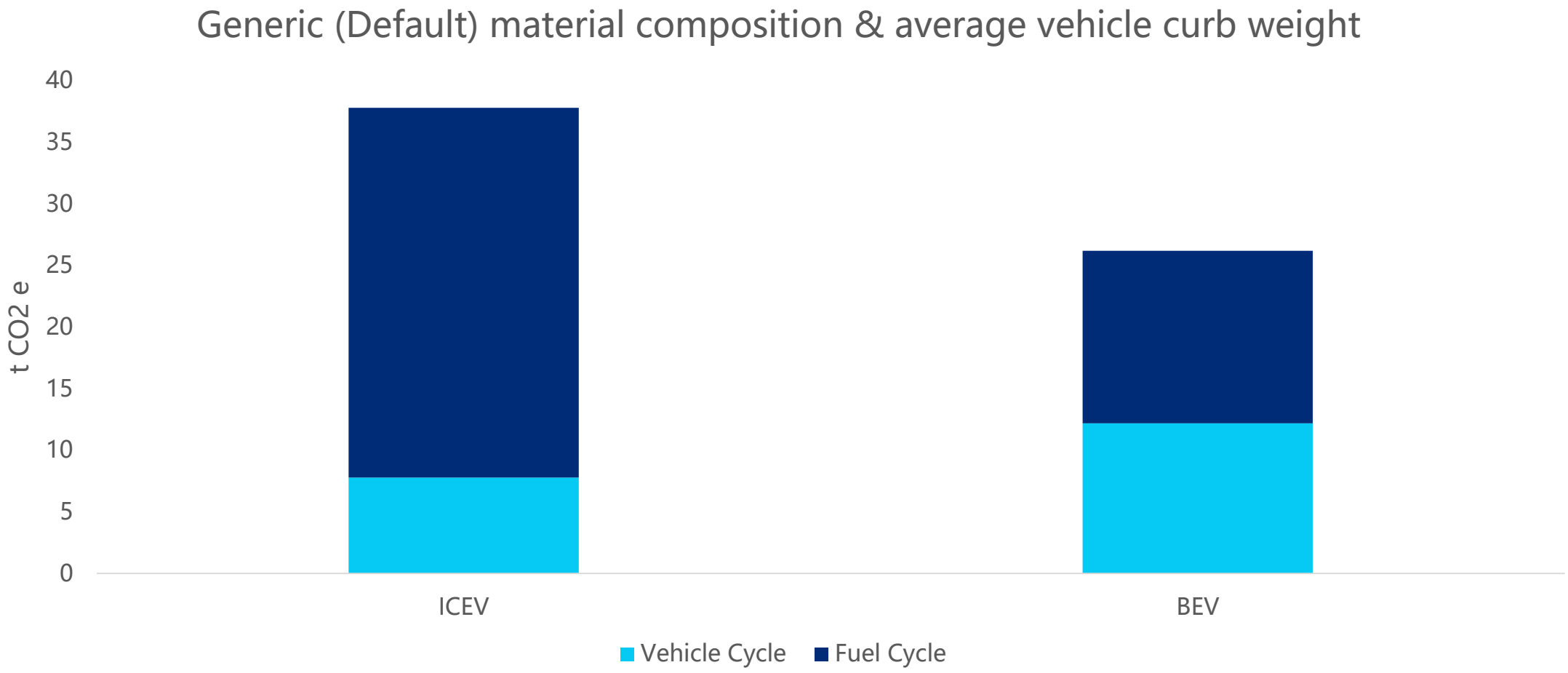
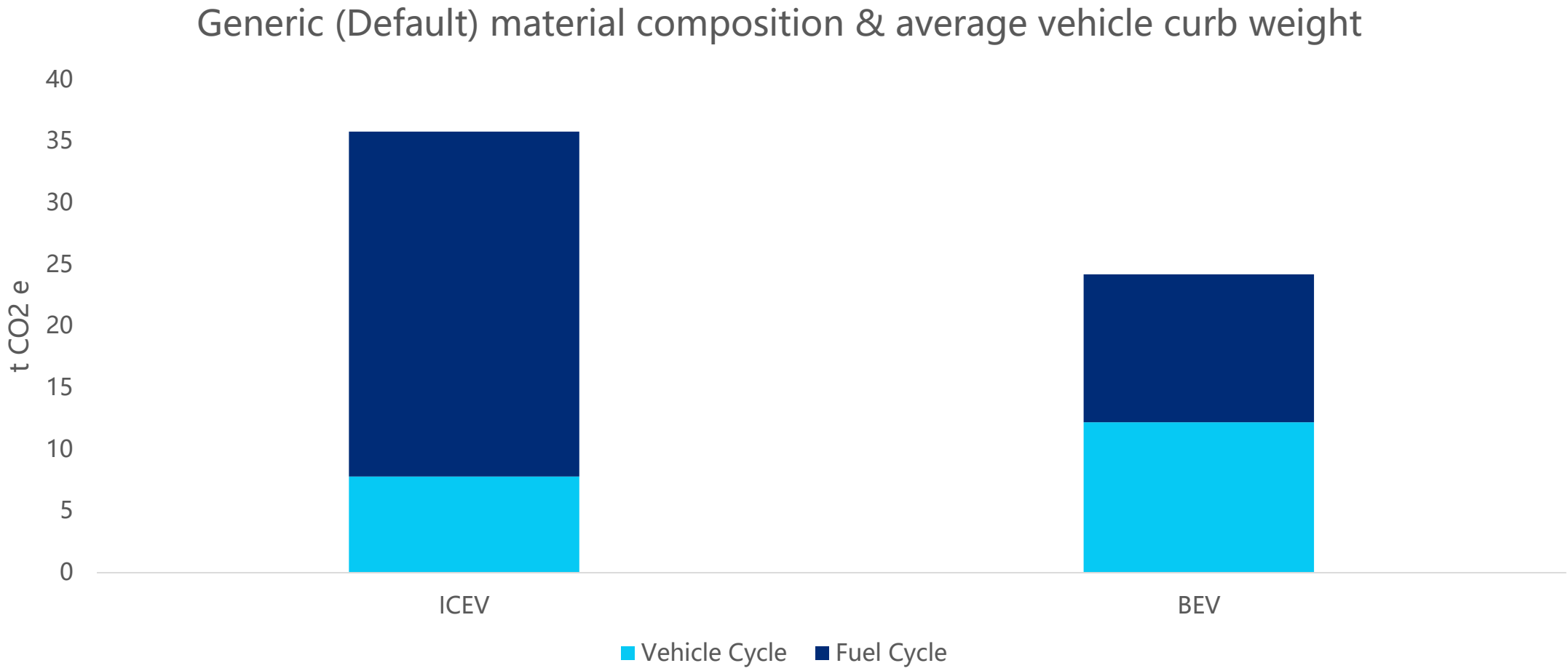
Cases performed in China

SUPPLY CHAIN & PRODUCTION	Possible Comparison1)	Vehicle modelling	Representativeness2)	Supply chain modelling	OEM manufacturing Processes	Supplier manufacturing process	Individual decarbonisation measures
Level 1	General concept of drivetrains & specific vehicle fuel efficiency (BEV vs. ICEV)	Generic (Default) material composition & average vehicle curb weight	China	generic footprint per kg of vehicle curb weight China Automotive life cycle database (CALCD)			none
Level 2	General concept of drivetrains (BEV vs. ICEV) based on exemplary real car vehicle model (Sedan at A class)	BOM & Material information system (CMDS) & specific vehicle curb weight	China	China Automotive life cycle database (CALCD)			none
Level 3	A representative ICEV model of OEM A VS A representative BEV model of OEM A (Sedan at A class)	BOM & Material information system (CMDS) & „part-by-part“ for hotspots	China & individual SC for hotspots	primary information for the vehicle hotspot parts (BIW & powertrain system)	primary data for OEM's inhouse hotspot processes (stamping, welding, painting, final assembly, power station house)	primary information for the manufacturing of vehicle hotspot parts (BIW & powertrain system)	included
				secondary information for the rest &CALCD	Secondary information for the rest or average values per vehicle from OEM's Scope 1 & 2 emissions &CALCD	secondary information for the rest&CALCD	
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

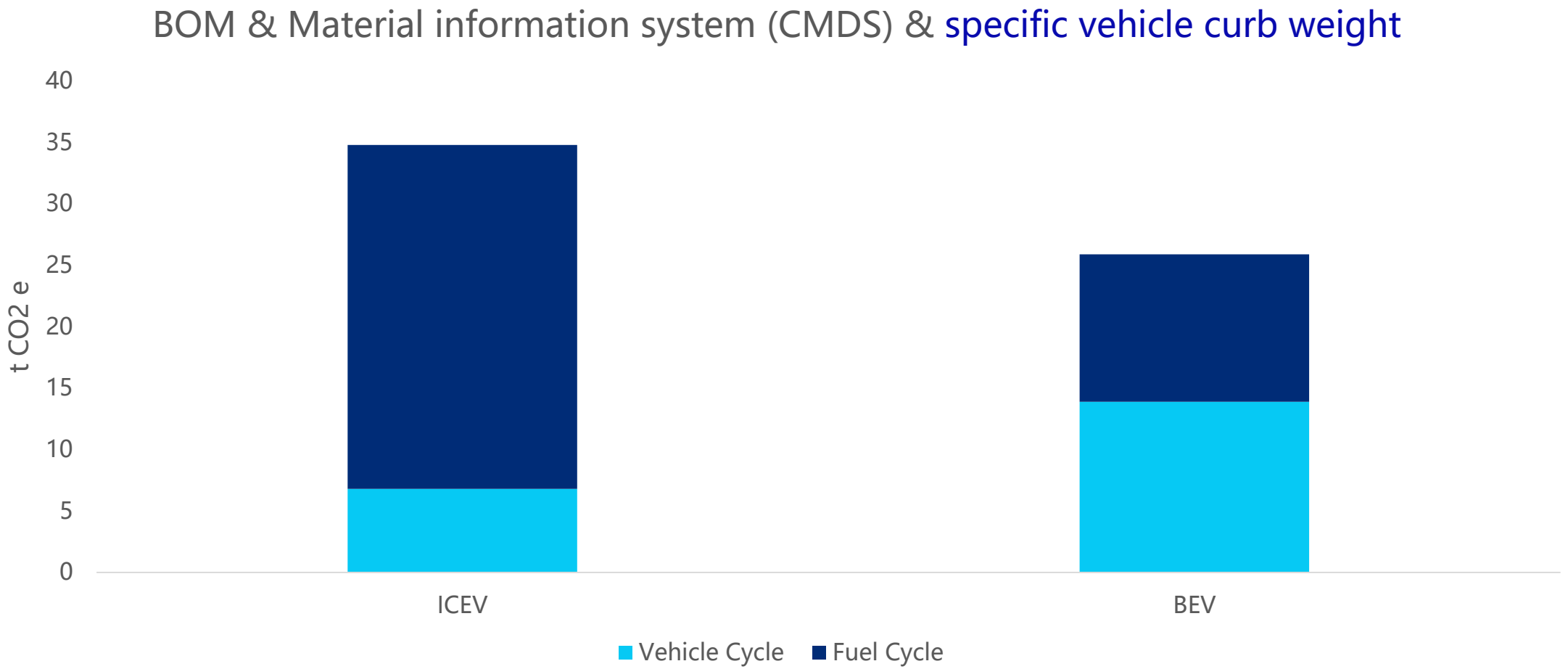
Level 1: General concept of drivetrains (BEV vs. ICEV)



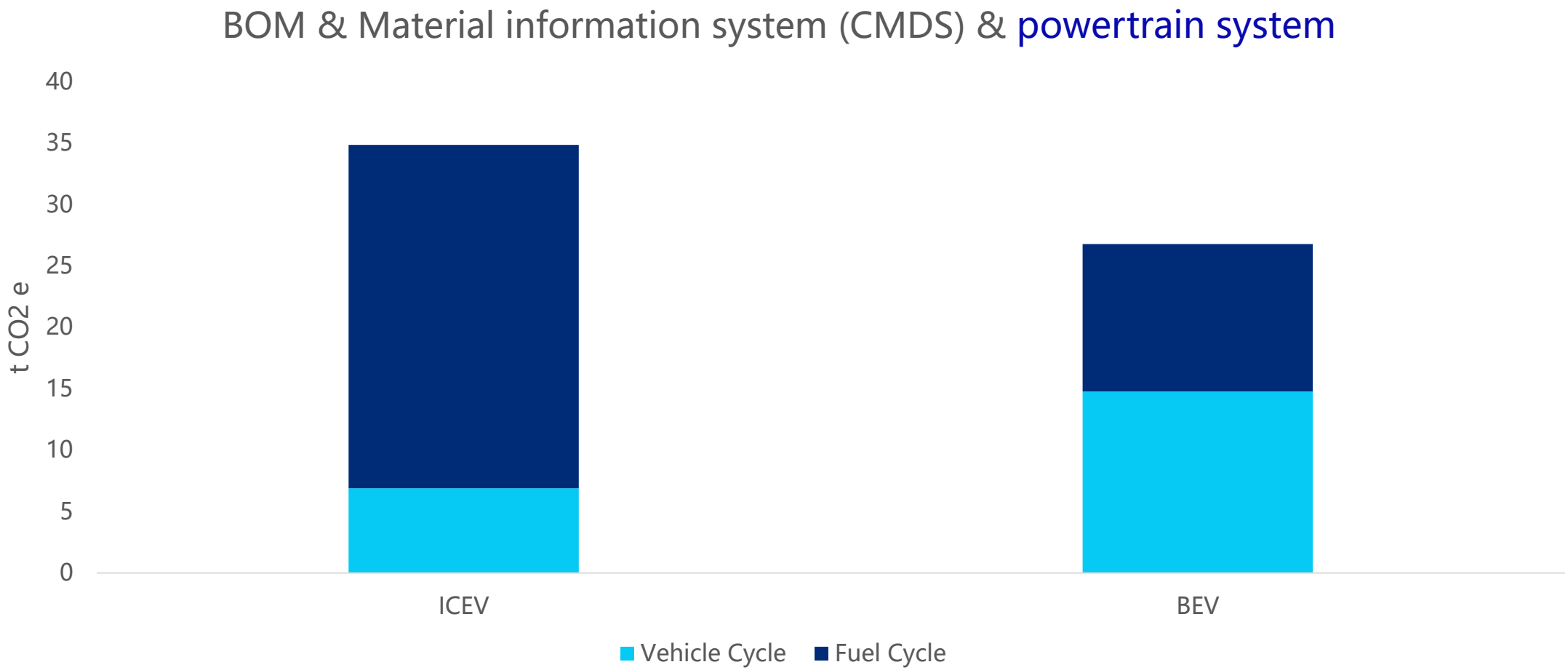
Level 1: General concept of drivetrains & specific vehicle fuel efficiency (BEV vs. ICEV)



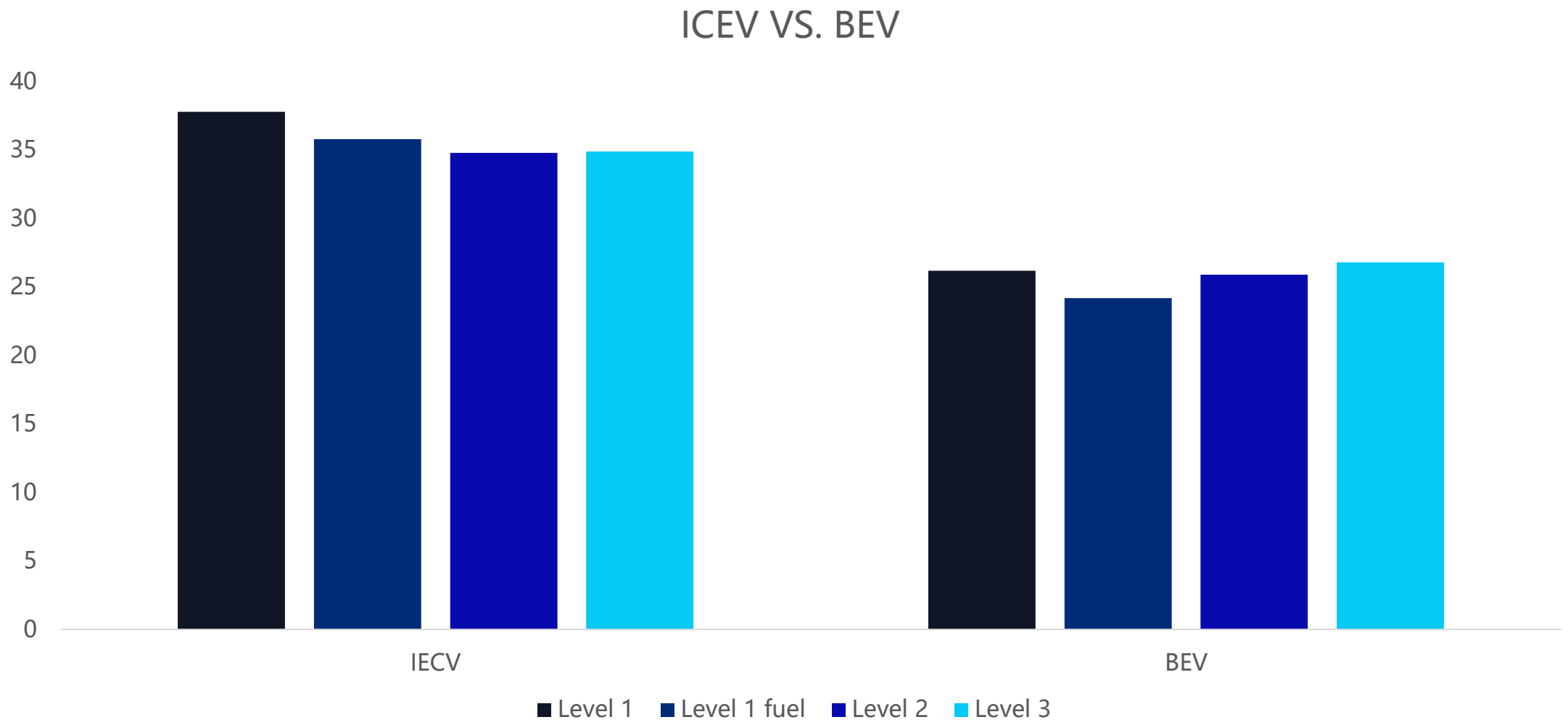
Level 2: General concept of drivetrains (BEV vs. ICEV) based on exemplary real car vehicle model (Sedan at A class)



Level 3: A representative ICEV model of OEM A VS A representative BEV model of OEM A (Sedan at A class)

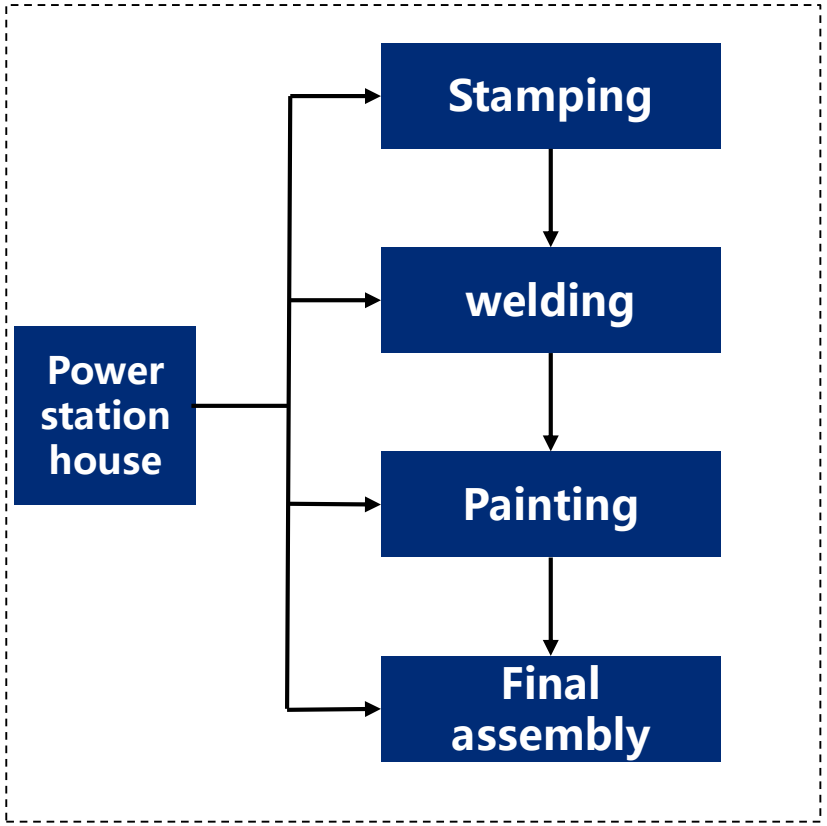


Level comparision



Hotspot of vehicle production process： Vehicle production process including stamping, welding, painting, final assembly, power station house, the entire process of carbon emissions of about 550 kgCO2e/p, excellent Oems can do even lower such as 320 kgCO2e/p

vehicle production process

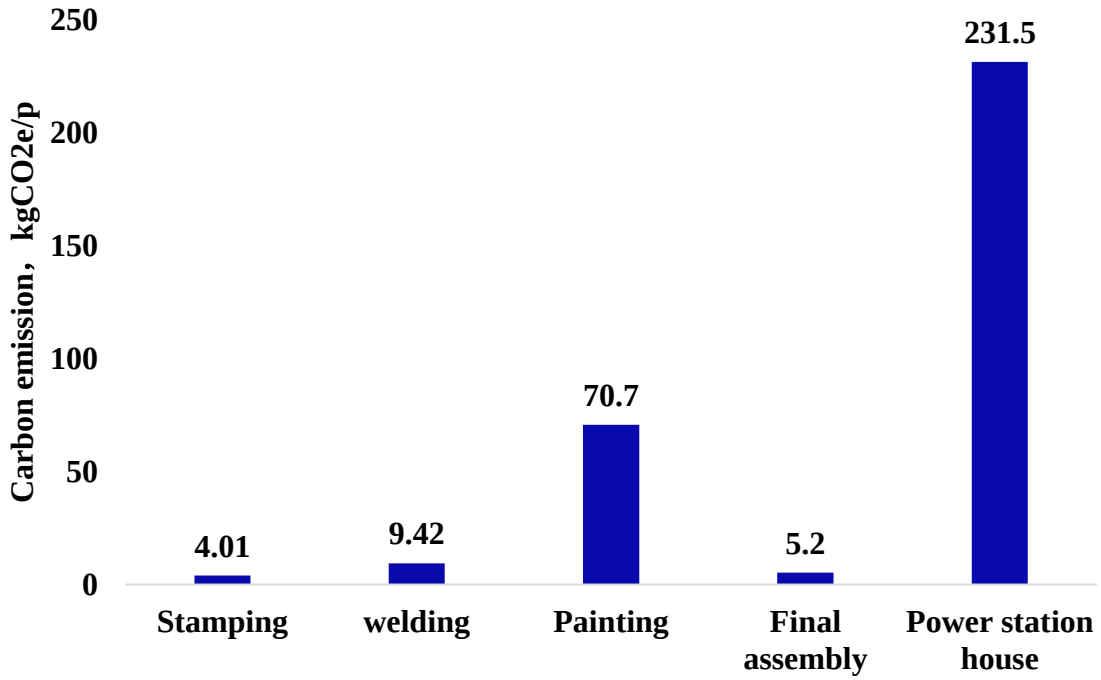


Carbon emission composition of vehicle production process

Process	Electricity, kgCO2e/p	Water, kgCO2e/p	Natural gas, kgCO2e/p	Steam, kgCO2e/p	CO2 escape, kgCO2e/p	Subtotal, kgCO2e/p
Stamping	4	0.01				4.01
welding	9	0.02			0.4	9.42
Painting	10	1.7	59			70.7
Final assembly	5	0.2				5.2
Power station house	10	0.5		221		231.5
Subtotal	38	2.43	59	221	0.4	**320.83**

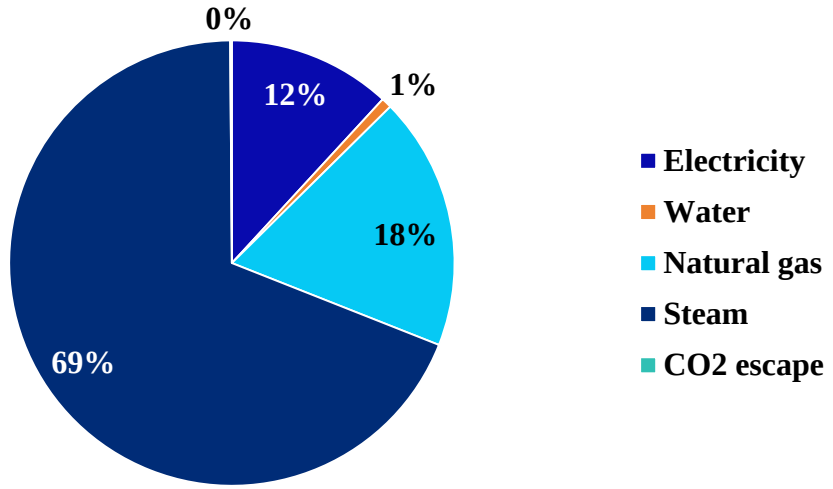
Hotspot of vehicle production process： In each process, the carbon emission of power station is the highest, followed by the painting process. Among all the emission sources, the carbon emissions of electricity account for the largest proportion, followed by the natural gas

Carbon composition of each process



In each process, the highest carbon emission of the power station building is 231kgCO2e/p, followed by 70kgCO2e/p in the painting process.

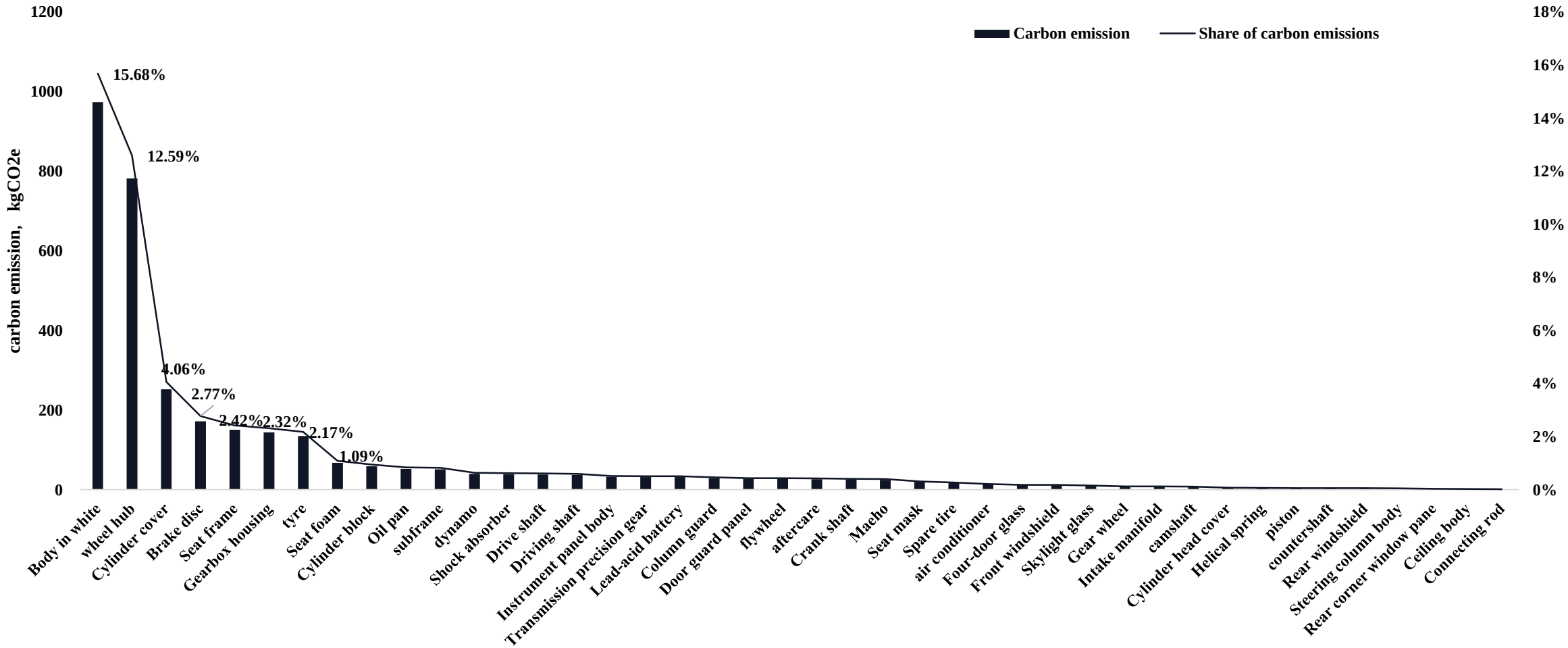
Carbon emission ratio of each emission source



Among all emission sources, the carbon emission of electric power accounts for the largest proportion, accounting for about 69%, followed by the carbon emission of natural gas, accounting for about 18%.

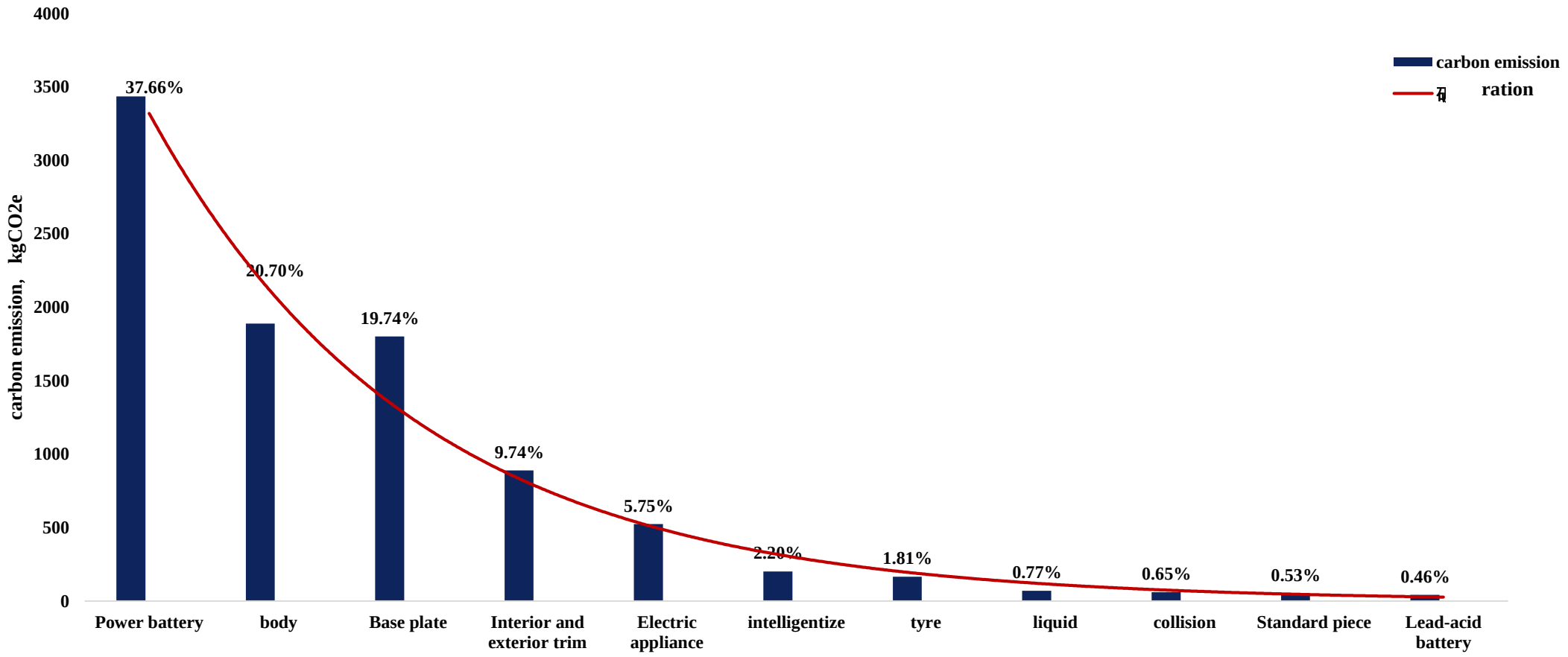
Hotspot analysis in high CO2 emissions parts

Hotspot of high CO2 emissions parts： Taking one ICEV model as an example, the parts with higher carbon emissions are the body in white, wheel hub, cylinder head, brake frame and seat skeleton, with carbon emissions accounting for 16%, 13%, 4%, 2.8% and 2.5%, respectively



Hotspot analysis in high CO2 emissions parts

Hotspot of high CO2 emissions parts： Taking one BEV model as an example, the components with higher carbon emissions are the power battery, body, chassis, interior and exterior decoration and electrical equipment, accounting for 38%, 20%, 20%, 10% and 6% respectively



China Automotive Life Cycle Database - carbon emission factor database

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The database covers the industry average carbon emission factors ranging from the automotive material manufacturing, parts and vehicle manufacturing, use and end-of-life, supporting the industry to carry out product carbon footprint accounting and research.

Vehicle manufacturing

100

Production energy consumption and emission data of over 100 OMEs

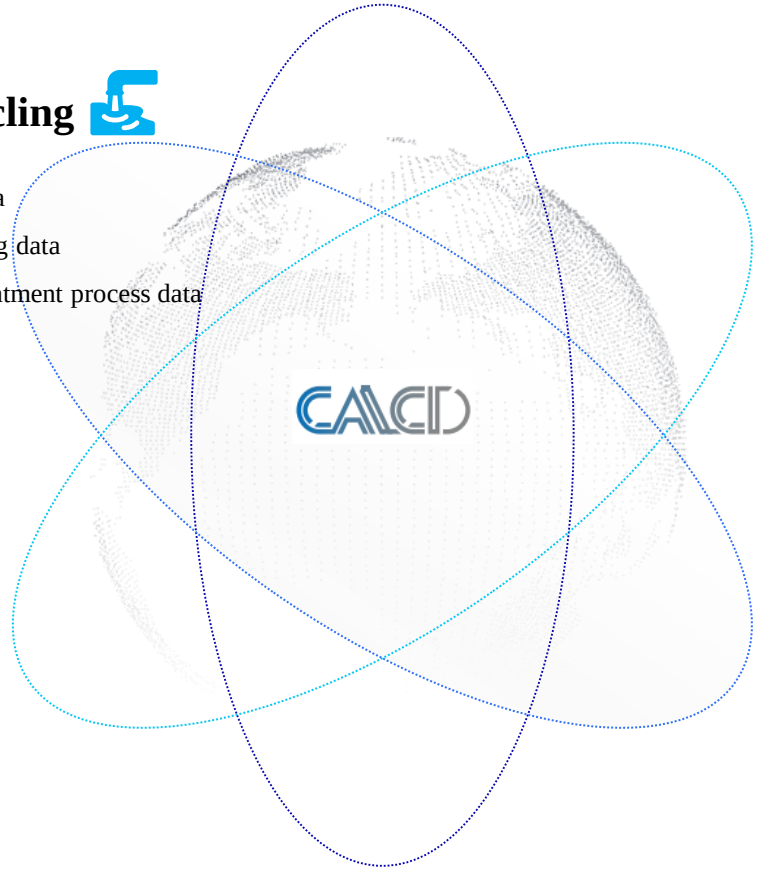
Vehicle usage

10000

Fuel consumption data of more than 10,000 vehicle models in the using stage
Emission data of more than 10,000 vehicle models in the using stage

End-of-life recycling

Power battery recycling data
Vehicle end-of-life recycling data
Incineration and landfill treatment process data



Material manufacturing

50

Inventory data for over 50 vehicle materials, fuels/energy, fluids, etc

Parts manufacturing

1000

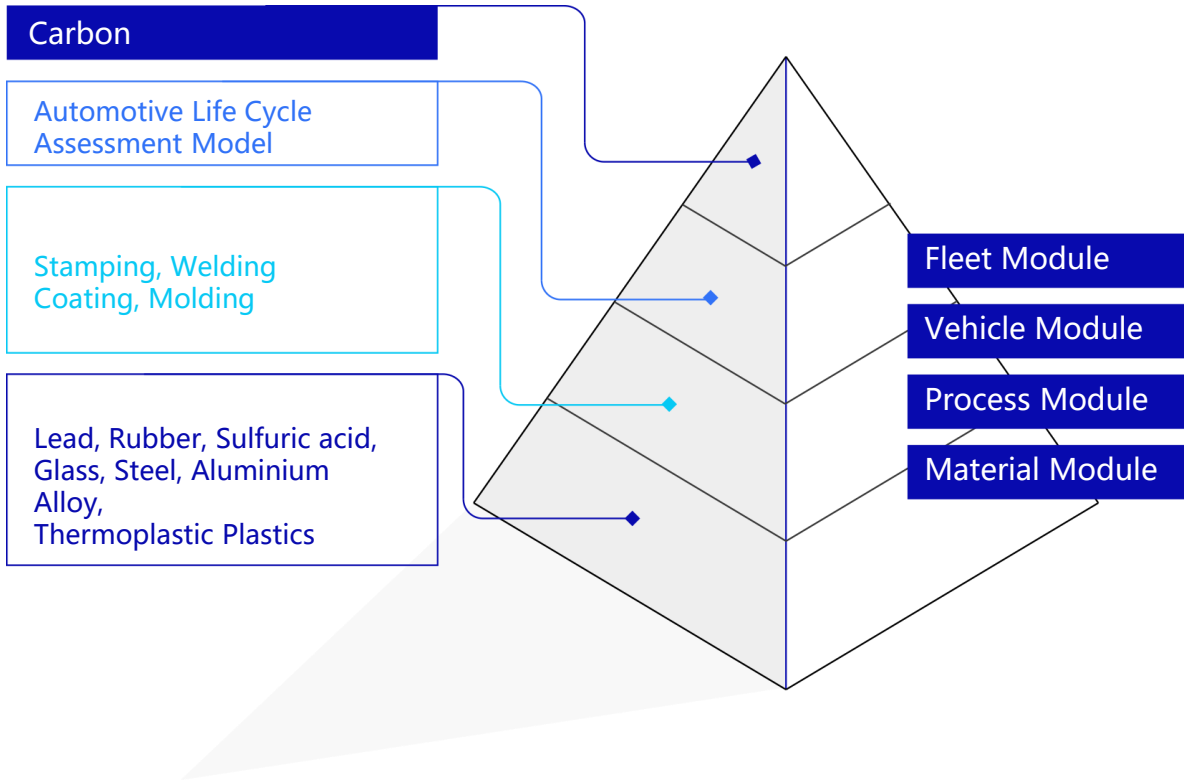
Energy consumption and emission data of nearly 1,000 parts manufacturing and processing processes
Energy consumption and emission data of power battery manufacturing and processing process

100

Weight and material composition data of nearly 100 kinds of parts
Weight and material composition data of more than 100 vehicle models

China Automotive Life Cycle Assessment Model- standardization of carbon footprint accounting

This model serves as the packaging methodology and database to standardize and streamlining the carbon footprint accounting of vehicles

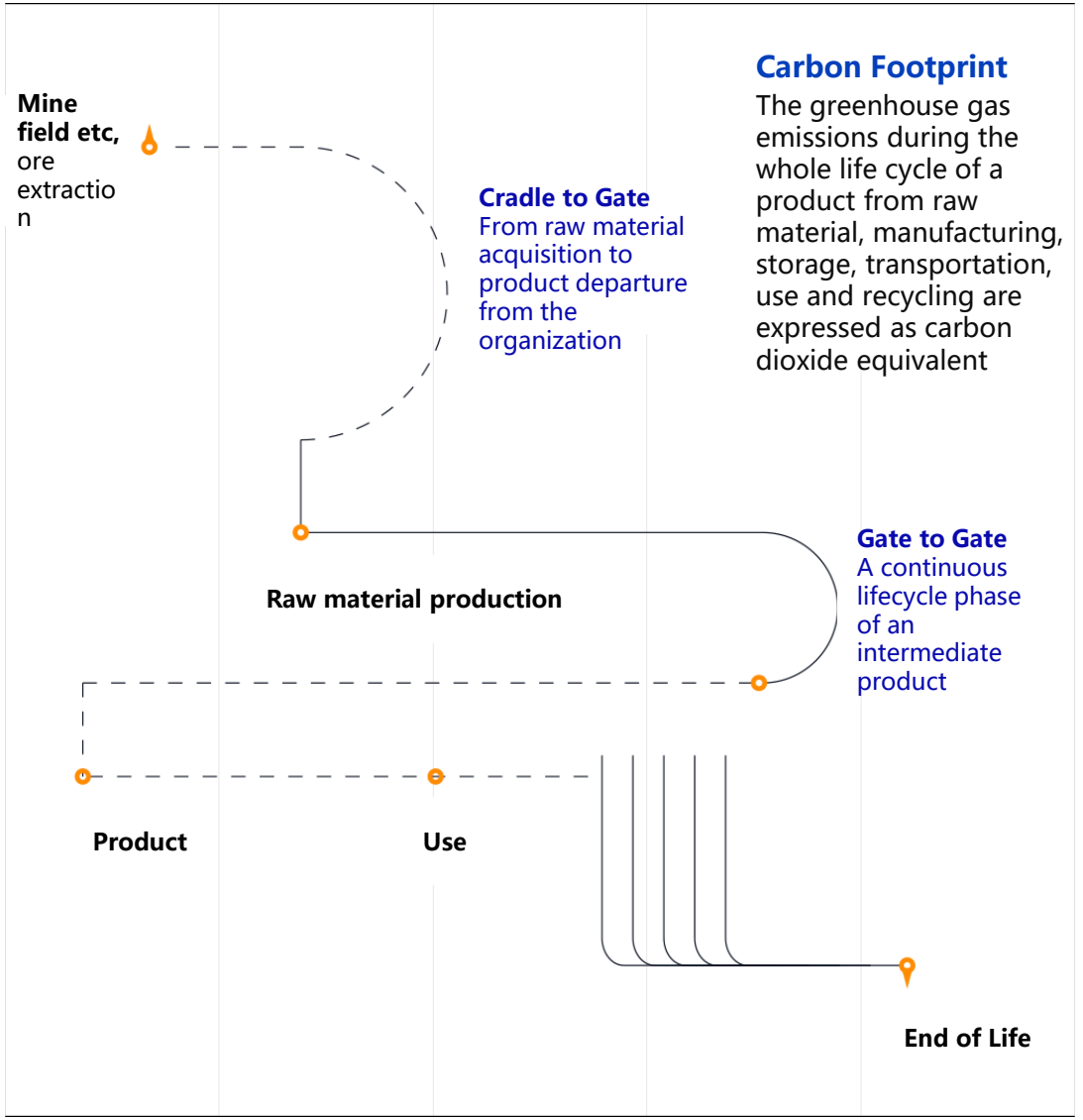


Industrial Carbon Emission: ICEV, HEV, PHEV, BEV, FCV

Vehicle Carbon Footprint: Material, Process, Fuel Use&Production

Process Emission Factors: Main equipment, auxiliary equipment, tooling parameters

Material Emission Factors: Primary Material, Recycled Material, Mineral Production



The model has been authorized to be used by more than 100 international institutions, universities and enterprises, such as University of Cambridge, Yale University, Tsinghua University, Peking University and University of Chinese Academy of Sciences, to guide scientific research and enterprise R&D work, and to promote the academic progress in the field of life cycle carbon emissions research

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