

Sustainable

#225

Automotive Sustainability Guide

In recent years, sustainability has evolved from a corporate goal to detailed functional KPIs among all major OEMs. While today sustainability initiatives revolve around building a zero-emission vehicle portfolio, the breadth of sustainability has spread beyond vehicles to wider environmental and societal aspects, such as carbon neutral manufacturing and conscious material sourcing.

For many players in the automotive industry, the biggest challenge around sustainability will be identifying prioritizations in technologies and applications that balance compliance with cost effective changes to product and process. As 2030 approaches, the year set as a deadline for many government-led sustainability initiatives, it is crucial that automakers not only formulate and commit to their own strategies, but identify the tools, technologies, products, partnerships, and more that will help them achieve their sustainability goals.

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EV Legislation & Incentives Guide – 218

The EV Legislation & Incentives Guide provides in-depth analysis of how and where legislation is impacting electrification in the automotive industry. It aims to help OEMs and lawmakers understand the regulations and incentives surrounding EVs today, as well as the legislation being worked towards by governments in different regions.

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Key questions answered

- > What are the current corporate level case studies and best practices around OEM sustainability initiatives?
- > How are OEM product portfolios differing in terms of CO2/km, and how are they performance against their sales in a region?
- > What are the use cases OEMs are planning for sustainability in the design and engineering stages to track, measure, and reduce emissions across the product lifecycle?
- > What are the key technologies being implemented by OEMs that enable their sustainability goals?

This research supports



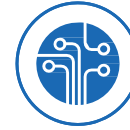
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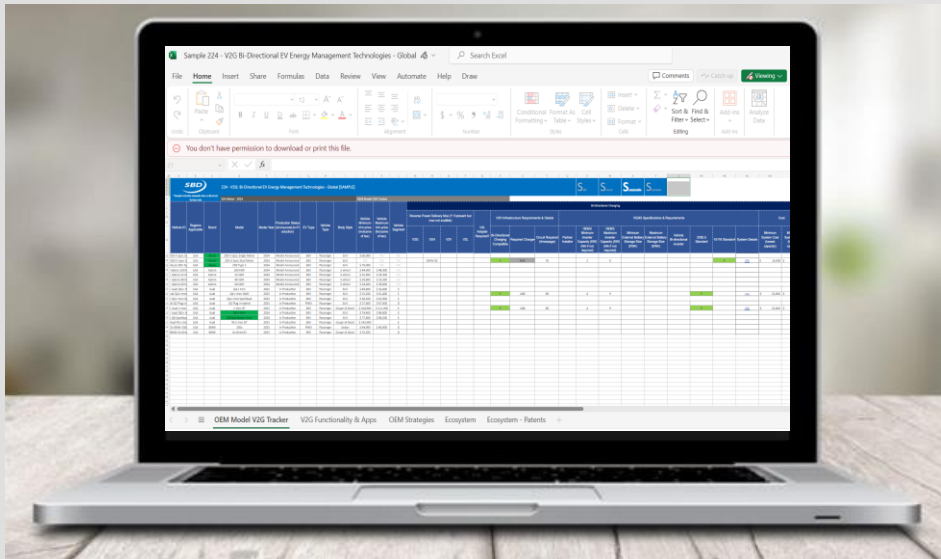
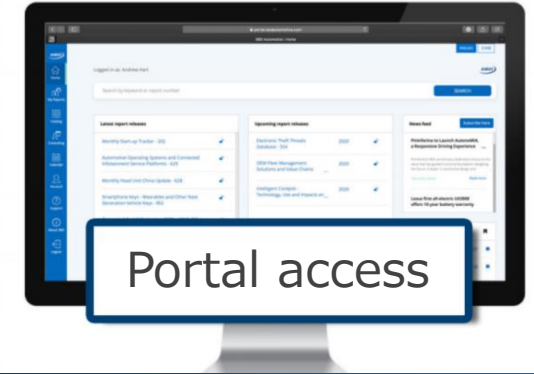
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Automotive Sustainability Guide

For an in-depth benchmark and view of sustainability initiatives and pre-built dashboard showing OEM competitiveness

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datapoints

>35
OEMs covered

OEM Sustainability
Timescale, Guidelines,
Strategies &
Initiatives

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2024

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Introduction



Chapter Introduction

For all OEMs, sustainability has expanded from broad corporate level goals to detailed functional KPIs across teams and members of staff. Currently, sustainability initiatives revolve around building a zero-emission portfolio. This will expand beyond vehicles to environmental and societal aspects like carbon neutral manufacturing and welfare conscious material sourcing. The biggest challenges associated with sustainability are the identification and prioritization of technologies that balance compliance and cost whilst achieving effective changes to products and processes. This report aims to identify the major drivers and barriers for the **six key OEM motivations for Sustainability**. These six motivations are:

 Environmental & Image	 Consumer Demand	 Reduced Overheads
 Simplifying Complexity	 New Segments & Industries	 Sustainable Fleets

What are the key findings of this report?

- What are the current corporate level case studies and best practices related to OEMs' sustainability initiatives?
- What are the approaches to carbon capture and carbon offsetting, energy utilization and major manufacturing?
- How are product portfolios differing in terms of CO2 g/km and how are CO2 emissions being impacted by sales in a region?
- What are the key technologies being implemented by OEMs that enable their sustainability goals?

Section	Content
Sustainability Birds Eye View	An overview of the key findings from SBD's view of what's important on Sustainability
Executive Summary	Presents key highlights and conclusions from the report.
The Basics	What do you need to know about sustainability?
What's New	Latest announcements
Analysis	Analysis of key case studies identified in our research, including SBD insight on best practice
Summary Tables	Overview of each OEM's offerings and indicators on future activities
Future Outlook	Four OEM personas are considered against drivers and barriers into the future to understand when sustainability motivations will be truly realized
Next Steps	Can SBD help you with any unanswered questions?

We Listened and Invested In Our Report to Align to Your Goals



You Said...

"I sometimes struggle to relate conclusions from research reports to the Outcomes and KPIs that we are working towards..."

"I would like to see what has recently changed within a forecast or domain to help decide if any changes to strategy need to be made..."

"I want to know where we stand 'head-to-head' against the competition on major industry trends..."

"I can find it difficult to take actionable next steps on Guides without assessing the future direction of the industry..."

"It would be helpful to identify disruptive companies and start-ups to keep an eye for partnerships in the future..."

"I would like the topics to be more 'forward looking' to help with future planning and take advantage of enabling technologies."



We Did...

Added a Sustainability **BIRDS-EYE VIEW** chapter with a high-level overview of research influencing Sustainability.

Enhanced **CROSS-REFERENCING** with EV data from our EV Guide and national V2G strategies from our V2G report compared with energy generation

Introduced a **FUTURE OUTLOOK** chapter with motivations such as Simplifying Complexity, and the associated reduction in hazardous materials


More **DATA-DRIVEN ANALYSIS** through our Summary Table analysis, our dedicated Analysis chapter, and Executive Summary.

Created a **SUSTAINABILITY OEM RANKING** and an **ECOSYSTEM** chapter with offering, acquisition and patent insights for key non-OEM stakeholders.

Pushed boundaries to add the disruptive **NEW TITLE** Automotive Sustainability Guide



Example slides from the report



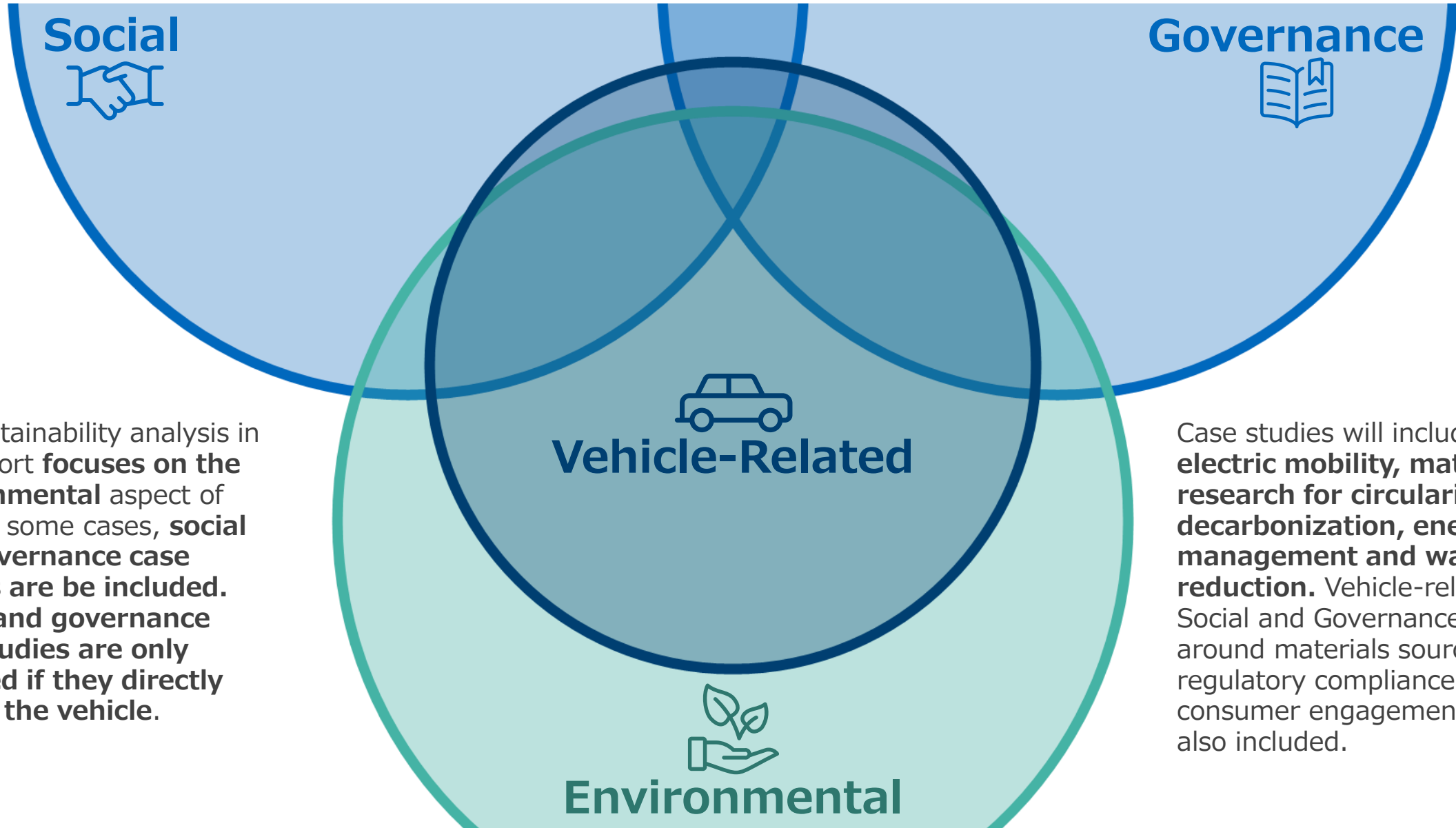
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The product card is a rectangular white box with a thin border. It features a top image of a blue car on a grid background. Below the image is a blue banner with the SBD logo and the text '2024 Automotive Sustainability Guide 2025'. At the bottom of the card is a blue button with the text 'Request price' and a white right-pointing chevron symbol.



How is sustainability defined in this report?



The sustainability analysis in this report **focuses on the environmental** aspect of ESG. In some cases, **social and governance case studies are be included. Social and governance case studies are only included if they directly impact the vehicle.**

Case studies will include **electric mobility, materials research for circularity, decarbonization, energy management and waste reduction.** Vehicle-related Social and Governance topics around materials sourcing, regulatory compliance, and consumer engagement are also included.

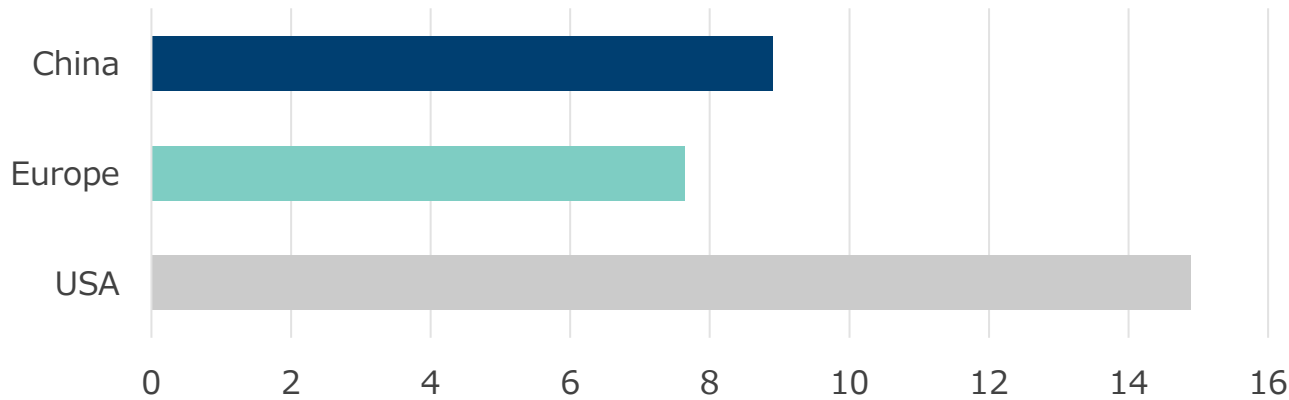


Europe is leading the environmental sustainability charge

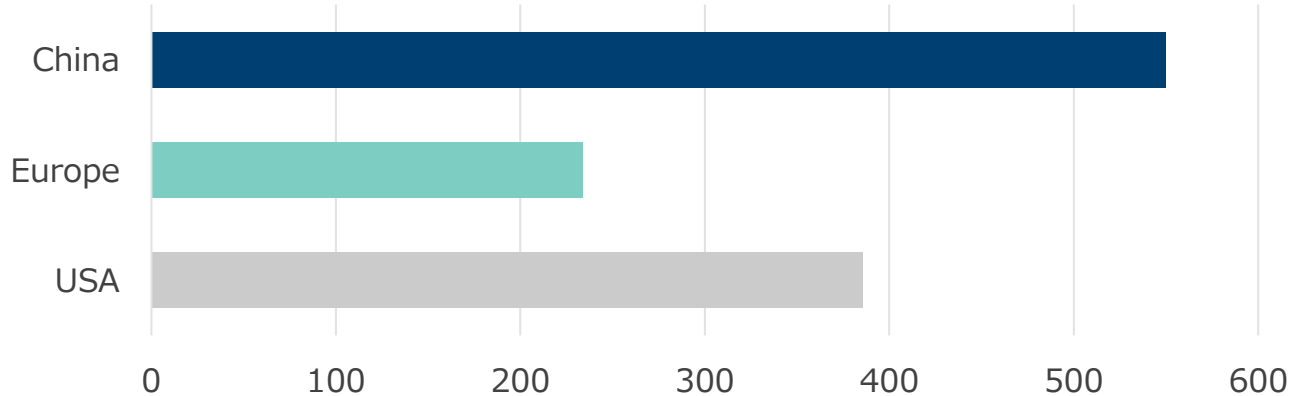
Global Environmental Impact Overview

Europe currently has the lowest emissions in both average emissions per capita and carbon footprint for energy consumption. USA instead still has the highest per capita emissions while China surpasses both other regions in terms of carbon footprint for consumed energy. Yearly emissions share per vehicles sold per km also show a similar pattern.

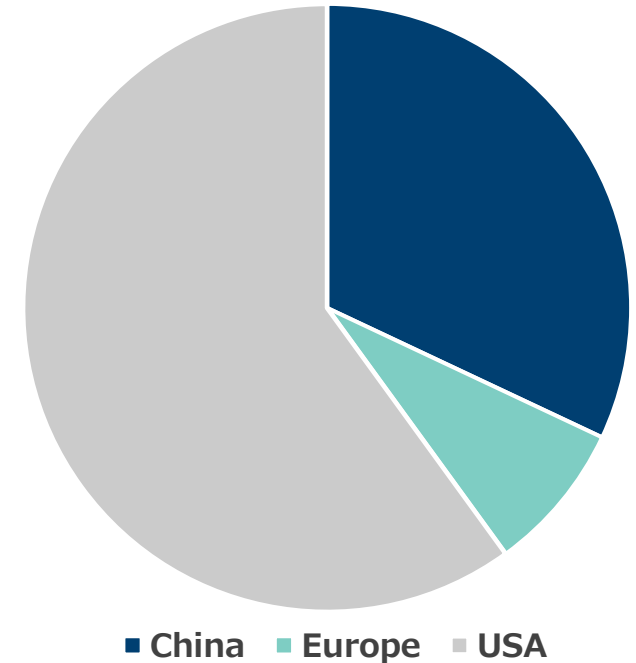
Global Carbon Budget - Average Emissions Per Capita (T of CO₂)



Consumed Energy Carbon Footprint (g CO₂/kWh)



Total share of CO₂ per vehicles in 2023-2024 (T/km)



Sustainability Outcomes

In the environmental sustainability analysis SBD focuses on outcomes of different activities considering emissions from **mining, raw materials and chemicals refining and manufacturing, machinery production, construction, vehicles manufacturing.**

Similarly **waste reduction, recycling, second life, and energy efficiency** integrating renewables play key roles in the long-run in **improving people lives through affordability, potential for better services,** and customer experience. Last but not least, the **reduction of pollution,** particularly in cities, and **limitation of climate change.**

Next Steps for OEMs who are already full BEV OEMs

Next steps if good sustainability is... Use-Phase CO₂ Emissions Reduction

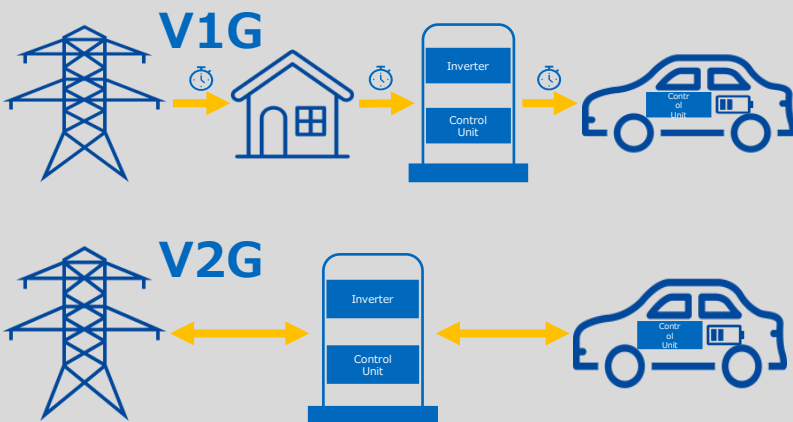
Groups with 100% BEV and/or FCEV have **further opportunities to reduce Scope 3 emissions** from vehicles use-phase

- **Driver coaching behavior**

Proprietary or 3rd party applications giving suggestions on routes and energy saving tips even through **gamification to better engage with drivers**, can encourage positive driving habits.

- **Green & Smart Charging**

Increased adoption **of renewable energy in charging** along with **smart or bi-directional capabilities**.



Next steps if good sustainability is... Constant & Gradual Improvement

Along with additional measures to reduce CO₂ and other GHG emissions, for continued sustainable improvement OEMs can adopt other solutions **reducing other sources of pollution**

- **Non-tailpipe Emissions**

Brake consumption particulate, typically PM₁₀, can be reduced with **lightweight vehicles**. Also, affordable options made **from aluminum or magnesium alloys** instead of iron are being researched.

- **Battery second-life and recycling**

A sustainable electrification strategy requires plans to reuse or recycle batteries. **Second-life as energy storage or next-level recycling methods like direct recycling** offer the best solutions to tackle this key sustainability factor.

- **Smart manufacturing**

Other forms of **automation and digitalization** can make BEV development easier and faster. **Manufacturing automation with AI applied, and software managing and automating robotic processes with AGVs and cobots** result in efficiency and significant energy saving.

Next steps if good sustainability is... Ambitious Targets

Beyond use-phase, Scope 3 emissions coming from the **supply chain and including suppliers, logistics and end-of-life** can be the **most complex source** to control

- **Supply Chain**

The use of **blockchain or other secure data exchange and recording methods** enables a **higher level of traceability** with tools like the **battery passport** that benefits the reduction of emissions across the whole value chain. Establishing **partnerships or consortia** with specific standards can help achieve such targets.



- **Organizational**

Participation in **in-use testing programmes** that may go over and above type approval requirements, for example Green NCAP.



Key activities for carbon footprint reduction and energy efficiency

	Opportunities	Challenges												
Sourcing & Supply Chain	<ul style="list-style-type: none"> Improvements on lean manufacturing principles through new technologies, automation, robotics, AI, and supported by digital processes and planning such as with virtual factories make production more efficient further reducing Scope 1 and 2 emissions, water consumption and waste. 	<ul style="list-style-type: none"> While the root cause of energy price increases is debated, some cite an increased focus on sustainable products, which could in turn increase the costs of manufacturing for OEMs. Adapting manufacturing facilities to sustainable production and repurposing them in general to the transition toward EVs requires an important investment commitment and an uncertain market development could result in financial problems and business sustainability issues. A similar situation could be caused by excessive R&D investment requirements for new manufacturing techniques. Potential lack of specialized workforce represents an issue for manufacturing and additional investments are needed to improve training of new skills. Connected to the additional costs driven by sustainability practices, compliance with increasingly stringent regulations can become constraints for OEMs or could lead to penalties. 												
Physical & Software Design	<ul style="list-style-type: none"> 3D printing helps create lightweight components, thanks to structural optimization which can make the use phase more efficient. It also leads to cheaper, faster development and manufacturing processes, reduced waste and material complexity. This is also relevant for remanufacturing as another way to improve efficiency. 													
Manufacturing	<ul style="list-style-type: none"> Renewables integration through solar, wind and other sources while common thanks to electrification and V2X can further improve. Strategic partnerships for software and EV batteries offer quicker and reliable access to specialized know-how. This approach is being used by several automakers to rapidly improve sustainability. 													
	Targets trend													
Use Phase	<p><i>The graph shows the percentage of sustainability activity categories impacted by all the activities tracked in this phase.</i></p> <table border="1"> <caption>Percentage of sustainability activity categories impacted</caption> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Carbon Footprint</td> <td>~65%</td> </tr> <tr> <td>Recycle</td> <td>~25%</td> </tr> <tr> <td>Reduce</td> <td>~65%</td> </tr> <tr> <td>Reuse</td> <td>~15%</td> </tr> <tr> <td>Social</td> <td>~25%</td> </tr> </tbody> </table>	Category	Percentage	Carbon Footprint	~65%	Recycle	~25%	Reduce	~65%	Reuse	~15%	Social	~25%	<p>Target Trends Highlights</p> <ul style="list-style-type: none"> More than other phases, manufacturing targets mostly a reduction in carbon footprint, resources consumption, and energy waste. Both the Carbon Footprint, and Reduce impact categories are included in over 60% of the initiatives reviewed. Manufacturing is an important focus for OEMs and by far the one with the highest number of initiatives as it is under more direct control and to a certain extent presents fewer complexities compared to the control of the supply chain. Scope 1 and 2 direct emissions then can be tackled through improved efficiency and renewable energy adoption. Recycling while impacting this phase is usually performed more often in later stages as is the reuse of resources adopted for remanufacturing.
Category	Percentage													
Carbon Footprint	~65%													
Recycle	~25%													
Reduce	~65%													
Reuse	~15%													
Social	~25%													
End-of-Life														



Sustainability regulations and incentives in USA

Overview

The following table shows a recap of some of USA's main sustainability-oriented regulations and incentives, including standards promoted by different states' local governments.

Title	Region of Impact and Type	Description and Key Sustainability Takeaways
Inflation Reduction Act (IRA)	USA – Legislation & Incentive	The IRA establishes the eligibility criteria for a credit of up to \$7,500 per vehicle (\$3,750 for meeting specific critical minerals requirements and \$3,750 for meeting battery component requirements) to reduce carbon emissions by 40% by 2030 , and directly contributes to the development and production of new batteries and a domestic supply chain in the US. Total investment is \$369 billion in “Energy Security and Climate Change” programs over ten years.
Infrastructure Investment and Jobs Act of 2021	USA – Legislation	Infrastructure Investment and Jobs Act is designed to address the country's aging infrastructure through \$1.2 trillion in funding over five years and create jobs and training in the process. Focus will be on transportation and infrastructure, with \$550 billion for new investments and grants. The National Electric Vehicle Infrastructure Formula Program, part IIJA, provides funding to deploy EV charging infrastructure and hydrogen fueling stations .
Multi-Pollutant Emissions Standards	USA – Regulation	The EPA announced rules for model years 2027 introducing gradually more stringent emissions standards to reduce fine particulate and GHG emissions. Other benefits include improved public health and cost savings through reduced fuel and maintenance expenses.
California Air Resources Board ZEV Program	California, Connecticut, Delaware, District of Columbia, Hawaii, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia – Standards	CARB sets standards for ICE emissions and implements programs to reduce emissions from these sources. The Zero Emissions Vehicle (ZEV) program requires automakers to produce a certain number of zero-emission vehicles each year. CARB's standards have been adopted by 15 other states which accounts for 35% of the total vehicles sales in the US.
Vehicle purchase cash incentives	California, Connecticut, Illinois, Delaware, Maryland, Massachusetts, Minnesota, Rhode Island, Vermont, Utah – Incentive	Vehicle purchase cash incentives have played an important part in increasing the EV market share over time. These financial incentives to help consumers with EV purchase range from \$4,000-\$10,000 for high impact ones, and mid ones at \$1,000-\$4,000 .
Corporate Average Fuel Economy (CAFE) Standards	USA – Standards	Set to improve the average fuel economy of cars and light trucks and reduce overall GHG emission . Established in 1975, the targets are periodically updated. The latest requires OEMs' fleet-wide average economy to reach 49 mpg by model year 2026.

Insights on more regulations and incentives for the region are detailed in the “Country Sustainability Impact” excel data sheet



Volkswagen Group

Overview

Volkswagen Group is looking to expand in-house **battery recycling capabilities** and has entered into a partnership with Umicore to achieve this. There are a range of sustainability initiatives being carried out across the Volkswagen group, including **closed loop aluminum recycling at Audi**. The closed loop recycling involves taking waste aluminum from sheet metal parts to be reused in new material.

Sustainability Strategy Assessment

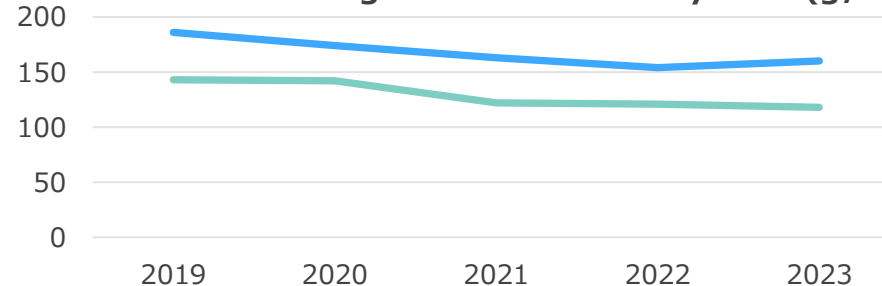
Volkswagen Group's strategies impact most elements of sustainability, resulting in a **high impact score**. Clearly defined and shared sustainability targets make Volkswagen Group's activities **highly transparent**.

	Strategic Commitment		
	Low	Med.	High
Impact			
Transparency			
Innovation			

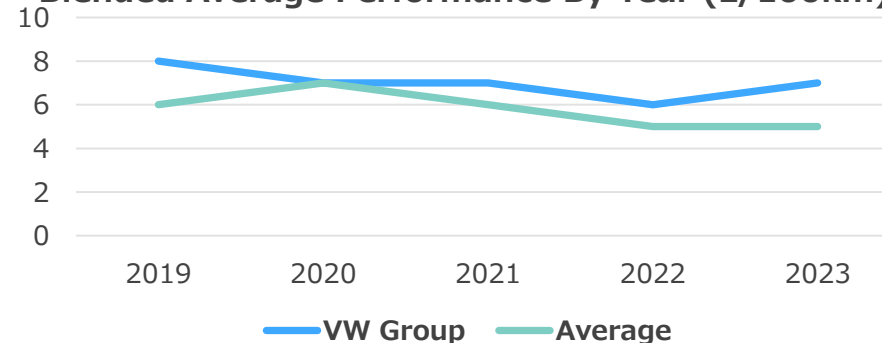
Top Sustainability Initiatives

- **Global** - Volkswagen Group is committed to reduce CO2 footprint of its entire trading network globally by at least 30% by 2030, 50% by 2040 and 75% by 2050 compared to 2020.
- **Global** - Tackling emissions by increasing model diversity and improving efficiency in early stages of development. Improvements in manufacturing with increasing adoption of renewable energy.
- **Global** - Increasing materials recycling to achieve circular economy and remanufacturing of components. Includes EV battery and compliance with new regulations through increased use of secondary and renewable materials.

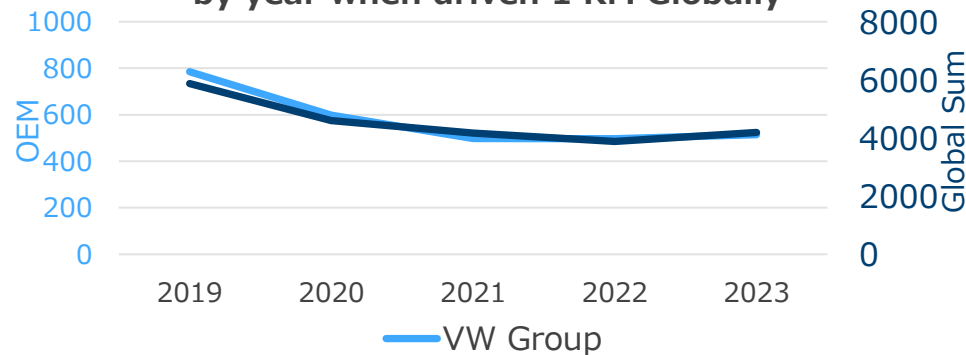
Global Blended Average CO2 Emissions By Year (g/km)



Blended Average Performance By Year (L/100km)



Total CO2 (in Tons) released from vehicles sold by year when driven 1 KM Globally





Explore our Sustainability data in our accompanying Data Deep Dive

This guide gives an overview of national strategies, the key activities being carried out by OEM groups and their planned timelines for achieving key targets. It is accompanied by an associated database with a more exhaustive data set.

How can the accompanying spreadsheet help you go deeper?

- View OEM by OEM offerings
- Identify announced targets

[Click for Sample](#) >

Sample includes example data to illustrate format only			225 Global - 2024					OEM Sustainability Timescale	
OEM Group	HQ Country	Total Global Sales Volume 2023	2023 % Of Global Sales with alternative fuel					EU Credits Expiring	US Credits Expiring
			Total Alternative Powertrain	Hybrid	PHEV	FCEV	BEV		
BYD	China	3,000,000	100%	0%	0%	0%	100%	5,500,000	0
GM	USA	5,900,000	28%	3%	1%	0%	24%	450,000	2,000,000
Ford	USA	4,200,000	30%	10%	10%	0%	10%	2,100,000	250,000
Stellantis	USA	6,000,000	42%	10%	12%	0%	20%	540,000	0
VW	Germany	8,200,000	60%	20%	10%	0%	30%	3,500,000	120,000



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