In collaboration
with Oliver Wyman

WORLD ECONOMIC FORUM

Nature Positive:
Role of the Automotive Sector
China Deep-dive

INSIGHT REPORT

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Images: Getty Images

Contents

Foreword

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Transition is always exciting, as it creates opportunities. To support the achievement of global climate goals, the transport system is undergoing a fundamental transformation in how it is fuelled and powered.

Electric vehicles and lithium-ion batteries are among the “new three” products significantly contributing to China’s export growth. China’s automotive sector is playing a championing role in global climate action and has made substantial progress in reducing environmental impact, improving water and material efficiency and scaling circularity to put green development into practice.

Yet we need to raise ambition and accelerate environmental action as an industry, thinking bigger than net zero to also include nature-positive goals.

In the global context of achieving a net-zero and nature-positive future, a more holistic transition presents even more opportunities. By systematically recognizing the automotive sector’s impacts and dependencies on nature and setting strategies accordingly, leading players in the sector can significantly enhance their global competitiveness.

Contemporary Amperex Technology Co., Limited (CATL) is committed to driving innovation in battery technology, integrating sustainability into every aspect of its operations – from design and production to product life cycle management – and collaborating with partners throughout the value chain to maximize positive environmental impact. By 2025, CATL aims to achieve carbon neutrality in its core operations and extend this to the entire battery supply chain by 2035. Additionally, CATL plans to increase the use of renewable energy to 50% by 2030 and implement over 500 energy-saving projects by 2025, reducing carbon emissions by at least 600,000 tons annually. Furthermore, we’re collaborating with suppliers to continue enhancing practices on waste treatment, monitoring and recycling of resources, and protecting soil and freshwater system.

Seizing opportunities in the global nature-positive transition won’t be easy, but with collaboration and partnership, value and positive impact can be created urgently and at scale. We call on our peers in China and global partners in the automotive sector to work together for our long-term prosperity and the vision of living in harmony with nature on our home planet.

Foreword

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We are faced with intertwined, multifaceted global challenges. These include immediate impacts such as record-breaking heatwaves, unprecedented floods in atypical regions and other extreme weather events significantly driven by climate change, as well as those rapidly evolving silent beasts exemplified by biodiversity loss and ecosystem collapse. Our window to reverse global nature loss is rapidly closing.

The philosophy of living in harmony with nature is deeply rooted in Chinese culture, reflected in ancient philosophies like Taoism and Confucianism and modernizing its culture integrated with ecological civilization. This enduring wisdom must be urgently awakened and translated into action.

The World Economic Forum, in collaboration with Oliver Wyman, has been working in the past two years to assess how environmental challenges materialize and impact sector activities and business actions. Together, we have developed the Nature Positive Transitions: Sector Report Series. This automotive report is the first regional deep-dive report within this series and adds country-specific perspectives to the findings in the global automotive report.

China remains imperative to the world economy and global supply chain. China's automotive sector is one of the leaders in the transition towards autonomous, electric, connected and shared mobility in this new era driven by the macro force of technological revolution. Actions towards a nature-positive transition could enhance the sector's sustainability and overall competitiveness while also facilitating resilience and new growth opportunities. The report entails Chinese business practices and potential opportunities from the automotive sector's nature-positive transition in China.

About the Nature Positive Transitions report series

Nature Positive: Role of the Automotive Sector – China Deep-dive is published by the World Economic Forum in collaboration with Oliver Wyman. It is part of the World Economic Forum's Nature Positive Transitions report series, which outlines the different pathways to halt and reverse nature loss by 2030 – the mission at the heart of the Global Biodiversity Framework.

The series consists of three transitions: business sectors, cities and financial institutions. These reports highlight the relevance of nature-related risks, identify the impacts and dependencies of the economy and society on nature, and provide guidelines for business, city and financial institution leaders on key actions to accelerate the nature-positive transition.

The Nature Positive Transitions report series builds on the New Nature Economy Report Series. For more information, please visit Nature Positive Transitions.

Sector reports:

- Nature Positive: Role of the Cement and Concrete Sector
- Nature Positive: Role of the Household and Personal Care Products Sector
- Nature Positive: Role of the Chemical Sector
- Nature Positive: Role of the Mining and Metals Sector
- Nature Positive: Role of the Automotive Sector
- Nature Positive: Role of the Offshore Wind Sector
- Nature Positive: Role of the Port Sector

Cities reports:

- Nature Positive: Guidelines for the Transition in Cities
- Nature Positive: Leaders' Insights for the Transition in Cities
- Nature Positive: Financing the Transition in Cities
- Nature Positive: Cities' Efforts to Advance the Transition – Durban

Finance reports:

- Financing the Nature-Positive Transition: Understanding the Role of Banks, Investors and Insurers

Executive summary

China's automotive sector leads globally in production and exports- it should likewise lead in a sectoral nature-positive transition.

In total, 65% of China's overall gross domestic product (GDP) is at risk due to nature loss. However, there is hope – China has committed to pursuing ecological civilization and green development. To achieve these goals and contribute to a nature-positive future, urgent action from businesses across all sectors in China is imperative.

The Chinese automotive industry is experiencing a profound transformation driven by technological advancements, policy support and a heightened focus on sustainability. China has emerged as the largest automotive manufacturing hub globally, leading in both production and exports. The electric vehicle (EV) market is experiencing rapid growth, with EV penetration in China projected to reach 90% by 2030. As the industry matures, Chinese companies are increasingly looking to expand globally, despite unfamiliar market dynamics and more stringent regulatory requirements. The industry's growth has substantial implications for global automotive markets and environmental sustainability.

The impacts and dependencies of the Chinese automotive sector on nature span the entire value chain. The industry heavily relies on key materials with a high dependency on imports, making efficiency and recycling crucial for a resilient value chain. Midstream and downstream activities, including materials processing, production of parts and use of vehicles, all contribute to the overall impact on nature.

This report delves into the automotive industry's impacts and dependencies on nature in China, how industrial activities amplify such impacts and how the sector in China has been addressing these challenges. Four major challenges have been identified:

- The industry's growth has heightened its impact and dependency on environmental assets and ecosystem services, particularly due to the intensified demand for critical minerals like lithium and nickel.
- Limited focus on land use assessment and protection poses risks. The industry's reliance on raw materials is pushing operations upstream, potentially leading to increased land use pressure due to intensified extraction activities.
- While EVs are an important part of cleaner transport, their production process is often carbon-intense. Decarbonization requires cross-industry collaboration and significant investment, including reducing the power grid's carbon intensity.
- Improved water stewardship and innovation are needed for water-saving and recycling technologies during the extraction and industrial processes, given that the industry's growth will increase water use.

By 2030, nature-positive transitions in China can unlock $1.9 trillion worth of annual business opportunities, accounting for close to 20% of the total global opportunities, with the automotive industry alone capturing $161 billion. These opportunities call for business actions and policy support to be realized. China's automotive industry, in particular, is positioned to lead this change through strategic actions and investments.

The report includes five priority actions and case studies for China's automotive sector to contribute to a nature-positive future: avoiding and reducing impacts from operations and materials, transforming product offerings, conserving and restoring nature, and driving cross-sector collaboration. Many of these actions have already been proven to be effective within the market.

Introduction

Given how dependent China's economy is on nature, urgent actions from policy-makers and the private sector are needed to halt and reverse nature loss.

of China's total GDP is at risk due to nature loss.

Globally (and within China specifically), society and the economy are deeply interlinked with the natural world. According to the 2022 Forum report, *Seizing Business Opportunities in China's Transition towards a Nature-positive Economy*, over half of global gross domestic product (GDP) and 65% of China's total GDP is at risk due to nature loss.

Tackling nature loss and achieving net-zero emissions are increasingly recognized as twin priorities globally, and nature action is gaining momentum alongside climate action. Nature-related considerations are being integrated into guidance and standards setting, financial institutions' strategies and the expectations of customers and employees.[1]

As the world's second-largest economy and a global manufacturing hub, China is witnessing evolving efforts around nature across societal and economic sectors.

This report is based on analysis presented in the *Nature Positive: Role of the Automotive Sector* insight report. It is highly recommended to review the global report before delving into this specific analysis of China's automotive sector.

Why China's economic sectors should act for nature

Business and biodiversity as a priority action in China's National Biodiversity Strategy and Action Plan 2023-2030

As the presidency of the 15th Conference of Parties (COP15) to the United Nations Convention on Biological Diversity (CBD), China is committed to leading the global implementation of the Kunming-Montreal Global Biodiversity Framework. China published its updated National Biodiversity Strategy and Action Plan (NBSAP) in January 2024, becoming the first developing country to do so post-COP15. The updated version prioritizes business and biodiversity, encouraging businesses to assess and manage nature-related impacts and dependencies and to disclose associated risks and opportunities.[2]

Biodiversity-related indicators in China's unifying sustainability reporting requirements

In April 2024, China's three major stock markets – the Shanghai Stock Exchange SSE), Shenzhen Stock Exchange (SZSE) and Beijing Stock Exchange (BSE) – officially released their guidelines on corporate sustainability reporting, which came into effect on 1 May 2024. These guidelines require the disclosure of material impacts on biodiversity.

In May 2024, China's Ministry of Finance began soliciting feedback on a draft set of guidelines for unifying corporate sustainability disclosures, with the goal of establishing a nationwide standard by 2030.[3]

These initiatives urge Chinese businesses, especially listed companies, to thoroughly assess the guidelines, rethink their business strategies and operations, and adopt a proactive approach to compliance. By setting strategies that integrate systematic consideration of nature's four realms – land, ocean, freshwater and atmosphere – with climate strategy, businesses can champion comprehensive environmental sustainability and lead a systematic transformation.

State-owned enterprises taking action for green and high-quality development

The 2023 white paper *China's Green Development in the New Era*[4] outlines strategies for reducing pollution and promoting circularity. In June 2024, the State-owned Assets Supervision and Administration Commission (SASAC) of the State Council of China issued directive input urging state-owned enterprises (SOEs) to prioritize social responsibilities. A key component of this guidance is the enhancement of ecologically and environmentally friendly actions under the broader theme of compliance and ethical operations.[5] These top-down directives are expected to bolster the sustainable development strategies and practices of SOEs, which contribute about one-third of China's total GDP[6] and significantly influence economic trends.

Significant business opportunities from implementing nature-positive transitions

China is proactively pursuing an innovation-driven development strategy.[7] Currently, about 39% of its total GDP is derived from secondary industries (which is higher than in most other developing countries).[8] Throughout the world, these sectors are generally resource- and energy-intensive, posing significant stress on nature. The impact of these sectors – such

as automotive and other manufacturing-focused industries – is often underestimated due to their interactions with nature being seen chiefly in their broader value chains. This may change as the global nature agenda rapidly evolves.

Seize the 20% of global business opportunities from nature-positive transitions in China

Nature-positive transitions present enormous opportunities for companies in China's automotive industry. The World Economic Forum's *Seizing Business Opportunities in China's Transition towards a Nature-positive Economy* report estimated that the nature-positive transition could unlock $1.9 trillion in annual business opportunities by 2030 in China (representing 20% of the global total).

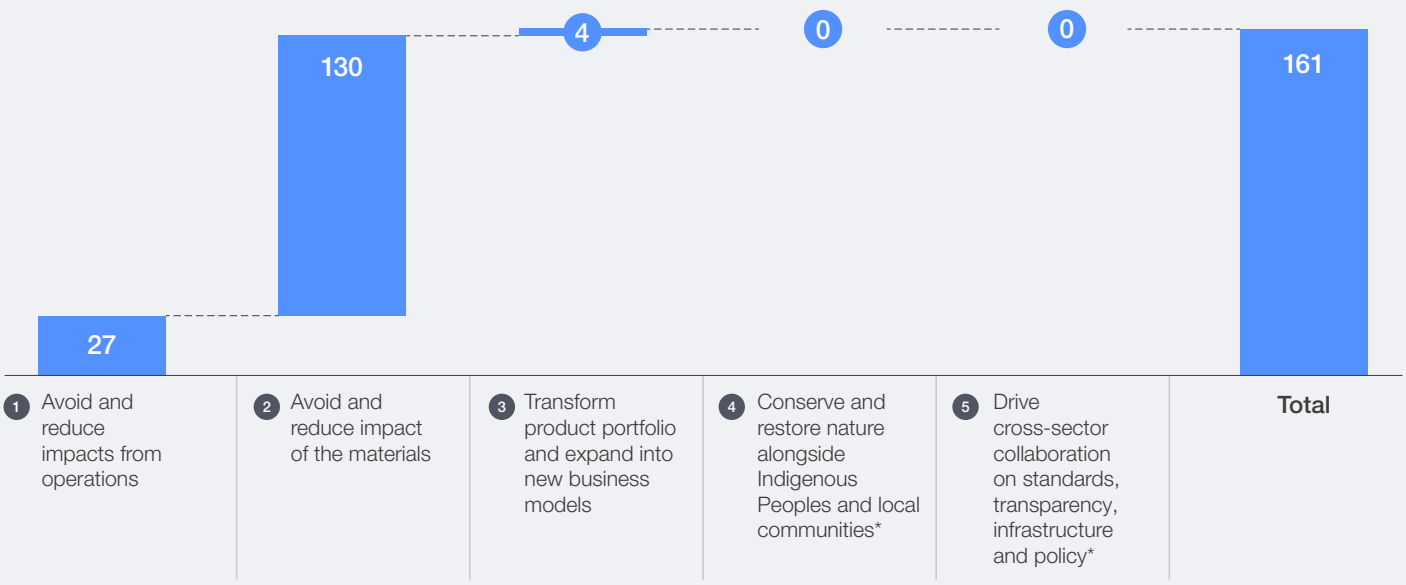
Estimates show that undertaking the five priority actions for the automotive sector, as identified in the *Nature Positive: Role of the Automotive Sector* report,[9] could unlock more than $160 billion of this amount in cost savings and revenue upside by 2030 in China.

Managing the impacts of raw materials and operations on nature is critical, potentially contributing $157 billion in business opportunities. The transition to a circular economy represents the majority – nearly $120 billion – of the total opportunity (see Figure 1 and Table 1).

Notably, the potential business opportunity could significantly exceed current estimates, which are limited by existing market statistics. For instance, service-oriented business model innovation had not yet emerged when the estimates were completed in 2022. Actions such as the conservation and restoration of nature and cross-sectoral collaboration, outlined in Figure 1, may present comparatively smaller direct business opportunities at present. With sustainability-oriented innovations (e.g. the voluntary carbon market, in which restoring nature generates transactable carbon credits) in development, however, this is certain to change.

To calculate the opportunity summarized in the waterfall in Figure 1, the following opportunities from the *Future of Nature and Business* report were identified as relevant (see Table 1). Further information on the calculation methodology can be found in the Appendix.

FIGURE 1 **Business opportunities for the automotive sector in China by 2030 ($, billion)**



*Additional opportunities exist not covered in this analysis due to limitations.

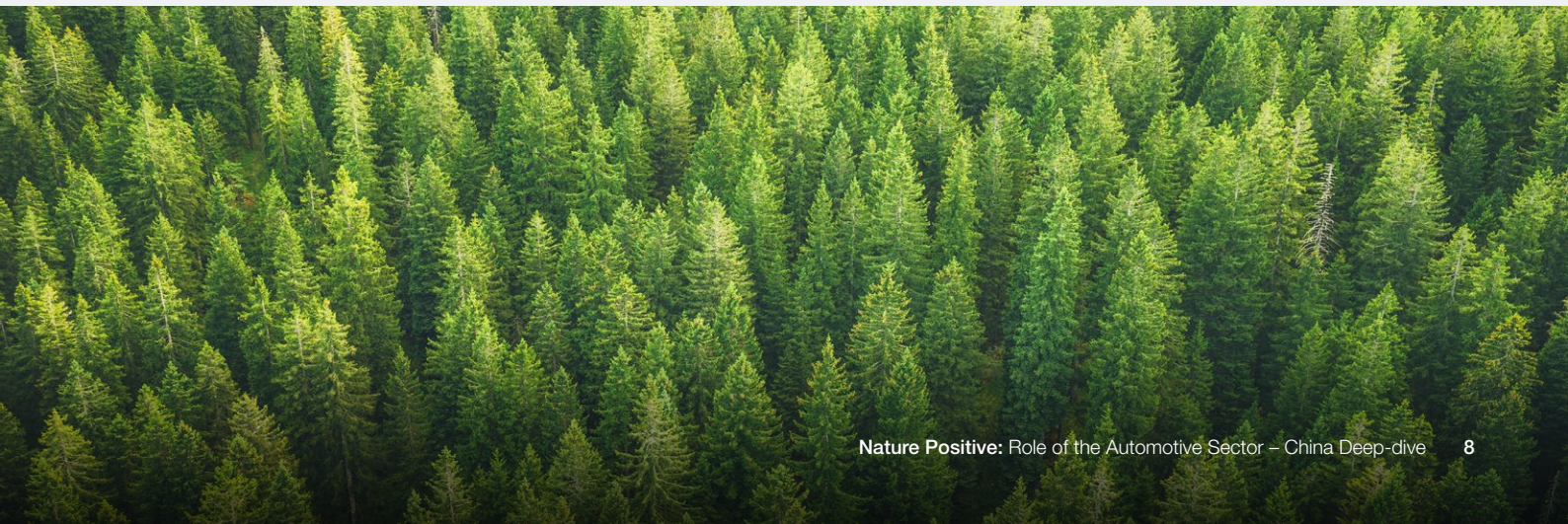


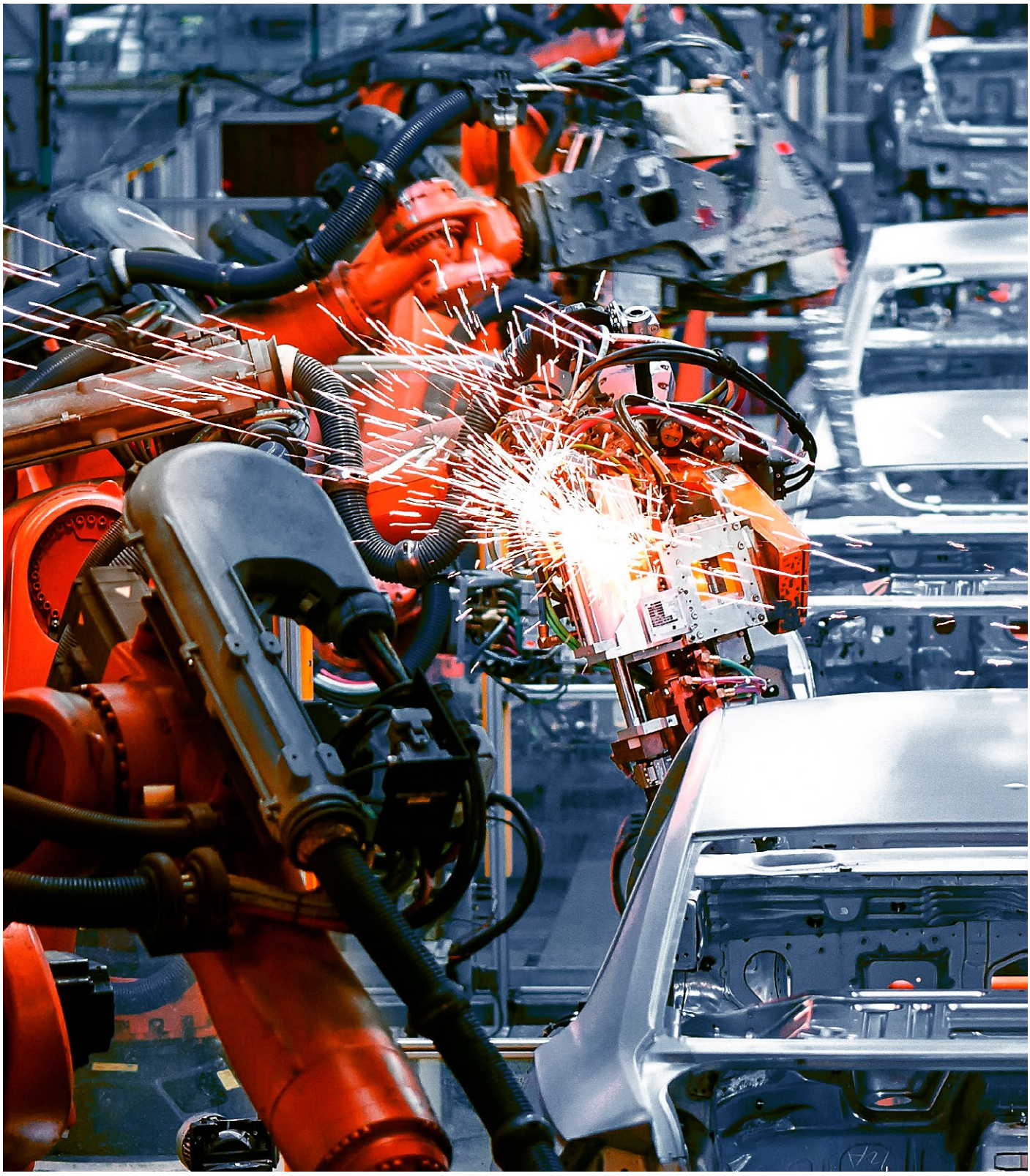
TABLE 1 | **Nature-positive business opportunities for the automotive sector in China**

Priority action	Business opportunity from *Seizing Business Opportunities in China's Transition Towards a Nature-positive Economy* report	Original size *Seizing Business Opportunities in China's Transition Towards a Nature-positive Economy* report ($ billion)	Adjustment factor to size and share of automotive sector	Opportunity size for automotive sector ($ billion)
1 Avoid and reduce impacts from operations	Wastewater reuse	9	Automotive sector share: 6.87%	0.62
	Expansion of renewables	157		10.78
	Energy efficiency – buildings	161		11.06
	Energy efficiency – non-energy intensive sectors*	66		4.51
2 Avoid and reduce impact of the materials	Technology in large scale farms	6		0.41
	Technology in smallholder farms	10		0.69
	Livestock intensification	2		0.14
	Reducing packaging waste	10		0.69
	Additive manufacturing	19		1.3
	Technology in energy and extractives supply chains	14		0.96
	End-use steel efficiency	87		5.97
	Circular economy – automotive	122	Total (excluding mining and metals sector) share: 98.30%	119.89
3 Transform product offering	Green long-range transport	52	Automotive sector share: 6.87%	3.57
	Fourth Industrial Revolution-enabled long-distance transport	10		0.69
4 Conserve and restore nature with Indigenous Peoples and local communities	Nature climate solutions	3		0.21
5 Drive cross-sector collaboration on standards, transparency, infrastructure and policy				

*Additional opportunity beyond *Future of Nature and Business* report analysis, scaled to China's share of global GDP.

1 The state of China's automotive sector today

China's automotive sector is leading the global energy transition, propelled by supportive policies and cutting-edge technologies.

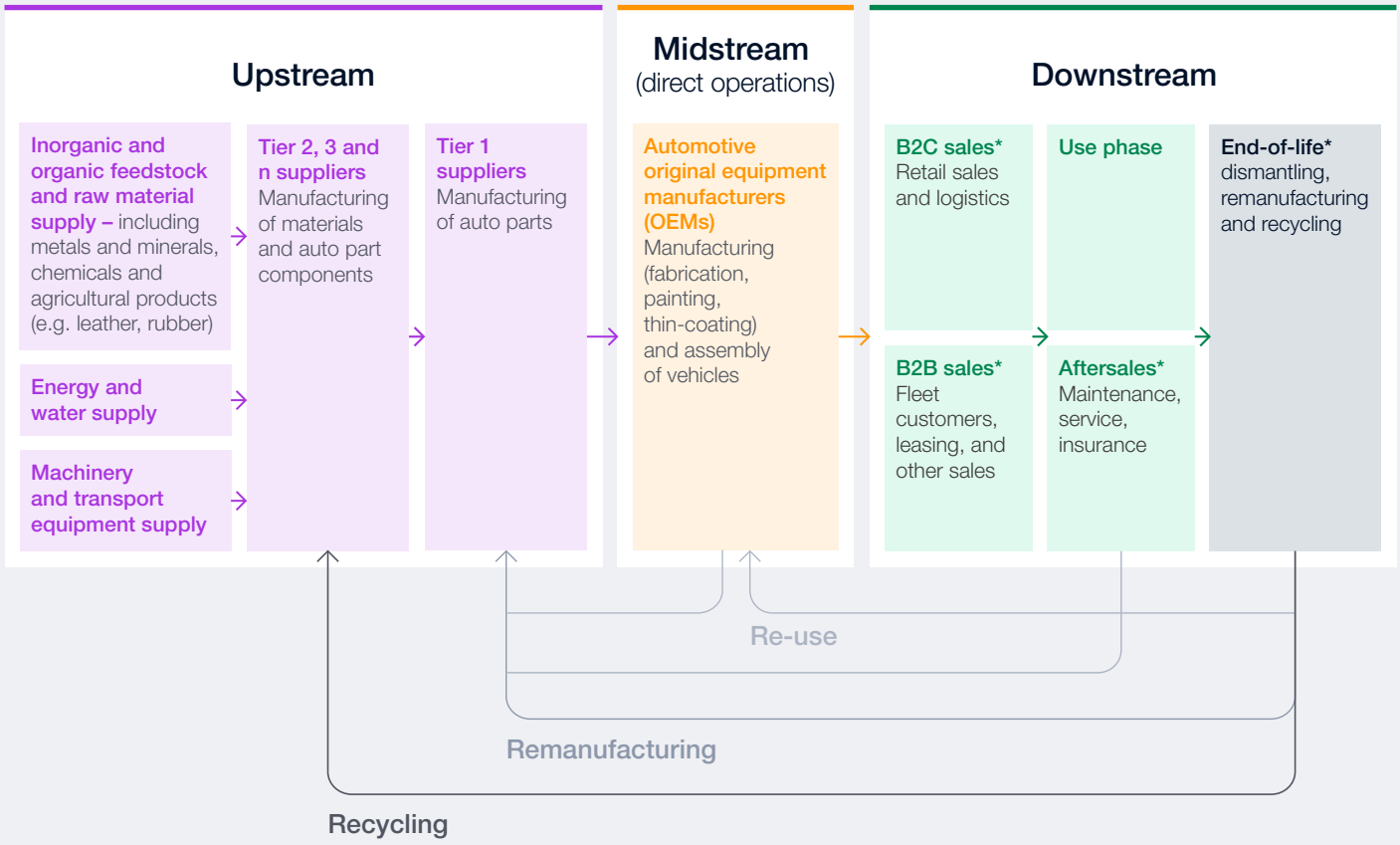


China's automotive sector has grown rapidly, especially over the last few decades. In 2012, China became the largest automotive market, and it continued to grow at an average of 15% each year until 2019.[10] In 2023, China became the world's largest automotive exporter.[11]

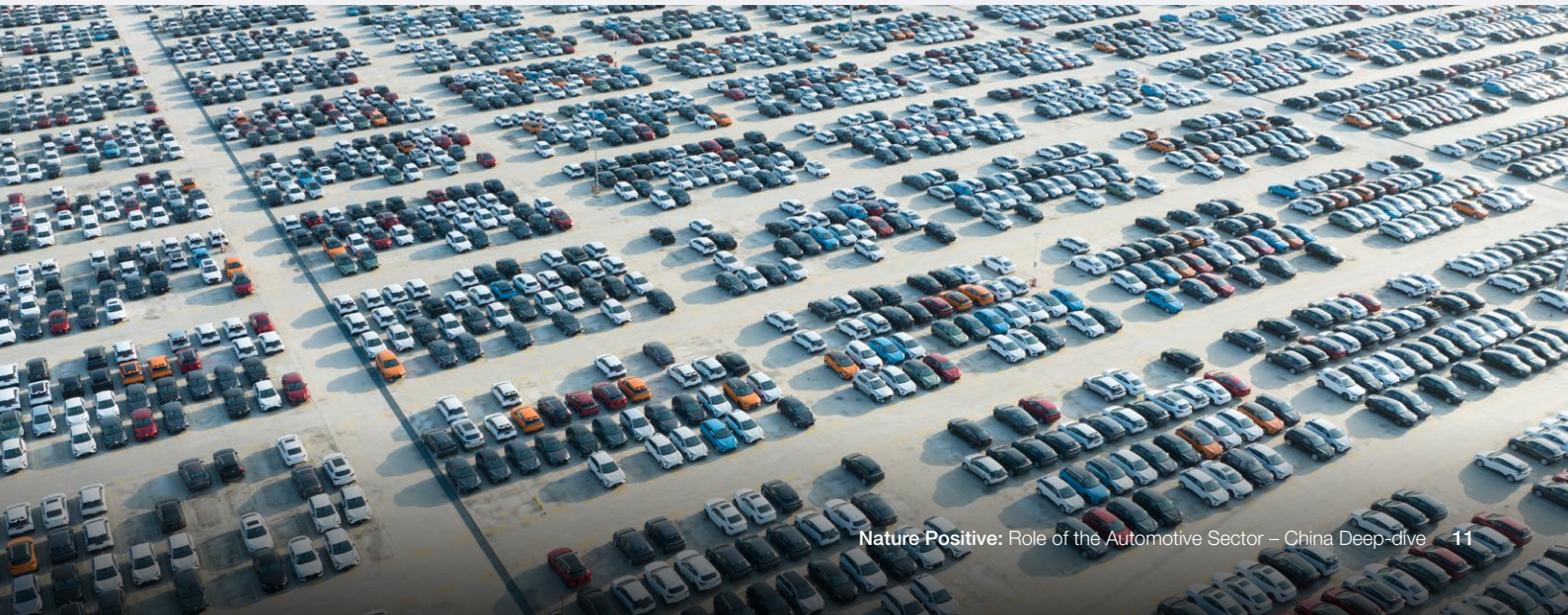
As highlighted in the global report on the automotive sector, the sector depends on environmental assets and ecosystem services to function and grow across its entire value chain, creating significant risk, given the complexity of global supply chains. Accounting for around 35% of global automotive production and close to 40% of global automotive sales, China's automotive industry is uniquely positioned to spearhead the global transformation of the sector, mitigate nature risk and contribute to nature-positive goals.

This report encompasses the entire automotive industry value chain, in alignment with the global report. The definition of the automotive sector can be referred to in Box 1 (page 15) of the global report.

FIGURE 2 **Illustrative automotive value chain**



*Sales and aftersales may be conducted by OEMs (midstream) or by independent retailers/service providers (downstream); end-of-life is not covered in the analysis of impacts and dependencies



1.1 The global significance of China's automotive sector

Vehicle ownership in China reached 336 million in 2023, representing nearly 20% of the global total.

China plays a pivotal role in the global automotive industry. It not only drives one-fifth of global car ownership, but it is also in a leading position in the development of electric vehicles (EVs), which contributes to the reduction of air pollution and the energy transition. This rapid growth, however, has also significantly increased the demand for natural resources, heightening dependencies on nature. Therefore, promoting a nature-positive transition in China's automotive industry will help to build its long-term resilience.

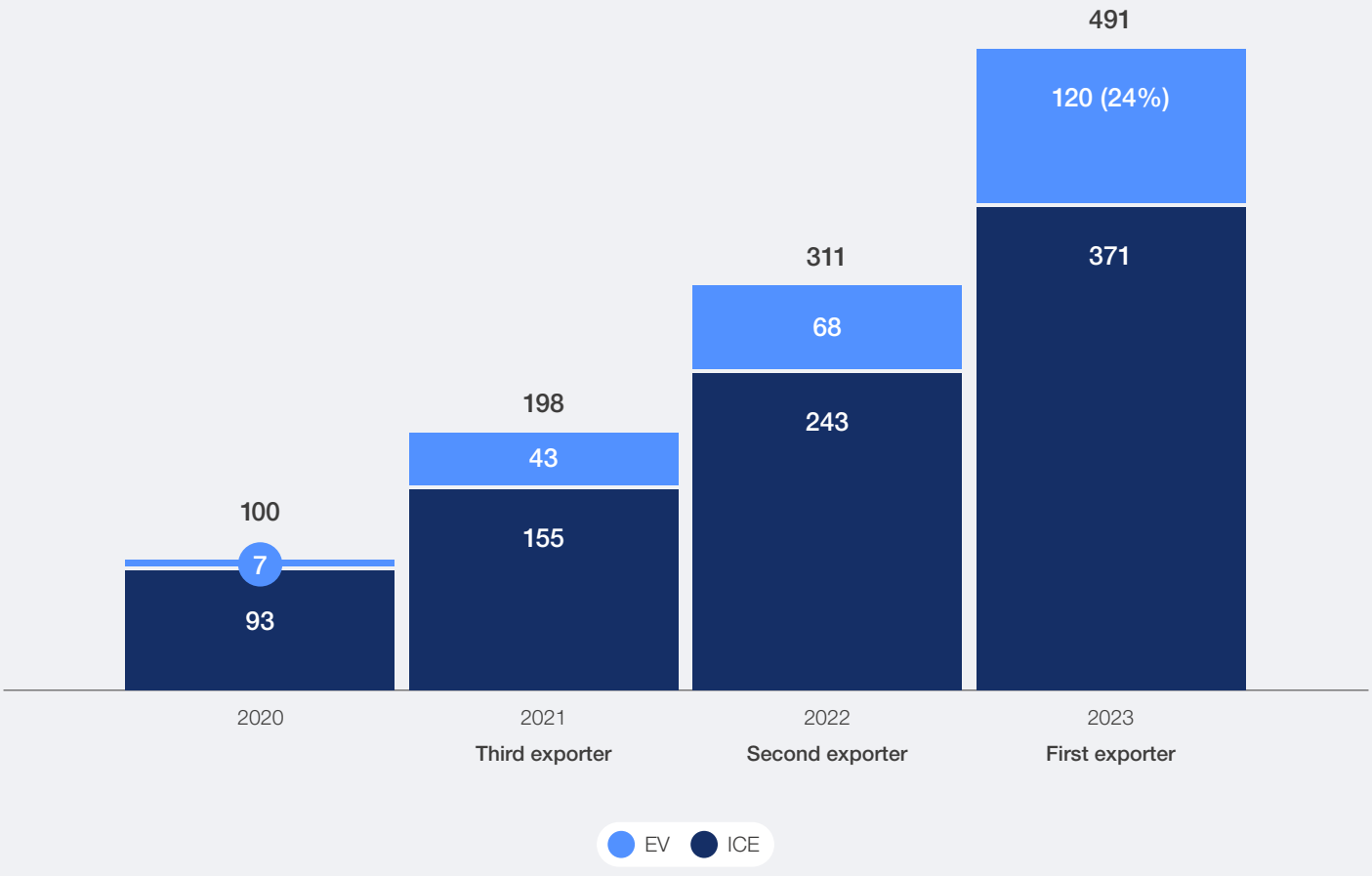
The largest automotive manufacturing hub

Currently, the automotive industry in China is globally significant in terms of vehicle ownership, production, sales and export volumes.[12] For example:

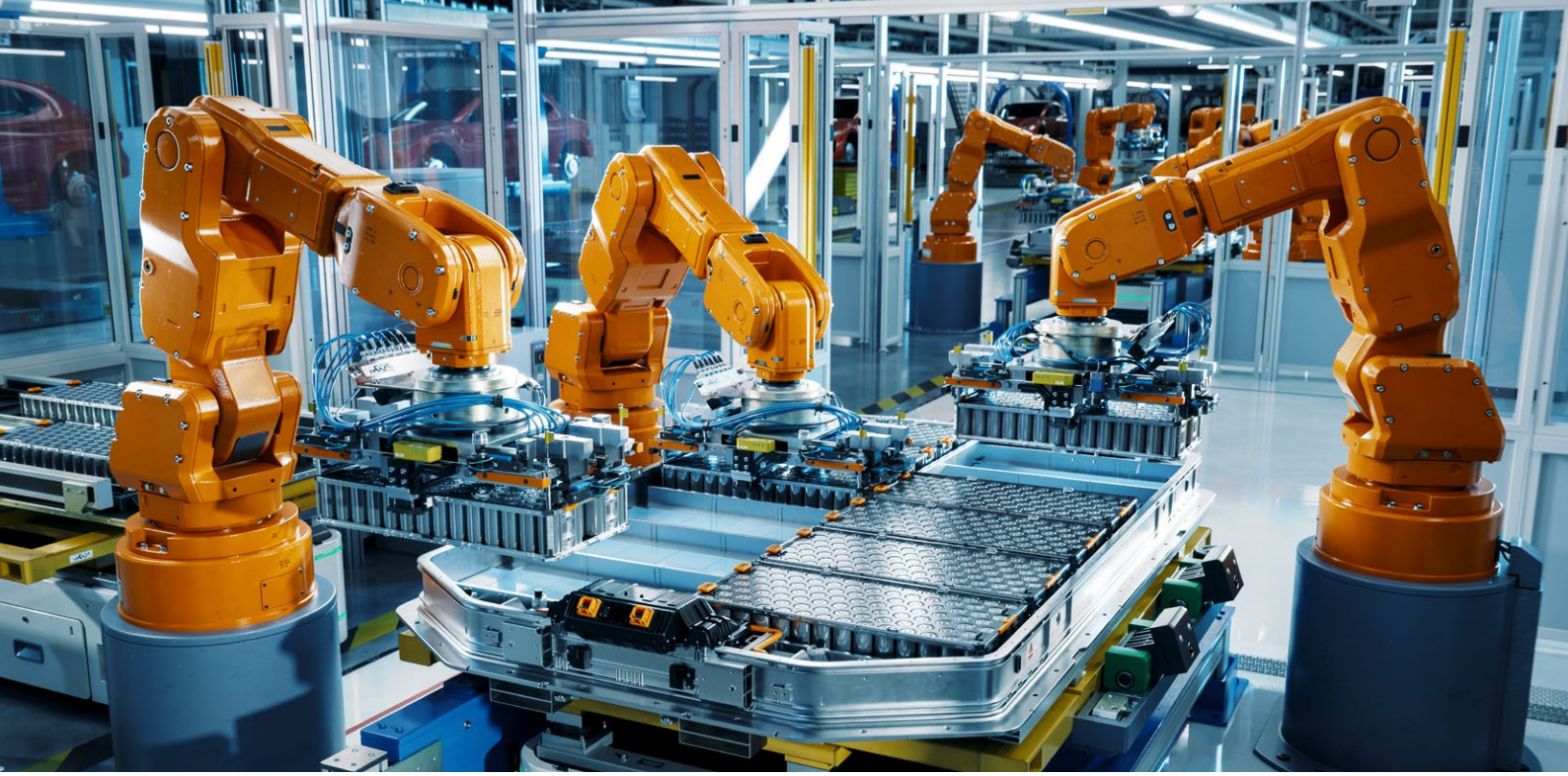
1. With rising consumer spending and improved road infrastructure in China, the adoption of passenger and commercial vehicles has been steadily increasing. Vehicle ownership in China reached 336 million in 2023, representing nearly 20% of the global total.
2. China's automobile production and sales have increased progressively and surpassed Japan's for the first time, making China the world's largest automotive exporter in 2023. The total number of overseas sales reached 4.91 million, of which 24% were EVs[13] (up from 7% in 2020).[14]
3. China is a key production hub for car parts and components, such as interior and exterior trim, seats and wheels, for leading automotive manufacturers globally. By 2023, China had over 18,000 auto parts suppliers, far ahead of other countries.[15]

FIGURE 3 **China became the biggest car exporter in 2023**

China automobile export volume
10,000 units, 2020-2023



Source: CPCA; China Automotives Industry Association



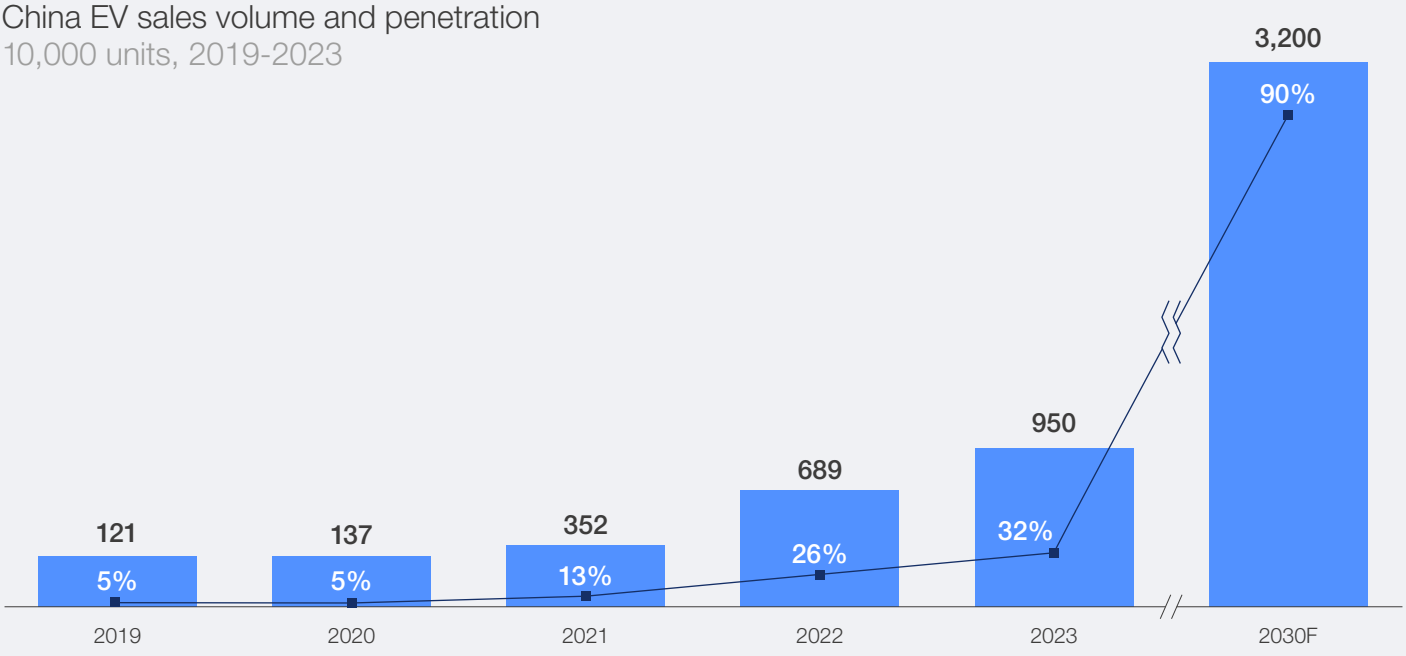
Emerging EV players leading the charge

China's automotive sector has rapidly caught up with global standards and is now a global leader, particularly in the production and manufacturing of EVs. China sees EV manufacturing as a strategic emerging industry and EV adoption as critical to reducing air pollution and supporting China's energy transition. Together with its related sectors, the EV industry has received increased investments since the 2009 launch of key policies incentivizing automotive industry development in China. Such policies include the notice given by the Ministry of Finance and the Ministry of Science and Technology on issuing subsidies for energy savings and new energy vehicles.[16]

China's EV market share has consistently exceeded expectations. For example, EV penetration rose from 5% in 2019 to 32% in 2023.[17] By 2030, EVs are expected to make up 90% of vehicle sales.[18]

FIGURE 4 **China's EV market maintains rapid growth**

China EV sales volume and penetration
10,000 units, 2019-2023



Source: CPCA; Qing Wang

China is expected to account for 70% of global battery production capacity from now until 2030.

- As the industry scales, a competitive, large-scale network of companies has emerged alongside vehicle manufacturers (including those in battery production, materials manufacturing and recycling). Research shows that China has established a leading position in the global market share, and the operating quality of power batteries and other major automotive parts industries in China are growing stronger.[19]

- Local automotive brands have become the new market favourites, with several Chinese EV brands now among the top 10 for retail sales in China,[20] a ranking once dominated by European and American brands. The rise of Chinese EV manufacturers has disrupted automotive industry competitiveness and influenced the rising trend of automotive technology development.

Rising demand for key raw materials

The strategic prioritization of developing new energy vehicles will significantly boost the high-quality development of the industry in China till 2035.[21]

While China produces three-quarters of all lithium-ion batteries, the majority of key minerals are mined in other resource-rich countries such as Australia, Chile and the Democratic Republic of the Congo.[22] China's EV industry will still depend on the global supply of several key raw materials to thrive:

- The demand for **key minerals for batteries** continues to rise. China dominates the global market of processing operations for the majority of critical minerals such as lithium (55%), cobalt (65%) and nickel (35%). China is expected to account for 70% of global battery production capacity from now until 2030.[23]

- The automotive industry is currently the third largest consumer of **steel**. Steel-related products make up about 50-60% of a vehicle's total weight.[24] In 2023, the transport sector (including light-duty vehicles, trucks and buses, auto parts, etc.) alone in China consumed 82 million tonnes of steel, and this may increase due to EV industry expansion.[25]

- **Aluminium** alloy is currently one of the best lightweight materials with improved energy efficiency and vehicle performance, which has led to significant demand from the automotive industry. The Ministry of Industry and Information Technology's (MIIT's) *Energy-Saving and New Energy Vehicle Technology Roadmap 2.0* set targets for aluminium use per vehicle in China – specifically, 250 kilograms (kg) per vehicle by 2025 and 350 kg per vehicle by 2030.[26] As the aluminium use per vehicle in China (see Table 2) remains well below these targets, the demand is estimated to grow.

Given the high consumption of raw materials, which could potentially cause significant impacts on nature and invite risks for companies in the value chain, relying only on mineral extraction is no longer optimal. Recycled materials are gradually becoming a significant source of raw materials supply. Research found that recycling critical metals would be an effective way to avoid a decrease in the supply of critical metals in China. The economic benefits could also be significant.[27]

TABLE 2 **China's aluminium use per vehicle (2020)**

Energy type	Aluminium use per vehicle (kg/vehicle)
Passenger car	138.6
Battery EV	157.9
Hybrid EV	198.1

Source: International Aluminium Institute (IAI). (n.d.). *Assessment of Aluminium Usage in China's Automobile Industry 2016-2030.*

1.2 Sustainability-powered transition of China's automotive sector

The amount of domestic unit EV sales in 2022 was 17 times that of the amount of sales in 2016.

The EV industry has powered the rapid development of China's automotive sector in the past few decades. The amount of domestic unit EV sales in 2022 was 17 times that of the amount of sales in 2016. Now, the domestic market is stabilizing. With EV unit sales from 2024 to 2029 potentially moderated to 2% growth,[28] "going global" has become a key focus for China's automotive industry.

Policy-driven green transition

To promote a green transition and the sustainable development of the automotive industry, the Chinese government has launched and continuously adjusted numerous industrial development policies. The focus of the EV sector in China has shifted from policy-driven to market-driven growth. Key policies include industry development planning and guidance, emissions standards, the phase-out of high-emission vehicles and improvement of energy replenishment infrastructure.

Promote EV industry

Since 2012, when the State Council released a document designating new energy vehicles (NEVs) as the main focus for automotive industry development, numerous documents have been released to clarify industry development plans, promote industrial application and improve the ecosystem:

- The State Council 2012 *Energy-Saving and New Energy Vehicle Industry Development Plan (2012-2020)* initially designated NEVs as the main focus for the development of the automotive industry in China.
- The General Office of the State Council 2014 *Guiding Opinions on Accelerating the Promotion and Application of New Energy Vehicles* aimed to accelerate the adoption of NEVs and promote the transformation of the automotive industry.
- The General Office of the State Council 2020 *New Energy Vehicle Industry Development Plan (2021-2035)* established a market-driven industry development orientation and encouraged technological and business model innovation.

To promote NEV industries development, China began offering purchase subsidies in 2009.[29] Over time, subsidy thresholds have risen multiple times, while financial subsidies for EVs officially ended in 2022. Meanwhile, the purchase tax reduction was phased out in accordance with a planned schedule.[30] With these supporting policies being phased out, the EV industry needs to explore other engines for continued growth.

Phase out high-emission vehicles

To limit air pollutants and greenhouse gas (GHG) emissions, China released the Stage 6 Limits and Measurement Methods for Emissions from light-duty

vehicles[31] and heavy-duty vehicles[32] and has fully enforced the new emissions standards across the country since July 2023.[33] Any new production, import or sale of vehicles must meet these standards.

To promote the phase-out of high-emission vehicles for cleaner air, China implemented "trade-in" subsidy programmes. For example, the Shanghai municipal government offers a one-time subsidy for consumers scrapping or transferring vehicles and purchasing low emissions (Stage 6) fuel vehicles. Additionally, a subsidy is offered for those who scrap or transfer their vehicles and purchase EVs. Scrapped vehicles are then recycled for material reuse.[34]

Build a recycling system

To address the environmental impact of solid waste generated from end-of-life vehicles and parts, and to maximize residual value, China introduced the Pilot Implementation Plan for Extended Producer Responsibility of Automotive Products in 2021 (see Box 1). This plan included pilot schemes (such as the establishment of a recycling system, comprehensive resource use and the implementation of a green supply chain). Participants of the pilot schemes were designated in 2022.

BOX 1

China's extended producer responsibility system – impacts and outlook

To accelerate the advancement of green and low-carbon development, China introduced the extended producer responsibility (EPR) system in 2016, mandating that producers assume responsibility for waste recycling.[35]

In 2021, the Ministry of Industry and Information Technology (MIIT), the Ministry of Science and Technology, the Ministry of Finance and the Ministry of Commerce jointly issued the *Notice on the Issuance of the Pilot Implementation Plan for the Extension of Producer Responsibility for Automotive Products*, setting an expectation of 95% recyclability of vehicles by 2023.[36]

Following the momentum in 2022, the four key ministries announced the list of pilot enterprises with EPR for automotive products, with 11 Chinese automotive companies selected to test and exemplify circularity in production and operations.[37] Many of these companies set significant targets – for example, Geely Auto aims to achieve 75% of resource reuse, and First Automotive Works (FAW) aims to improve to 76% by August of 2023.[38]

To build sector capacity, relevant government departments have taken measures such as issuing technical guidance and creating information platforms.[39] Notably, power battery enterprises emerged as a primary focal point within the EPR system. In August 2024, the MIIT issued draft industry standards on the comprehensive use of pre-used NEV batteries for public consultation, including specific requirements for recycling metals. For example, it specified that the recycling rate should be at least 98% for copper and aluminium, at least 90% for lithium during the smelting process and at least 98% for nickel, cobalt and manganese.[40]

By 2030, there will be more than 26.3 million passenger vehicles[41] and 708,000 tonnes of power batteries[42] retired in China. Enhancing the sector's recycling capacity is critical to ensuring its sustainability and creating supplementary material supply.

Enhance charging infrastructure

Energy replenishment infrastructure is crucial for the EV industry's development. To improve the charging infrastructure system,[43] China has issued several documents since 2022 (including the *Implementation Opinions on Further Enhancing the Service Capability of Electric Vehicle Charging Infrastructure* and the *Guiding Opinions on Further Building a High-Quality Charging Infrastructure System*) to improve the supporting environment for energy replenishment infrastructure. As a result, China witnessed rapid development, contributing almost 90% of the global growth in fast chargers in 2022 and rising to the forefront of battery swapping.[44] Some other key initiatives were launched with the following aims:

– **Promote new technologies:** The *New Energy Vehicle Industry Development Plan (2021-2035)* advocates for new technologies and applications, including EV integration with the power grid. The 2023 *Implementation Opinions on Strengthening the Interaction between New Energy Vehicles and the Power Grid* aims to establish a preliminary vehicle-to-grid interaction technology standard system by 2025 and achieve large-scale application by 2030.

– **Develop rural charging infrastructure:** In 2023, the National Development and Reform Commission, along with other agencies, issued the *Implementation Opinions on Accelerating the Construction of Charging Infrastructure to Promote New Energy Vehicles in Rural Areas and Support Rural Revitalization*. This initiative focuses on deploying charging stations in rural areas and enhancing the planning and construction of charging and battery-swapping facilities in key villages and towns, thereby expanding EV applicability and use.

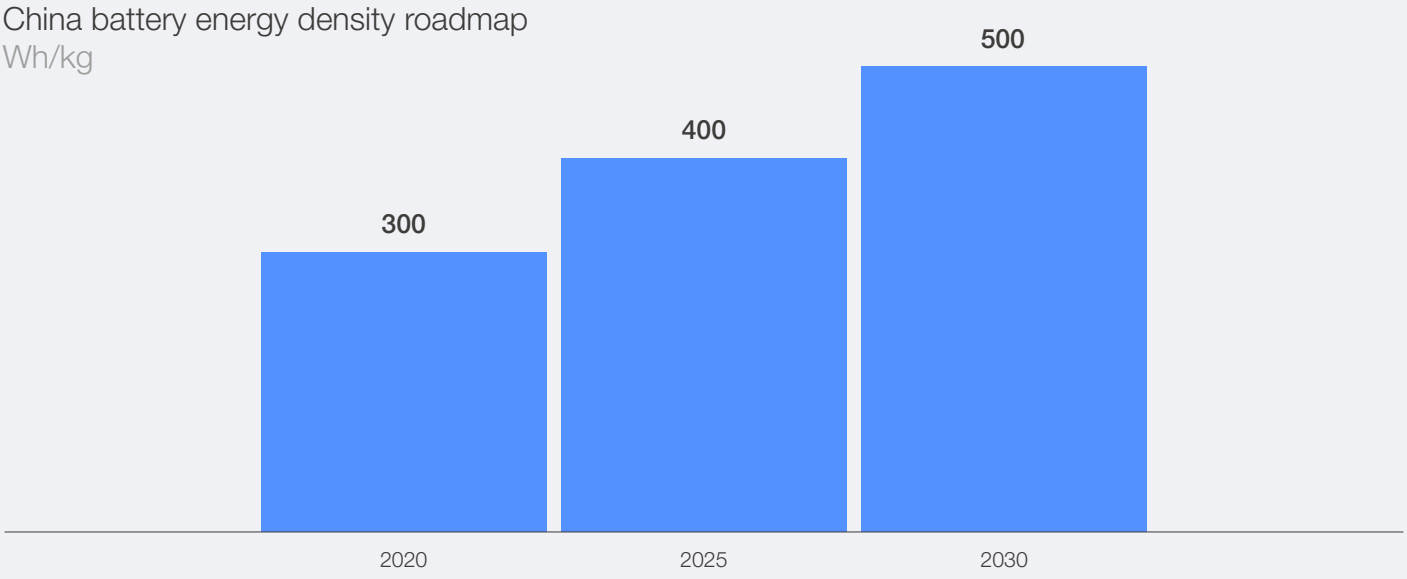
"By 2030, there will be more than 26.3 million passenger vehicles and 708,000 tonnes of power batteries retired in China.

Industry growth driven by technological development

China is gradually enhancing its international competitive advantage in EVs, largely due to a mature industrial supply chain, market scale and competition.

Key technological approaches, such as improving battery energy density, are expected to lead to breakthroughs in China. The energy density of the lithium ternary battery has exceeded 300 watt-hours per kilogram (Wh/kg), subsequently increasing the cruising range.[45] Solid-state batteries are also anticipated to provide more efficient energy for EVs, with leading companies advancing progress on all-solid-state batteries,[46] and some mass-producing semi-solid-state batteries.

FIGURE 5 **China's battery energy density development**[47]



Source: Ministry of Industry and Information Technology of the People's Republic of China.

Improvements in battery efficiency and optimizations in cost management are further reducing EV prices. In 2023 alone, the price of power lithium battery cells in China dropped by more than 40%.[48] Alongside cost reductions, China's EV industry continues to advance technologically, particularly in autonomous driving, connectivity via mobile internet, electrification and shared mobility trends (ACES trends).[49]

While these emerging technologies can reduce price and drive market expansion, they may also increase the consumption of key materials and cause nature loss if not managed well. It is crucial for the sector to address environmental impacts and contribute sustainability to evolving technologies from the outset.

> In 2023 alone, the price of power lithium battery cells in China dropped by more than 40%.

Chinese players going global

The demand for EVs is rapidly growing overseas, prompting Chinese automakers to accelerate their investments in key international markets. Since 2017, companies such as Build Your Dreams (BYD), Geely, NIO, SAIC Motor and Great Wall Motors have been investing in overseas manufacturing plants. Leading supply chain companies are also expanding their reach globally, such as Great Wall Motors in Thailand,[50] NIO in Hungary,[51] Contemporary Amperex Technology Co., Limited (CATL) in Germany[52] and BYD in Brazil.[53]

Chinese companies going global also face challenges, such as managing environmental impacts under overseas regulations. Regional legislation – such as the Inflation Reduction Act (IRA), the European Critical Raw Materials Act, the EU Battery Regulation and the Carbon Border Adjustment Mechanism (CBAM) – supports green industries locally but also imposes restrictions on foreign players and imported materials or goods, including automobiles or parts manufactured in China. This may encourage more Chinese automakers to establish operations in the region rather than relying on exports.

2 The Chinese automotive industry's impact and dependency on nature

China's dynamic automotive sector relies on natural resources; without transitioning action, increasing nature-related risks could threaten its growth.

As comprehensively analysed in the global report, the automotive sector and its value chain heavily depend on a number of environmental assets and ecosystem services, including:

- **Freshwater supply and rainfall regulation**
- **Cultivated biological resources**
- **Climate regulation, soil and sediment retention**
- **Flood protection**
- **Metal, mineral and energy resources**

For instance, freshwater is essential for cooling and cleaning processes. High-impact commodities such as metals, rubber, leather, pulp and paper for packaging, and energy represent critical demands of this sector, while their production can significantly impact land.[54] Therefore, nature loss caused by impact drivers like water use and land-use change greatly affects the industry's production and business stability.

Aligned with the global report and based on ENCORE's sector-specific impacts and Science Based Targets Network (SBTN's) sectoral materiality tools, this report covers the automotive sector's impact on nature across its entire value chain, as illustrated in Table 3. Company-specific impacts and dependencies vary by business model and position within the value chain. For a detailed overview of the assessment process, please refer to Box 2 and the global report, particularly Box 2 and Figure 9.

TABLE 3 **Top four drivers of nature loss in the value chain of the automotive sector**

	Upstream	Midstream (direct operations)	Downstream
Pollution	✓	✓*	✓*
Water use	✓	✓*	
Land-use change and ecosystem disturbance	✓		
GHG emissions	✓		✓*

Pressure materiality rating (ENCORE): High Medium

*Manually adjusted based on expert feedback. **Note:** See methodology in the Appendix. While GHG emissions are one of the highest materiality drivers of nature loss for the automotive sector, this is included last in this document given the automotive sector's net-zero transition has been covered extensively elsewhere.

By analysing the key upstream raw materials of the automotive industry, China's industrial activity and the automotive sector's impacts on nature, this report has identified the following findings, with a more detailed analysis:

Finding 1: A dynamic automotive industry requires more from nature.

The rapid expansion of the automotive industry and international trade has significantly increased activity in China's automotive sector, heightening its impact and dependency on environmental assets and ecosystem services. The substantial demand for critical minerals like lithium and nickel for batteries has further intensified upstream mining activities.

Finding 2: Limited focus on land-use-related materiality assessment and protection poses risks.

From publicly available information, there has been minimal assessment of land-use change and ecosystem disturbance among Chinese automotive industry players. The industry's dependence on raw materials, including essential minerals, is pushing automakers and other market participants to extend their operations from midstream and downstream to upstream. Their experience, however, is mainly in production management, with relatively limited experience in evaluation and governance methods across the value chain. This could potentially lead to further land use pressure and respective risks from limited assessment and action to address this impact on nature.

With the growing demand for EVs, sourcing key upstream raw materials has become essential for supply chain integration and cost and risk management.

Finding 3: Decarbonization of EVs requires collaboration.

While the EV sector promotes less carbon-intensive, cleaner transport in China, the increase in EV production also leads to higher emissions during manufacturing, which should not be overlooked. Achieving decarbonization goals for automotive raw materials will necessitate cross-industry collaboration and significant capital investment (which should be prioritized). Additionally, the carbon intensity of the power grid greatly influences the overall GHG emissions throughout the vehicle's life cycle.

Finding 4: Improved water stewardship and innovation are needed

The growth of the automotive industry will continue to increase industrial water use. It is crucial to consistently promote the adoption of water-saving and water-recycling technologies, especially in processes like cooling and cleaning during power generation and chemical cracking. This is particularly important for existing manufacturing operations in northern and western China, where projected water stress is much higher, making redistribution and north-to-south migration conceivable.[55]

2.1 Level of industrial activity in China

In China, industrial activities are concentrated in midstream and downstream segments such as components production, vehicle manufacturing and car sales and use (see Table 4). With the growing demand for EVs, sourcing key upstream raw materials has become essential for supply chain integration and cost and risk management.

TABLE 4 **Evaluation based on the comprehensive activity level of raw material industries.**

Material archetypes	Material name	Activity level	Global share consumed by China's automotive industry	China's share of global activity in each value chain segment		
				Upstream	Midstream	Downstream
Iron and steel	Steel material	High	12%	10.3%	53.9%	50.8%
Aluminium	Aluminium material	High	10%	23.3%	58.8%	57.5%
Power battery	Lithium, nickel	Very high	92%	18.3% 4.4%	73.8%	59.4%
Tyres	Rubber	High	70%	6.1%	54.0%	56.0%
Interior	Plastics, leather, textiles, etc.	Mid	Notes[56]	/	43.0%	31.0%

Notes: The upstream, midstream and downstream data is accounted for by China's raw material production, intermediate product production and end consumption, and, in the case of steel, iron ore production, crude steel production and steel consumption. Activity level: The percentage of global production and consumption of a material that occurs in China – higher proportions indicate greater industrial activity in China's material industry chain; Upstream activity: The percentage of a material's main components produced in China – for example, China mines 10.3% of the world's iron ore for steel production; Midstream activity: The percentage of the material produced in China – for example, China accounts for 73.8% of global battery production; Downstream activity: The percentage of the material consumed in China – for example, China consumes over 56% of the world's tyres.

Source: The National Bureau of Statistics of China; International Aluminium Institute (IAI); World Steel; EVtank; Energy Institute; China Association of Automobile Manufacturers.

The upstream automotive value chain, involving raw material extraction and production, significantly impacts nature. This report focuses on high-impact commodities identified by SBTN, including critical minerals for batteries (lithium, cobalt, nickel) steel, aluminium, rubber, leather and plastics.

Industries related to these key materials are highly active in China, with over half of global midstream and downstream activities (production and consumption) occurring in China. Upstream activities are less active, however, with only 23% of total bauxite mining and lower than 20% of mining for other materials occurring in China, indicating a high dependence on imports.

Notably, the demand for battery materials like lithium and nickel, largely for the automotive sector, has increased overseas mining activities. Investments and operational activities in mining these critical minerals and cultivating rubber for tyres should be based on comprehensive assessments on nature.'

2.2 Identify opportunity to address impact on nature

As discussed in the global report, the automotive sector causes impacts on nature through four impact drivers: **water use, land-use change and ecosystem disturbance, pollution** and **GHG emissions.**

These impact drivers are not new to China. The Chinese government has implemented relatively strict regulations addressing environmental issues. From 2013 to 2016, the Chinese government issued action plans for prevention and control of air pollution, water pollution and soil pollution. After issuing the "1+N" policy framework in 2023, which aimed to achieve the goal of peaking GHG emissions before 2030 and achieving carbon neutrality before 2060,[57] key industrial sectors, such as energy and transport, have undertaken numerous measures to reduce GHG emissions. Recent studies underscore notable progress in China's endeavour to mitigate GHG emissions, reduce air pollutants and conserve water resources.[58]

Reversing nature loss will require a greater degree of collective effort, however.

This section analyses economy-wide goals and progress observed in publicly available information and identifies opportunities for the automotive sector in China to support national and global goals on nature.

Water use

China faces severe challenges around water. Globally, the issue is often overlooked. The 2022 Baker Institute for Public Policy report *How China's Water Challenges Could Lead to a Global Food and Supply Chain Crisis* states that China's economy consumes 14 million barrels of crude oil per day, while its daily average water consumption is equivalent to 10 billion barrels on average, a quantity 700 times larger.[59]

The water use pressure of China's automotive sector is most significant in the upstream extraction of raw materials. For example, the steel industry, a major material supplier, accounts for approximately 9% of China's total industrial water consumption.[60]

China is a leading producer and consumer in the global automotive market, and a high percentage of its key materials are produced and consumed in-country. Given the significant capacity of parts and vehicle manufacturing, water consumption in production requires more attention from industry players.

China has established standards for water consumption, reuse rates and emissions in raw materials production (such as steel and nonferrous metals).[61] Currently, regulators aim to reduce water use per unit of economic output by 16% by 2025 compared to 2020 levels, with an additional target of achieving a national industrial water reuse rate of around 94% for industrial enterprises above a designated size.[62]

Driven by these economy-wide goals, sectors involved in materials, parts and vehicle manufacturing are making progress. For example, the China Iron and Steel Association reported that from January to August 2024, its key member companies' water withdrawals decreased by 3.34% compared with the same period last year, and their reuse rate reached 98.30%. Water consumption still increased by 1.69%, indicating higher water use from recycling.

China's automakers have begun disclosing more specific details about their water use in recent years. For example, Li Auto stated that its water consumption per vehicle is 2.9 cubic metres (m^3) and that its water reuse reached 98.8% in 2023.[63] Meanwhile, other brands have implemented initiatives to reduce water consumption.

Land-use change and ecosystem disturbance

From 2007 to 2018, the amount of land supply used for industrial purposes increased by 26%, much higher than for residential or commercial land.

China's updated NBSAP highlights significant land-use-related challenges – "intensified land-use changes have reduced natural ecological space, while overuse and uncontrolled exploitation of biological resources harm biodiversity".[64]

Upstream activities in the automotive sector place significant pressure on land both in China and overseas. Increased automotive production drives higher demand for raw materials like metals, rubber and leather, leading to mining or farming activities that impact land and surrounding ecosystems.

In the midstream, land used for automotive production sites is typically industrial land in China. From 2007 to 2018, the amount of land supply used for industrial purposes increased by 26%, much higher than for residential or commercial land.[65] Given this trend, the developing automotive sector in China, along with other industrial land occupiers, should improve responsible land use and ensure responsible treatment of ecosystems surrounding sites.

While supporting the rapid growth of EVs in China, charging infrastructure may cause disputes over city green space and suburban ecosystems. By the end of 2022, China owned more than half of the global stock of public slow chargers, and 90% of the growth in the global fast charger sector also came from China.[66] Given this rapid development, it's crucial to conduct evaluations of the sector's impacts on land and ecosystems throughout the life cycle – especially before implementation – to support climate and nature conservation goals in China.

China has been developing the Green Mine Construction initiative since 2017 to encourage sustainable mining practices. As a result, over 1,000 national-level green mines were built by April 2024. Since 2024, there has been a comprehensive country-wide push to promote green mining practices and ensure that 90% of large- and 80% of medium-sized mines meet the requirements of Green Mine Construction by 2028. In the meantime, China is also widening the scope of relevant standards to encompass smaller mines. Production and manufacturing have also been approached in a similar way, with initiatives such as Green Factories setting standards for compact land use, reuse of waste, reduction of GHG emission and so on.

In August 2023, the Ministry of Natural Resources of China announced that terrestrial ecological conservation red lines cover over 30% of the country's land area.[67] How the remaining 70% of land is used will significantly influence the economic transition towards nature positive. Currently, the primary focus in the automotive industry remains on resource efficiency and energy consumption, with insufficient attention given to land-use-related assessments.

Pollution

Given its large scale, China's automotive industry produces huge quantities of solid, liquid and gaseous waste. While motor vehicles are major contributors to air pollution in China,[68] the sector's upstream and direct operations also impact land, freshwater and oceans.[69]

End-of-life vehicles are a major source of solid waste in the sector, generating scrap metals, plastics and rubber that can be reused. With particularly high activity levels in China (see Table 4), end-of-life batteries can cause solid waste challenges and potential pollution when treated improperly. In 2023, there were 580,000 tons of end-of-life batteries in China – a 140% increase from 2022.[70]

China has issued several regulations to manage waste – including the Air Pollution Prevention and Control Law, the Guidelines for Feasible Technologies for Pollution Prevention in the Automotive Industry and the Battery Industry

> Currently, about 13% of the aluminium industry in China uses clean energy. To meet the 2030 carbon-peaking target, the aluminium industry would need a 45% clean energy use rate.

Pollutant Discharge Standards – and has promoted the conversion of waste into resources. For midstream automotive production, China has set the discharge standard of water pollutants for motor vehicle maintenance and repair.[71]

Much progress has been made in accordance with these guidelines, with many sector players addressing pollution from operations to meet relevant compliance requirements in China.

There's room for further enhancement in resource efficiency, however. For example:

- In total, 22% of raw materials used for steel production in China come from **scrap steel**, and the comprehensive use rate of steel slag is less than 30%, both of which are below the global average.[72,73]
- In 2021, China's output of **recycled aluminium** accounted for only 16% of total aluminium production,[74] falling short of the global average (about 33%).[75]
- The recycling of **power batteries** primarily relies on authorized companies on the Whitelist for Power Battery Recycling. More detailed guidelines or regulatory documents are expected to support scaling circular practices and reducing solid waste from end-of-life power batteries.

GHG emissions

GHG emissions from the automotive industry primarily come from midstream and downstream activities. From a full-life-cycle perspective, improving vehicle fuel efficiency and standards can help reduce short-term carbon emission pressures, but the long-term solution lies in transitioning to alternative power sources. In China, the life cycle emissions of BEVs were projected to be 37% to 45% lower than those from comparable gasoline vehicles in 2021 and 48% to 64% lower by 2030.[76]

China's fuel economy gap significantly impacts the sector's GHG emissions. In 2023, fuel vehicles accounted for 96% of China's GHG emissions, with an average fuel consumption of 6.26 litres per 100 kilometres (km), compared to the global average of 5 litres per 100 km for passenger cars.[77] To address this, China has set a target to reduce the average fuel consumption of new passenger cars to 4 litres per 100km by 2025.[78] Additionally, China has introduced the Stage 6 emission standards to push automakers to improve fuel efficiency.

For raw materials such as aluminium, China is pursuing industrial transformation in line with its dual-carbon goals. This includes gradually shifting electrolytic aluminium production capacity from thermal power regions to hydropower regions. Some challenges hinder further emission reductions, however:

- **Energy sources**: The carbon footprint of primary aluminium produced in coal-powered regions is about five times that in hydropower-based regions.[79] Currently, about 13% of the aluminium industry in China uses clean energy. To meet the 2030 carbon-peaking target, the aluminium industry would need a 45% clean energy use rate.[80] Transitioning to cleaner energy has huge potential.
- **Lack of aluminium scrap**: China's recycled aluminium industry faces challenges such as a lack of aluminium scrap supply and high import dependence.[81]

China emphasizes industrial transformation and promotes recycling and reuse to reduce GHG impacts in several documents like the *Carbon Peaking Implementation Plan for the Non-Ferrous Metal Industry*[82] and the *Recyclable and Renewable Design Guidelines for Plastic Products*.[83] In 2024, China started exploring including the electrolytic aluminium industry in the coverage of the national carbon emissions trading market,[84] which may help accelerate action from related industries.

While there is still a significant gap in the fuel economy within China's automotive industry, issues related to energy structure, production capacity structure and recycling indicate room for optimization in the life cycle emissions of key raw materials.

3 Five priority actions

With five priority actions, the sector can unlock $160 billion in annual business opportunities in China by 2030.

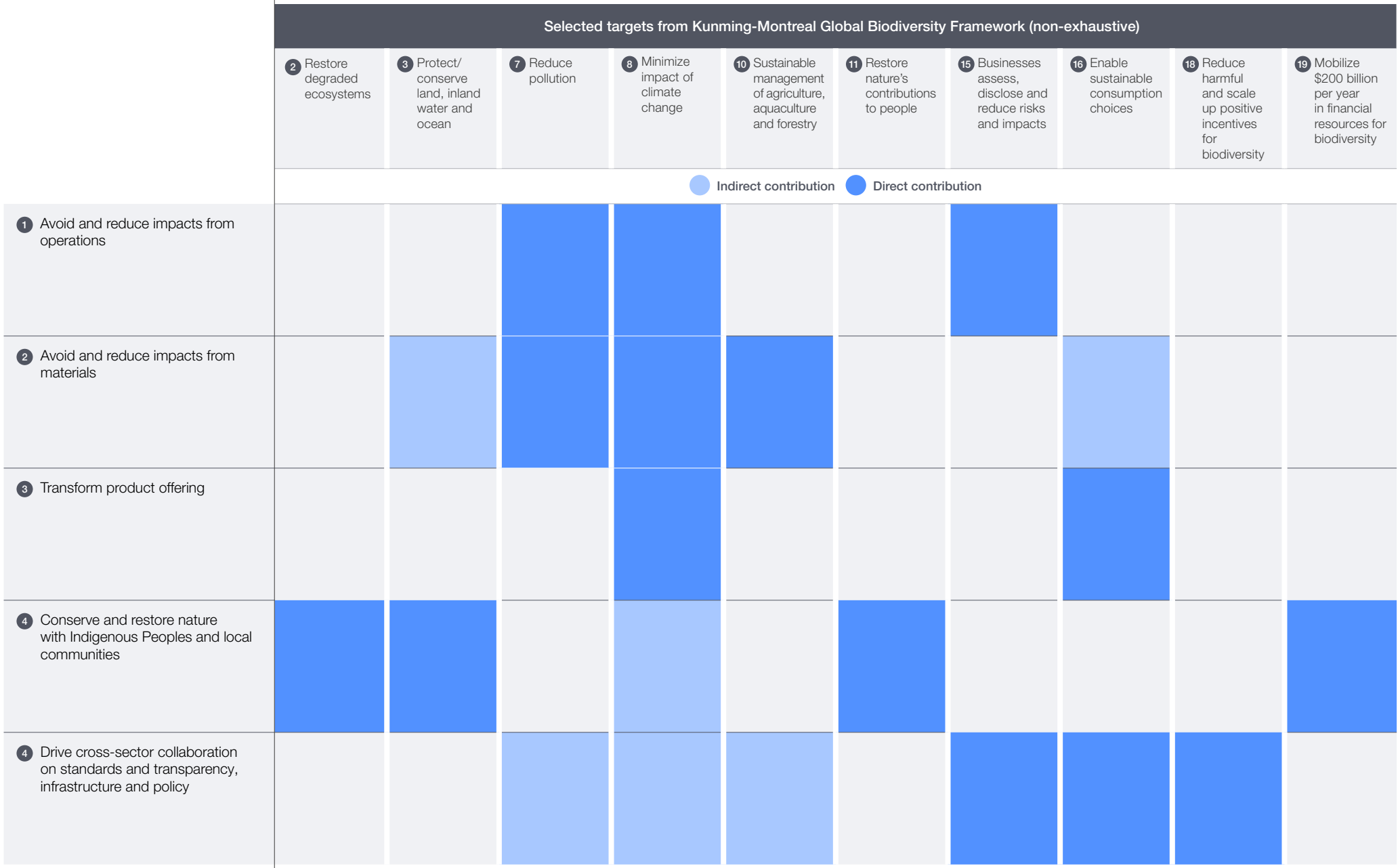
Automotive companies can contribute to a nature-positive future by prioritizing actions to: 1) avoid and reduce impacts from operations, 2) avoid and reduce impacts from materials, 3) transform product offerings, 4) conserve and restore nature, and 5) drive cross-sector collaboration.

Given how much of the sector's impacts are upstream and downstream, these priority actions require companies to actively engage with suppliers, retailers, customers, consumers and industry peers to transform their value chains. **While some of these actions are already being employed or gradually rolled out by Chinese businesses, this report calls for accelerated efforts in China's automotive sector.**

FIGURE 6 **Five priority actions for the automotive sector**

Taking these five priority actions across operations and the wider value chain will help companies in the sector avoid or reduce the four drivers of biodiversity loss (pollution, water use, land-use change, ecosystem disturbance and GHG emissions) across the four nature realms (land, ocean, freshwater and atmosphere), mitigate risks to operations and unlock commercial opportunities. These actions will also contribute to the targets of the Global Biodiversity Framework, which aims to halt and reverse biodiversity loss by 2030 (see Table 5).

TABLE 5 | **Mapping of five priority actions to GBF framework**



For each action, companies should also set measurable and time-bound targets and report against the progress regularly to increase their accountability (see Chapter 4 in the global report for more details).

Companies should follow the mitigation hierarchy at site-level, in a landscape context, taking into consideration direct, indirect and cumulative impacts. They should first **avoid** impacts, then **reduce** impacts, **restore**, and finally, **compensate**[85] for unavoidable residual impacts.[86,87,88,89,90] Mitigation efforts should align with a "no net loss" or "biodiversity net gain" goal for each project.[91]

Priority action 1

3.1 Avoid and reduce impacts from operations

While the majority of companies leading on nature assessments and disclosure are based in Europe and Japan, progress is being made.

In recent years, leading Chinese automakers have taken actions in energy, water and waste management to mitigate impacts on nature from their operations. Meanwhile, government authorities have introduced various standards and technical documents to promote sustainable practices, such as pollution reduction in the automotive industry.[92]

To implement more comprehensive measures to avoid and reduce impacts from operations, China's automotive industry can improve its capacity of conducting comprehensive assessments on nature and establish robust systems to optimize energy and water resource management.

Conduct comprehensive biodiversity assessments and establish robust management

Guided by domestic and international policies, leading Chinese automakers have already developed capabilities to track and manage standardized carbon-related data. Their ability to track and manage impacts on nature remains lacking, however. Efforts should be made to raise awareness and refine management approaches.

To more effectively measure and track impacts on nature, it's recommended here that automakers establish a complete biodiversity assessment and management system. By referring to guiding documents – such as the *China National Biodiversity Conservation Strategy and Action Plan (2023-2030)* and the *Law of the People's Republic of China on Environmental Impact Assessment* – and drawing on assessment guidelines from international initiatives like the SBTN and frameworks proposed by the Taskforce on Nature-related Financial Disclosures (TNFD),[93] automakers can assess and disclose impacts of their operations.

While the majority of companies leading on nature assessments and disclosure are based in Europe (approximately 35% of TNFD adopters as of June 2024) and Japan (approximately 30%, versus 1.2% for China[94]), progress is being made. For example, to support the improvement of nature governance with qualitative data, Lotus Technology carried out a pilot project of natural capital accounting on aluminium in China, following the Natural Capital Protocol.[95] X Peng has also publicly stated it has engaged a qualified agency to conduct ecological impact assessments, including on biodiversity and habitats, to identify impacts and risks and formulate measures to address them.[96]

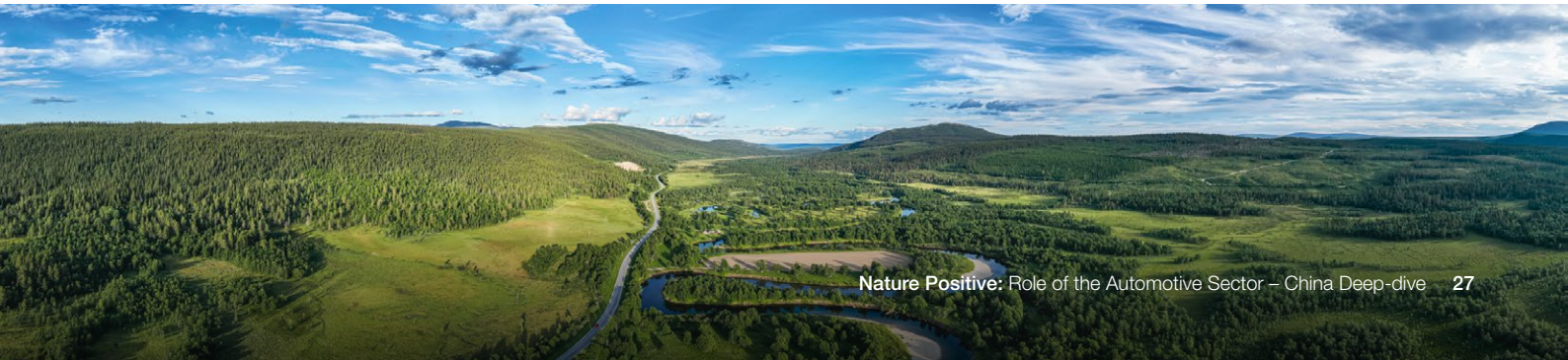
BOX 2 **Guidance and tools to improve biodiversity assessment and prioritization**

Various standards and guidelines exist to support companies. For example, the following resources outline the approach companies should take for biodiversity assessment and prioritization:

- TNFD's LEAP (locate, evaluate, assess and prepare) approach[97]
- SBTN's technical guidance to assess[98] and prioritize[99]

The following tools and datasets are also available to support a more detailed assessment:

- World Wide Fund for Nature's (WWF) Biodiversity Risk Filter[100]
- The Integrated Biodiversity Assessment Tool (IBAT)[101]
- UN Biodiversity Lab spatial data[102]
- International Union for Conservation of Nature (IUCN) Global Ecosystem Typology 2.0[103]
- Global Forest Watch[104]



Focus on energy management to reduce GHG emissions from operations

Compared to global automakers, the Chinese automotive sector is still catching up on operational decarbonization. To advance GHG emission reduction in manufacturing and operations, automakers should focus on adopting energy efficiency measures and low-carbon energy sources. By optimizing the use of electricity and adopting energy-efficient equipment and smart grid technologies, electricity consumption can be substantially reduced. Heat waste can also be reduced by waste heat recovery, heat pump technology and improved heat energy use efficiency.

Other possible energy solutions include introducing and expanding alternative energy sources such as solar and wind, and optimizing production processes to both reduce unnecessary consumption of electrical and thermal energy and improve overall production efficiency. See section 3.1 of the global report for additional detail on decarbonization levers and global examples.

BOX 3

Harness multiple approaches to reduce emissions from operations

Li Auto implemented several initiatives to reduce GHG emissions in its operations, including:

1. Expanding the use of renewable energy and increasing the proportion of clean energy
2. Applying an intelligent energy management system to regulate and adjust the energy system
3. Optimizing manufacturing processes with mechanical connection technology and adopting self-piercing riveting and rotary swaging to reduce welding energy consumption
4. Harnessing heat regenerators to recover waste heat from air compressors and equipping boilers with additional condensing heat exchangers at flue gas outlets to absorb heat energy[105]

These activities contributed significantly to its ESG performance – in 2023, it achieved a Morgan Stanley Capital International (MSCI) rating of AAA.

A growing number of Chinese automakers have begun investing in the development and application of alternative energy sources. Additionally, they continue to focus on improving energy efficiency, for instance by introducing energy-efficient lighting and air conditioning equipment and optimizing manufacturing processes to reduce energy consumption. These initiatives not only facilitate the reduction of GHG emissions in manufacturing but also provide additional benefits in many instances, such as cost-saving advantages.

Reduce freshwater consumption and improve water stewardship

It's crucial to consistently reduce water consumption and progressively optimize water management, especially in the use of non-freshwater resources and water recycling.

- Reduce freshwater consumption, replace freshwater with alternative water sources where possible (for example, by recycling rainwater for production equipment cooling), replenish cooling towers (by collecting rainwater or disposing of municipal waste), or invest in upgrades or replacements for water-using equipment to maximize efficiency. In BMW's Shenyang plant, water consumption was reduced to 1.72 m^3 per unit[106] in 2023, with 40% deduction from 2019.
- Recover and recycle water in operations. This can be done, for example, by introducing closed-loop recycling systems or upgrading water treatment facilities, and further disposing of industrial wastewater to meet the irrigation needs of plant landscapes, thus maximizing recovery and recycling of water resources.

Priority action 2

3.2 Avoid and reduce impacts from materials

In addition to reducing impacts from operations, it's also essential to avoid and reduce impacts on nature from raw material extraction and processing. Such actions can maximize potential benefits and extend the influence of automakers throughout the supply chain, enhancing resilience and promoting systematic shifts in the automotive industry and the upstream material sectors.

Promote life cycle assessment of impacts on nature

Assessing nature-related impacts, dependencies, risks and opportunities throughout the supply chain can improve overall product transparency and traceability and drive industry-wide action. To that end, crucial steps the sector can take include continuously collaborating with and educating suppliers, as well as aligning environmental data frameworks, standards and metrics. Ideally, the Chinese automotive sector would carry out these actions in partnership with the global automotive sector in order to drive convergence and enable the sharing of best practices across borders.

Major automotive players, who have more influencing power than downstream companies, can incorporate nature-related assessment factors into procurement standards and supplier evaluation systems to promote a wider array of nature-positive actions. For example, they can encourage practices such as using natural leather alternatives or sustainably harvested wood.

BOX 4

Supplier sustainability assessment tool for value chain transparency and collaboration

> Major automotive players can incorporate nature-related assessment factors into procurement standards and supplier evaluation systems to promote a wider array of nature-positive actions.

Contemporary Amperex Technology Co., Limited (CATL) is a global leader in innovative energy technologies headquartered in China, committed to providing solutions and services for new energy applications worldwide. In 2022, CATL launched a partnership programme named CREDIT (carbon footprint, recycling, energy, due diligence, innovation and transparency), which focused on sustainable lithium-ion battery supply chains. To support the global effort to achieve net zero and realize nature-positive outcomes, CATL started to explore nature-related dimensions that extend beyond the existing 114 evaluation indicators in the past two years.

The CREDIT tool offers on-site assessment and analysis of players' sustainability practices along the supply chain, with independent modules specific to environmental impact factors, including water use, GHG emissions, land use and biodiversity. The assessment of suppliers covers waste treatment, monitoring, recycling, soil, freshwater system protection and other areas. It requires suppliers to first become educated on and then proactively address impacts on nature. For any non-conformances identified, CATL has a comprehensive tracking system and facilitates partners in developing corrective action plans.

Additionally, CREDIT sets ambitious requirements for suppliers around GHG emissions – supported by measures such as professional empowerment and on-site emissions data collection – to uphold its commitment to achieving carbon neutrality across the battery supply chain by 2035.[107]

CATL plans to make this programme an open toolkit for partners by 2026. It also intends to share insights based on accumulated auditing results and construct supply chain risk maps, ultimately contributing to the sustainable development of the industrial system.[108]

Expand circularity and innovate to avoid and reduce material waste across the value chain

End-of-life vehicles can generate a large amount of solid waste, such as car frames, obsolete parts and tyres. With the rapid growth of EV production in China, a large number of automotive products will reach their end-of-life in the near future. In 2023, the volume of end-of-life batteries in China exceeded 580,000 tons.[109] Proper handling and recycling of vehicle and battery materials can improve resource use efficiency and bring economic benefits.

Automakers can enhance resource efficiency and improve recyclability through multiple approaches, for example:

- **Product and process innovation**: Adopt practices such as integrated die-casting and automated manufacturing to improve resource efficiency. Collaborate with upstream and downstream partners to design and use recyclable materials.
- **Invest in reuse, remanufacturing and large-scale recycling**: Optimize the recovery rate and quality of unavoidable production waste and improve the efficiency of end-of-life management to achieve high-value recycling.
- **Stringent waste management rules**: Optimize manufacturing processes to minimize waste generation during manufacturing, strictly control unavoidable waste with authorized suppliers, especially hazardous waste, and transfer waste to recycling facilities promptly to avoid additional pollution.

BOX 5

Partnership for non-downgrading circular use of aluminium

Currently, about 80% of aluminium can be recycled in China.[110] More than 90% of recyclable aluminium is used in a downgraded way, however.[111] Improving the quality of recycled aluminium – while simultaneously creating opportunities for innovation and new business ventures – is one of the major challenges facing the industry in China.

To enhance the efficiency and automation of scrap metal recycling and produce high-quality recycled aluminium, China Hongqiao Group partnered with Scholz, an automobile dismantling and metal recycling enterprise in Germany. This joint project harnesses Scholz's advanced scrap automobile dismantling capabilities and recycled-aluminium production technologies, ensuring that recycled aluminium can be used without degradation. Meanwhile, it integrates end-of-life motor vehicle recycling and dismantling, aluminium recycling and power battery recycling, with the aim of feeding the materials back into manufacturing in a closed loop.

This initiative helps to reduce the demand for primary aluminium and cut costs, and integrates dozens of companies in the upstream and downstream industrial chain of end-of-life motor vehicles, power battery recycling and aluminium scrap recycling.[112] Upon completion, the joint project is estimated to have an annual production capacity of 500,000 tons of recycled aluminium, with a 95% reduction of energy consumption and 85% reduction of carbon emission per ton compared with non-recycled aluminium.[113] It's additionally expected to have an annual recycling and dismantling capacity of 100,000 scrap motor vehicles and an output value of more than CNY 10 billion (Chinese yuan) (approximately $1.4 billion).[114]

Priority action 3

3.3 Transform product offering

A variety of new business models are facilitating decreases in natural resource use by generating value from service.

Despite efforts being made to improve efficiency and material substitution, the growth of the automotive sector has driven increasing natural resource consumption and waste. Leading players in China are proactively exploring new business models to find alternative avenues to growth and boost service-related revenue. As China's automotive industry moves into a stable phase of development, a variety of new business models are facilitating decreases in natural resource use by generating value from service. For example:

1. **Mobility as a service** (MaaS): This encompasses on-demand car use – e.g. car sharing, peer-to-peer (P2P) sharing, and micro-mobility – and on-demand mobility services (e.g. ride-hailing, ridesharing, and demand-responsive transport/ridesharing). MaaS improves the accessibility of public transport and the efficiency of vehicle use. Many companies have launched driverless ride-hailing service and pilots in major cities across China.
2. **Battery as a service**: Battery swap services offered by manufacturers such as NIO reduce the need to deploy large numbers of charging piles and improve the efficiency of power grids. The presence of battery monitoring in the swapping process enables more effective identification and decommissioning of used batteries and promotes used battery recycling.
3. **Subscription service**: In recent years, many companies – e.g. NIO[115] and Zeekr[116] – have launched subscription car services to provide flexible options and meet different needs.

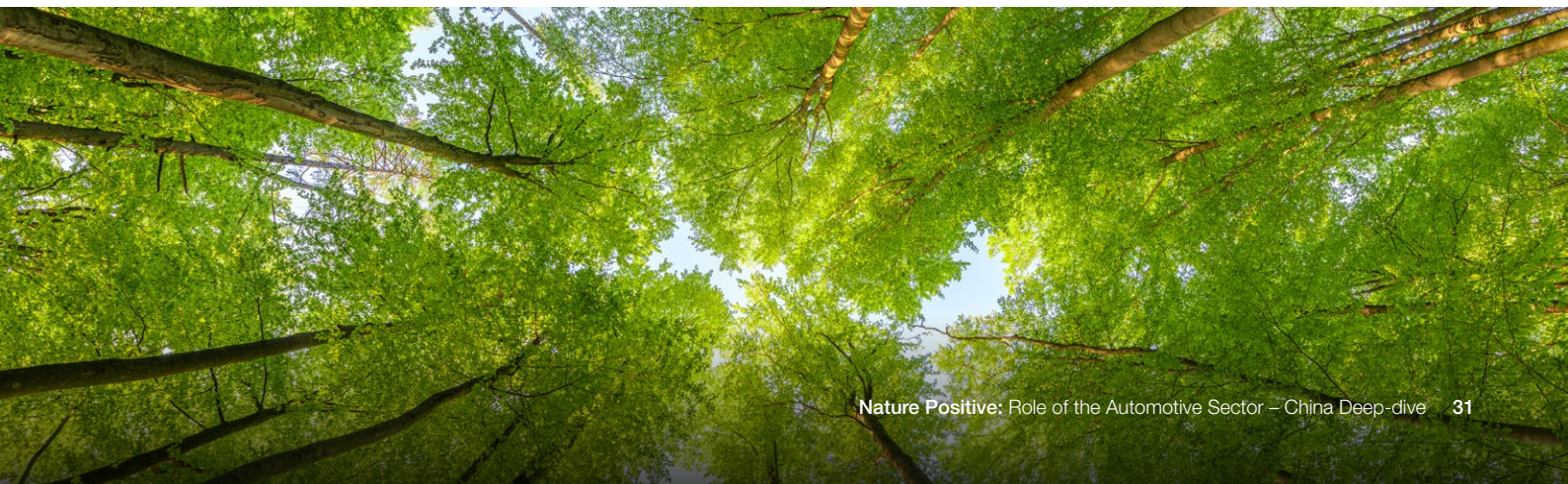
Priority action 4

3.4 Conserve and restore nature with Indigenous Peoples and local communities

Manufacturing and operations that have already occurred inevitably impact nature. Automakers should prioritize environmental protection and ecosystem restoration at the site of operations, incorporate potential impacts on nature into the assessment system and take measures to conserve and restore nature with Indigenous Peoples and local communities through the entire value chain.

Protection and restoration practices

Automakers should cooperate with local governments, protected area management committees, non-profit organizations and other key local stakeholders to proactively protect, restore and invest in landscapes and watersheds in the vicinity of their operations and beyond. Before launching manufacturing activities, impact on nature should be incorporated into site selection processes. Where negative impacts have already occurred, restoration work should be undertaken to offset harm and reduce dependencies on nature. Geely Auto has stated that, in its Guiyang base, considerations around water, energy, land, forest and biodiversity are being integrated into plant design, production processes and operational management.[117]



BOX 6 | **Automaker supports mangrove restoration in China**

> Chinese automakers should promote alignment with global standards and metrics on nature.

Leizhou Bay in Zhanjiang, Guangdong Province, is the most important wintering habitat in China for the spoon-billed sandpiper, one of the world's most endangered species. Based on the Ramsar Sites Criteria, Leizhou Bay is a wetland of international importance, as it regularly supports 1% of spoon-billed sandpipers. Surveys and daily monitoring results also show that an average of nearly 70 species and about 95,000 birds roost and winter in this wetland every year.[118]

In 2023, GAC Honda and the Society of Entrepreneurs and Ecology (SEE) Foundation officially launched the Mangrove Ecological Conservation Project, the first phase of which extends over five years (from 2023 to 2027). The project advances the synergized aims of driving both ecological value and social and economic value through actions such as mangrove restoration, blue carbon project development, community protection and species protection in Wenchang, Hainan and Zhanjiang, Guangdong Province.[119]

Among them, Zhanjiang Mangrove Forest is the nature reserve with the largest area and the most concentrated distribution of mangrove forests in China, and Wenchang Mangrove Forest in Hainan is the area with the most mangrove species in China.

A variety of international standards were considered in the design stage, such as the Sustainable Blue Economy Finance Principles (for developing the blue carbon sink project), and the IUCN Global Standard for Nature-based Solutions (for implementing nature-based solutions and engaging local communities).

By October 2024, the project planted 10 hectares (ha) – or 150 mu – of restored mangroves and cleared about 17 ha (250 mu) of invasive alien species. It's estimated that the project will help to prevent 15,400 tonnes of CO_2 from being emitted in 40 years (on average, 385 tonnes per year) and support blue carbon sink projects that can be traded in carbon markets to generate funds to continue these efforts.[120]

Invest in innovative biodiversity financing mechanisms

In addition to taking action to protect and restore natural ecosystems, automakers can proactively explore potential ecological compensation mechanisms in partnership with financial institutions, e.g. green or blue bonds, voluntary biodiversity certificates or credit markets and nature restoration funds. This would allow them to identify appropriate financial solutions for projects involving circularity and decarbonization technologies, among others. Geely Auto released its *Sustainable Financial Framework.* In 2022, the eligibility assessment categories included Sustainable Water and Wastewater Management, Waste Management and Circular Economy, and Pollution Prevention and Control.[121] Protection- and restoration-related practices, however, are still widely seen by sector players as corporate responsibilities.

Priority action 5

3.5 Drive cross-sector collaboration on standards, transparency, infrastructure and policy

Automakers can collaborate across the broader sector to proactively support vehicle infrastructure construction, data standardization, policy implementation and other actions. In particular, Chinese automakers should promote alignment with global standards and metrics on nature.

In order to support the decarbonization of the automotive sector in China, companies can assist in the expansion of low-carbon, grid-connected infrastructure, including via the improvement of smart charging networks and the promotion of vehicle-to-grid (V2G) technology. It's crucial that companies continuously improve the construction of charging infrastructure to enable electrification, expand the scale of grid-connected infrastructure and introduce technologies (e.g. V2G) to improve grid efficiency and reliability.

In recent years, automakers such as NIO[122] have introduced bi-directional V2G charging piles, which allow the car battery to enter the grid and improving the efficiency and reliability of the grid.

Chinese automakers can engage with the Chinese government to develop supportive policies, e.g. to enable data sharing or more effective end-of-life management of vehicles, promote full-chain data standards and transparency in the automotive industry. They can additionally incentivize road testing of new technologies to advance new business models (potentially helping reduce production and save natural resources), further define the rights and responsibilities for recycling of end-of-life vehicles/components and support the establishment of an improved carbon/green certificate trading system and platform.

Conclusion

The Kunming-Montreal Global Biodiversity Framework is driving a global movement towards social and economic reform and the rehabilitation of nature. Following the 2023 update to the Chinese NBSAP, which set ambitious targets through 2030, regulations within China are tightening to ensure more eco-friendly practices.

As China undergoes strategic shifts towards high-quality development, underpinned by technological advancements and sustainable development, the transforming automotive sector is poised to integrate innovations with nature-positive action.

China's automotive sector has laid a foundation for carbon neutrality, which should be built upon to transition towards a nature-positive future. Despite significant progress in electric vehicles, power batteries and charging infrastructure, the industry still faces substantial challenges regarding pollution, water- and land-use change throughout its value chain. Among the much needed actions, particular attention and effort should be paid to land use and biodiversity assessments, as well as the circularity of materials.

To create global impact beyond proving green technologies, Chinese automakers must recognize that integrating nature-related assessments and strategies into climate-related developments can enhance sustainability while creating value for business. Achieving this goal would help to mitigate risks, reduce costs and generate new business opportunities.

Appendix

Impacts and dependencies analysis

The sector-average assessment of the top drivers of nature loss shown in Table 3 is mostly based on ENCORE,[123] and follows a four-step process.

First, the relevant sub-industries were identified at an ISIC class level[124] for each stage of the value chain. After initially shortlisting the ISIC classes for the midstream section of the value chain (direct operations), the ENCORE upstream and downstream "links" were used to map each midstream ISIC class to relevant upstream and downstream ones. A manual review was also conducted to identify any other relevant categories, resulting in a total of 59 ISIC classes mapped to the value chain stages for the automotive sector.

Second, the ENCORE "pressures" were mapped to the five IPBES (The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) drivers of biodiversity and ecosystem change.[125] Note, "Resource exploitation" was mapped solely to "Volume of water use", as the other pressures ("Other biotic resource extraction (e.g. fish, timber)" and "Other abiotic resource extraction") were not material for the automotive sector, and "Introduction of invasive species" was similarly excluded given the materiality was mostly low or below for all ISIC classes where a value was assigned. See Table 6 for the complete mapping.

Third, for each stage of the value chain and IPBES driver, an average of the ENCORE "pressure materiality rating" was computed across all the ISIC classes where a materiality value was assigned (i.e. not N/A or ND). This was summarized in Table 3 for those with medium, high or very high materiality.

Finally, this output was tested with business, civil society and academic industry experts via interviews and consultation workshops, and the final ratings were adapted based on the feedback provided. For the automotive sector specifically, this involved updating the "midstream, pollution", "midstream, water use" and "downstream, pollution" from low to medium materiality, and "downstream, greenhouse gas (GHG) emissions" section from medium to high materiality.

The impact and dependency descriptions in Chapter 2 also use the ENCORE "pressure materiality ratings", "pressure links", "dependency materiality ratings" and "dependency links" datasets alongside several other sources. These include CDP Water Watch, WWF Water and Biodiversity Risk Filters, academic papers, civil society reviews, company-specific insights and assessments, analysis by the World Economic Forum and industry expert interviews and consultation workshops. The results of this analysis were then used to inform the development of the priority actions.

TABLE 6 **Mapping from ENCORE "pressures" to five IPBES drivers**

IPBES drivers of biodiversity and ecosystem change	Relevant ENCORE "pressures"
Land-use change and ecosystem disturbance	– Area of land use – Area of freshwater use – Area of seabed use
Pollution	– Emissions of toxic soil and water pollutants – Emissions of nutrient soil and water pollutants – Emissions of non-GHG air pollutants – Generation and release of solid waste – Disturbances (e.g. noise, light)
Resource exploitation (water use)	– Volume of water use
GHG emissions	– Emissions of GHGs

Opportunity sizing

The Forum's *Future of Nature and Business* report,[126] published in 2020, identifies about 60 major business opportunities in the nature-positive economy and estimates their respective market sizes (defined as concentrated shifts in profit pools that generate specific opportunities for business). The sizing reflects the annual additional opportunity in 2030 based on estimated savings (e.g. value of land saved through restoration) or revenue upside (e.g. new market potential for new products). For each opportunity, the incremental size of the opportunity in a nature-positive versus a business-as-usual scenario is measured. The opportunities selected are based on existing, commercialized technologies. A detailed overview of this sizing can be found in the methodology note for the *Future of Nature and Business* report.[127]

Identifying the business opportunity potential of the priority actions for the automotive sector followed a two-step approach. First, relevant opportunities were selected from the *Future of Nature and Business* report and mapped to the priority actions identified in this report (see Table 1). Second, the market potential for the automotive sector was estimated across each selected opportunity, using relevant adjustment factors such as the sector's share of China's total GDP for sector-agnostic opportunities or the total excluding the mining and metals sector's share of China's total GDP for circularity-related opportunities.

This sizing approach may not cover the entire set of business opportunities for the sector. For example, the market potential of new technologies under development was not considered in the original 2020 report and is, therefore, not covered in this report. Similarly, the 2020 report did not aspire to exhaustively cover all present opportunities.

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