公众环境研究中心
Institute of Public & Environmental Affairs

ENERGY FOUNDATION
能源基金会

Automotive-Steel and Aluminum Green Supply Chain Collaborative Carbon Reduction Research and Evaluation Report

Institute of Public & Environmental Affairs (IPE)

October 2024

About the Authors

LI Meng, ZHU Ziqi, DING Shanshan, MA Jun, XU Xin, ZHANG Hui, LI Yunting

About IPE

The Institute of Public & Environmental Affairs (IPE) is a non-profit environmental organization based in Beijing, China. Since its establishment in 2006, IPE has developed and operated the Blue Map Database (wwwen.ipe.org.cn), and launched the Blue Map app in 2014, promoting environmental information disclosure, facilitating green supply chain and green finance, empowering the green transition and growth of companies, and boosting multi-stakeholder participation in environmental governance.

About Energy Foundation

Energy Foundation is a professional grantmaking charitable organization registered in California, U.S. It has been working in China since 1999, and is dedicated to China’ s sustainable energy development.

Acknowledgements

This report is a product of the Institute of Public & Environmental Affairs (IPE) and is funded by Energy Foundation China.
The team is grateful for the generous support it received throughout this research from China Automotive Carbon Digital Technology Center Co., Ltd.
The team would like to thank the following experts for their contribution to this research:
BAI Rongchun, National Standardization Technical Committee for Energy Fundamental and Management
DAI Yande, Energy Research Institute, National Development and Reform Commission
YANG Shangbao, Public Policy Scholar (Professor)
LI Bing, China Metallurgical Industry Planning and Research Institute
HU Tao, Lakestone Institute of Sustainable Development
ZHANG Ting, China Automotive Carbon Digital Technology Center Co., Ltd.
LI Dan, China nonferrous Metals Industry Association
WANG Jianlei, China nonferrous Metals Industry Association
SU Cunjiang, Hebei Huilv Resource Utilization Company

The team would like to thank Center for International Economic and Technological Cooperation, Ministry of Industry and Information Technology for organizing "Green Supply Chain Corporate Assisting Program", and MAO Tao for organizing the study tour to automotive companies. We would like to thank Geely Automotive for sharing their green supply chain best practices.

We would also like to express our gratitude to Green Jiangnan, SI Xiaodong, SI Xiaotong and MA Wenjing for their contributions.

Disclaimer

This report was written by IPE. Unless otherwise specified, the views expressed in this report are those of the authors and do not necessarily represent the views of Energy Foundation China. Energy Foundation China does not guarantee the accuracy of the information and data included in this report and will not be responsible for any liabilities resulting from or related to using this report by any third party. The mention of specific companies, products and services does not imply that they are endorsed or recommended by Energy Foundation China in preference to others of a similar nature that are not mentioned.

The information contained in this report is for reference only and was obtained from public and lawful sources. Therefore, to the best of our knowledge the information is reliable, accurate, and complete. However, it cannot be regarded that the information has any legal basis or that its veracity is assumed by IPE. IPE may supplement, correct and revise the information in this report in accordance with legal requirements and actual circumstances, and will publish such supplements, corrections or revisions as quickly as possible. IPE does not accept responsibility for any direct or indirect consequences arising from the publication of information in this report. Any quotations from the report must be referenced to IPE and should not be used incorrectly, out of context, or in an abridged or amended manner.

This Report has been translated into English by IPE for reference purposes only. If any questions arise related to the accuracy of the information contained in this translated version, please refer to the Chinese version of the report, which is the official version. The right to final interpretation, modification and updating of the report is solely reserved by IPE.

Executive Summary

In 2023, the global automobile production and sales reached 92.72 million[1], with China's annual automobile production and sales surpassing 30 million for the first time, ranking first in the world[2]. The automotive industry's 'contribution' to greenhouse gas emissions is also significant. Globally, the transportation industry accounts for about 16% of global greenhouse gas emissions[3], while the processing and manufacturing of raw materials such as steel and aluminum being the emission hotspots and major contributors to China's industrial carbon emissions. Thus, the automotive industry urgently needs to innovate and explore pathways for collaborative carbon reduction measures with their suppliers, to incentivize and accelerate the innovation and application of low-carbon green technologies, and to drive the low-carbon transition of steel and aluminum companies.

In view of this, with the support of the Energy Foundation, IPE has conducted study on the 'Automobile-Steel and Aluminum Green Supply Chain Collaborative Carbon Reduction'. The study focuses on motivating the automotive industry to publicly disclose supply chain carbon reduction targets, implement low-carbon procurement requirements, and lead and incentivize hard-to-abate industries such as steel and aluminum smelting to accelerate the production and supply of low-carbon products. This will then assist the automotive industry to accelerate its decarbonization process, supporting China's 'Dual Carbon' goals, and contributing to climate change mitigation.

To evaluate the progress of collaborative carbon reduction in the automotive industry, particularly the challenges and best practices in reducing emissions in the production of raw materials such as steel and aluminum, IPE developed the Automotive Industry Climate Action CATI Index. Using latest data including that of automotive product carbon footprints, the index

[1] https://www.oica.net/category/sales-statistics/

[2] http://finance.people.com.cn/n1/2024/0119/c1004-40162571.html

[3] Our World in Data. Sector by sector: where do global greenhouse gas emissions come from? [EB/OL]. [2024-05-10]. https://ourworldindata.org/ghg-emissions-by-sector.

quantitatively evaluates the climate action and low carbon transition of 51 companies across five dimensions, namely: Governance, Measurement & Disclosure, Carbon Targets Setting, Performance Towards Targets, and Climate Actions.

The evaluation shows that Chinese automotive companies are transitioning to new energy on a larger scale. Six of them, including NIO, Leapmotor, Xpeng, and Li Auto are now selling new energy vehicles (NEVs) only. Another six Chinese automotive companies have more than 20% of their product sales from NEVs in 2023. With the advancement of global energy transition, the carbon emissions of NEVs during their usage phase will continue to decrease. Thus, Chinese automotive companies are expected to play a greater role in assisting the decarbonization of transportation in China and globally.

On the other hand, the emissions from raw materials in the production process is relatively high regardless of gasoline or electric vehicle; and the higher the vehicle class[4], the higher the vehicle carbon footprint. This is mainly due to the higher carbon emissions associated with materials such as steel and aluminum. With the advancement of energy transition, the proportion of carbon emissions in the production process of automobiles and raw materials will continue to increase. This requires traditional and NEV companies to pay more attention to low-carbon manufacturing and focus on reducing carbon emissions in the production of raw materials such as steel and aluminum smelting.

The evaluation also shows that NEV companies score lower than traditional automotive companies in areas such as supply chain carbon emission measure and disclosure, as well as target setting. Automakers headquartered in Europe, North America, Japan, and South Korea had an earlier start in setting Scope 3 carbon neutrality targets and emission reduction targets covering raw materials such as steel and aluminum. However, with the announcement of the 'Dual Carbon' goals, Chinese automakers such as Geely Auto have begun researching the product carbon footprint of raw materials. Geely Auto and Changan have also started setting emission reduction targets for the supply chain, while Li Auto, Xpeng, NIO, Seres, Chery, and BAIC Group have disclosed emission reduction pilot projects covering steel and aluminum production.

In recent years, IPE has been collaborating with the China City Greenhouse Gas Working Group to build the China Products Carbon Footprint Factors Database (CPCD) and the Product Carbon Footprint Disclosure and Catalogue (PCFD). Since 2023, through collaboration with the China Automotive Carbon Digital Technology Center Co., Ltd., IPE has conducted quantitative

[4] The vehicle classes from low to high are: microcar, subcompact car, compact car, midsize car, upper midsize car, and full-size car

analyses of the carbon footprint of various mainstream automotive models and the proportion of carbon emissions from material production in automotives manufactured by 40 NEV and traditional automotive companies.

In conducting the study, IPE also interviewed automotive companies, auto parts manufacturers and steel companies to understand the obstacles and challenges faced by automotive companies in procuring low-carbon materials. These include the automotive companies' procurement of low-carbon materials remaining in a pilot stage, and there is a lack of clear reduction targets and performance evaluation for steel and aluminum-related carbon emissions. It is difficult to obtain data from suppliers, and some emission factors are not representative, making it a challenge to understand the Scope 3 supply chain emissions status and reduction progress. The emission reduction path for Scope 3, especially for the upstream material supply chain is unclear, and the green premium for using low-carbon technologies and recycled resources in the production of steel and aluminum remains high.

These challenges are closely related to a series of external obstacles, including the mainstream ESG ratings not effectively incorporating low-carbon procurement into its rating. There is no consensus on the definitions of 'low-carbon emission steel/green steel' and 'low-carbon emission aluminum/green aluminum'. The recycling mechanism for scrap steel and aluminum is not optimal, and many recycled aluminum alloy materials can only be downgraded for use. Lastly, the consumers' willingness to pay for the "green premium" for low-carbon products is also significantly lacking.

In spite of this, IPE identifies significant opportunities for collaborative carbon reduction in the automotive industry. This includes: China's policies to guide the steel and aluminum smelting industries to implement energy-saving and emission reduction measures, and active promotion to include them into China's carbon market. The large-scale expansion of China's renewable energy installations provides important foundation for decarbonization. Data-based solutions and internet technology enables automotive and steel-aluminum companies to enhance their carbon management capabilities and assist the public in monitoring the implementation of corporate climate goals.

Meanwhile, China is actively formulating corporate carbon accounting and disclosure standards, and accelerating the development of product carbon footprint accounting methodologies and emission factor databases. The carbon footprints of mainstream vehicle models and the carbon emission of key materials used in this evaluation are sourced from the China Automobile industry chain carbon publicity platform (CPP), China Iron and Steel Industry EPD Programme, China Nonferrous Metals Industry EPD Platform, and publicly disclosed carbon footprints by companies, as well as that collected in CPCD and PCFD.

Based on the evaluation results, IPE recommends Chinese and overseas automotive companies to assess the global low-carbon development trend of the automotive industry, leverage their leading influence, and set quantifiable green procurement requirements for suppliers, including those of steel and aluminum. In particular, NEV companies should balance 'manufacturing green' with 'green manufacturing,' thereby playing a greater role in climate action for China and globally. IPE also suggests automotive companies to improve the accuracy of Scope 3 and product carbon footprint data accounting, scientifically set greenhouse gas emission reduction and neutrality targets, and break them down into steel and aluminum and other raw material manufacturing stages. This will encourage core material suppliers to set their own emission reduction targets, accelerate the use of renewable energy, and apply energy-saving and low-carbon metallurgical technologies. Automotive companies should also participate in improving the recycling mechanism and expanding the use of recycled materials. Ensuring information disclosure and environmental statements is also essential to assist investors in assessing the progress and potential of a company's low carbon transition, while guiding consumers in making green choices.

IPE also suggests stakeholders to construct accountability mechanism. This includes government authorities improving carbon accounting standards for key industries such as steel and aluminum, and incorporating them into the carbon market. The government should also establish the product carbon footprint management system of the automotive industry chain, and accelerate the construction of emission factor databases in China. A product labeling certification system for low carbon automobiles, low carbon emission steel, and aluminum should also be established to empower financial institutions to implement transition finance, while guiding the public to pay attention to the climate impact of and choose low carbon automobile products. This will incentivize automotive companies to accelerate their low carbon transition, driving deep decarbonization in upstream hard-to-abate industries and promoting the low carbon transition of the entire industry chain.

CONTENTS

EXECUTIVE SUMMARY 4

CHAPTER I BACKGROUND 9

CHAPTER II AUTOMOTIVE INDUSTRY LOW-CARBON TRANSITION POLICY AND STATUS STUDY 19

CHAPTER III AUTOMOTIVE-STEEL AND ALUMINUM GREEN SUPPLY CHAIN COLLABORATIVE CARBON REDUCTION EVALUATION 23

1. Evaluation Methodology 23
2. Scope of Evaluation 26
3. Evaluation Results 30
4. Evaluation Findings 36
5. Case Studies 55

CHAPTER IV AUTOMOTIVE-STEEL AND ALUMINUM GREEN SUPPLY CHAIN COLLABORATIVE CARBON REDUCTION CHALLENGES AND OPPORTUNITIES 68

1. Major Challenges 68
2. Major Opportunities 81

CHAPTER V CONCLUSIONS AND RECOMMENDATIONS 107

1. Conclusions 107
2. Recommendations 108

Chapter I Background

1. In the Face of Global Climate Crises, Companies Urgently Need to Accelerate Decarbonization

The United Nations Environment Programme's *2024 Emissions Gap Report* released in October 2024 points out that global greenhouse gas emissions must be reduced by 42% by 2030 and 57% by 2035, otherwise the 1.5°C target of the Paris Agreement will become unattainable within a few years.[5]

Meanwhile, global climate governance is facing significant challenges. Despite more than 150 countries and regions worldwide having made carbon neutrality commitments, covering over 80% of global carbon dioxide emissions, GDP, and population[6], and the consistent increase of global solar power generation capacity, energy shortages and geopolitical tensions continue to intensify. Major economies are releasing fossil energy production capacity to strengthen energy resource security, food security, and supply chain security. The *2023 Emissions Gap Report* shows that global GHG emissions increased by 1.2% from 2021 to 2022 to reach a new record of 57.4 gigatons of CO_2 equivalent (Figure 1-1-1). CO_2 emissions from fossil fuel combustion and industrial processes were the main contributors to the overall increase, accounting for about two thirds of current GHG emissions. Unless countries strengthen their actions and go beyond existing commitments, the world will face a temperature rise far exceeding the targets of the Paris Agreement.

Notably, COP28 reached a consensus for the first time on developing a roadmap for 'transitioning away from fossil fuels'.[7] Moreover, the 'Industrial Transition Accelerator' plan aims

[5] United Nations Environment Programme. 2024 Emissions Gap Report [EB/OL]. [2024-10-25]. https://www.unep.org/resources/emissions-gap-report-2024.

[6] Tsinghua University. The '2023 Global Carbon Neutrality Annual Progress Report' Released: Accelerating Carbon Neutrality Progress Requires 'Actions Speak Louder Than Words' [EB/OL]. [2024-05-20]. https://www.tsinghua.edu.cn/info/1182/106866.htm.

[7] United Nations. Special Report on the 28th United Nations Climate Change Conference [EB/OL]. [2024-05-20]. https://news.un.org/zh/events/cop28.

to accelerate decarbonization across key heavy-emitting sectors and encourage policymakers, technical experts and financial backers to work hand-in-hand with industries to unlock investment and rapidly scale the implementation and delivery of emissions-reduction projects.[8]

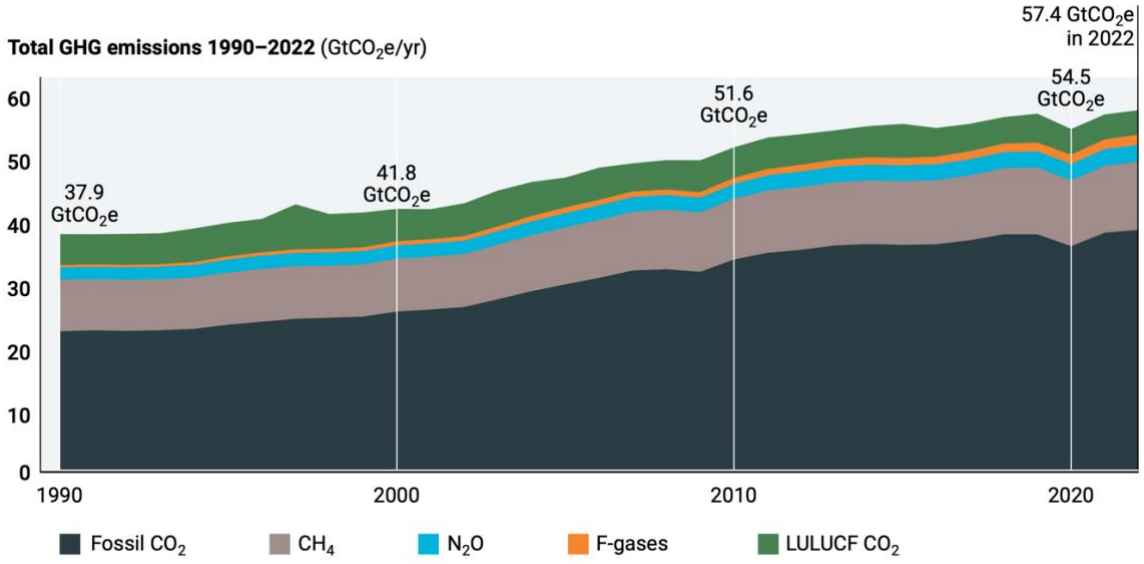


Figure 1-1-1 Total net anthropogenic GHG emissions, 1990–2022[9]

The Report *An Energy Sector Roadmap to Carbon Neutrality in China*[10] released by the International Energy Agency (IEA) points out that the main sources of China's fossil fuel combustion and greenhouse gas emissions are the power industry (48%) and industry (36%) (Figure 1-1-2). An article published in 2021 by the China Development Observation magazine, supervised by the Development Research Center of the State Council of China[11], pointed out that industrial carbon emissions account for more than 70% of China's national carbon

[8] China Steel News Network. The 'Global Decarbonization Accelerator' Plan Announced: The 'Industrial Transformation Accelerator' Plan Focuses on Low-carbon Transition in Industries like Steel Supply Chains [EB/OL]. [2024-05-20]. http://www.csteelnews.com/xwzx/gjgt/202312/t20231208_82479.html.

[9] United Nations Environment Programme. 2023 Emissions Gap Report [EB/OL]. [2024-05-20]. https://wedocs.unep.org/bitstream/handle/20.500.11822/43923/EGR2023_ESCH.pdf?sequence=9.

[10] IEA. An Energy Sector Roadmap to Carbon Neutrality in China [EB/OL]. [2024-05-21]. https://iea.blob.core.windows.net/assets/9448bd6e-670e-4cfd-953c-32e822a80f77/AnenergysectorroadmaptocarbonneutralityinChina.pdf.

[11] Zhang Shengchun (China Electronics Standardization Institute). 3060 | Focus on the 'Carbon Peak and Carbon Neutrality' Strategy ④—Actively Promoting Carbon Reduction in the Industrial Sector [EB/OL]. [2024-05-20]. https://mp.weixin.qq.com/s/5wgnvA3i5eN2i9jF01OsEA.

emissions. Since 2005, the carbon emissions of six major energy-intensive industries: chemical raw materials and chemical products manufacturing, ferrous metal smelting and rolling processing, non-ferrous metal smelting and rolling processing, non-metallic mineral products industry, petroleum processing, coking and nuclear fuel processing industry, and the production and supply of electric and thermal power, accounted for more than 70% of industrial carbon emissions.

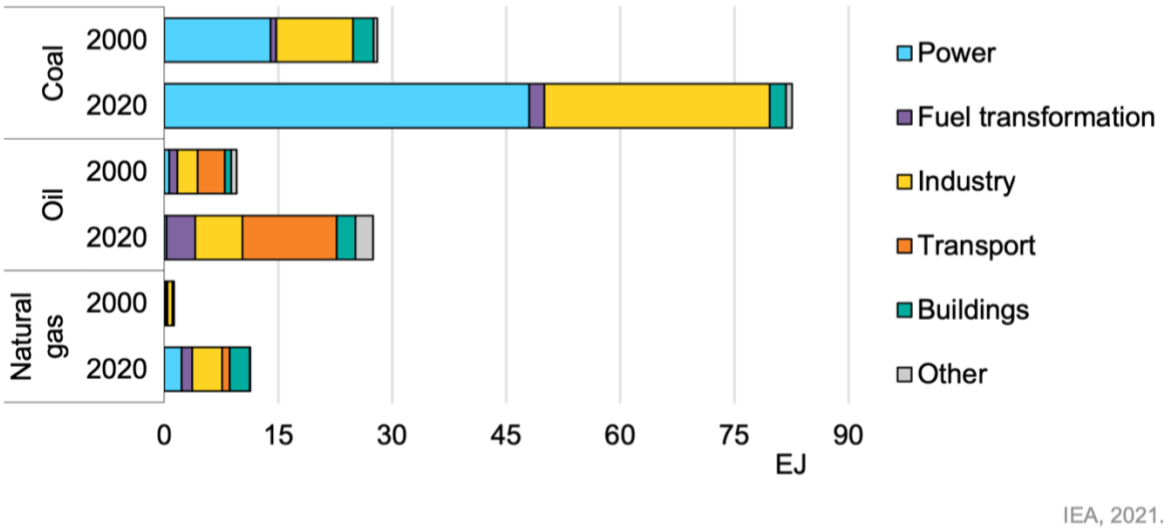


Figure 1-1-2 Fossil fuel consumption by sector in China

In these industries, the energy consumption of the ferrous metal smelting and rolling processing industry accounts for 14% of China's total energy consumption, and its carbon emissions account for about 15% of China's total carbon emissions, ranking first among all industrial sectors.[12] This is because China is the world's largest steel producer. Data released by the World Steel Association shows that in 2023, China's crude steel production reached 1.0191 billion tons, accounting for nearly 54% of the global crude steel production for the year.[13] In addition, the *China Steel Industry Energy Conservation and Low Carbon Development Report*

[12] Metallurgical Industry Planning and Research Institute. Major Release: China Steel Industry Energy Conservation and Low Carbon Development Report (2023) [EB/OL]. [2024-10-01]. https://mp.weixin.qq.com/s/WnUzvoEUrQ2Ug7IxT6YgpQ.

[13] World Steel Association. December 2023 and Full Year Global Crude Steel Production [EB/OL]. [2024-05-20]. https://worldsteel.org/zh-hans/media/press-releases/2024/december-2023-crude-steel-production-and-2023-global-totals/.

(2023) released by the China Energy Conservation Association Metallurgical Industry Energy Conservation Professional Committee and China Metallurgical Industry Planning and Research Institute points out that[14] China's steel industry still faces issues such as a low proportion of green energy, unbalanced levels of green development, difficulties in energy-saving technology innovation, and limited room for reduction in energy-saving indicators. According to the statistical data released by the China Iron and Steel Association on key large and medium-sized steel companies, in 2023, due to a decline in steel demand and a slight decrease in overall capacity utilization, the energy consumption per ton of steel for key member steel companies was 558.3 kilograms of standard coal, an increase of 1.27% from previous year.

Similar to steel, China's primary aluminum production also ranks first in the world. Data released by the International Aluminium Institute (IAI)[15] shows that in 2023, China's primary aluminum production reached 41.666 million tons, accounting for more than 59% of the global total primary aluminum production. The massive production volume and the substantial electricity consumption during the electrolysis process mean that the carbon emissions of the aluminum industry chain account for about 6% of China's carbon dioxide emissions.[16] Thus, accelerating the reduction of greenhouse gas emissions in the industrial sector, particularly in the steel and aluminum smelting industries, will aid China in achieving its "Dual Carbon" goals and contribute to global climate governance.

[14] Metallurgical Industry Planning and Research Institute. Major Release: China Steel Industry Energy Conservation and Low Carbon Development Report (2023) [EB/OL]. [2024-10-01]. https://mp.weixin.qq.com/s/WnUzvoEUrQ2Ug7IxT6YgpQ.

[15] International Aluminium. Primary Aluminium Production [EB/OL]. [2024-05-20]. https://international-aluminium.org/statistics/primary-aluminium-production/.

[16] People's Daily Online. Carbon Peak Plan for the Non-Ferrous Metal Industry Released: Green Recycled Aluminum Welcomes Development Opportunities [EB/OL]. [2024-05-20]. http://finance.people.com.cn/n1/2022/1130/c1004-32577651.html.

2. Companies Are Required to Implement Energy Conservation and Emission Reduction Actions, Measure and Disclose Carbon Emissions

To guide the implementation of energy conservation and emission reduction measures in the steel and aluminum smelting industries, the Ministry of Ecology and Environment, the Ministry of Industry and Information Technology, the National Development and Reform Commission, and the National Energy Administration have issued multiple policies (see Appendix II), and are gradually advancing the inclusion of these two industries in China's carbon emissions trading market. In the steel smelting industry, companies are required to continuously carry out ultra-low emission transformations, promote electrification, reduce energy consumption per unit of added value for companies above a designated size, improve comprehensive utilization rate of smelting slag, enhance processing capacity of scrap steel, increase the proportion of short-process steelmaking, and reduce water consumption per ton of steel. In the aluminum smelting industry, increasing renewable energy in the electrolytic aluminum process, developing smelting technology for low-carbon emission aluminum, promoting green industry certification, and carbon footprint accounting are the key tasks to achieving a low-carbon transition before 2030.

The *Administrative Measures for the Legal Disclosure of Corporate Environmental Information*[17] and the *Measures for the Administration of Carbon Emission Trading (Trial)*[18], which came into effect in 2022, have imposed more mandatory requirements for the disclosure of environmental information and carbon data on companies, including that of steel and aluminum smelting. Regarding listed companies, the Hong Kong Stock Exchange released a consultation summary on April 19, 2024, concerning climate information disclosure requirements[19]. It mandates that large-cap issuers disclose Scope 3 emissions on a 'comply or

[17] Ministry of Ecology and Environment. Administrative Measures for the Legal Disclosure of Corporate Environmental Information [EB/OL]. [2024-05-21]. https://www.mee.gov.cn/gzk/gz/202112/t20211210_963770.shtml.

[18] Ministry of Ecology and Environment. Measures for the Administration of Carbon Emission Trading (Trial) [EB/OL]. [2024-05-21]. https://www.mee.gov.cn/xxgk2018/xxgk/xxgk02/202101/t20210105_816131.html.

[19] Hong Kong Stock Exchange. The Stock Exchange of Hong Kong Limited's Consultation Conclusions on Climate Information Disclosure Requirements [EB/OL]. [2024-05-11].

explain' basis and requires mandatory disclosure of Scope 3 data starting in 2026. Regarding the A-shares, the China Securities Regulatory Commission revised *the Guidelines for the Content and Format of Information Disclosure by Companies Offering Securities to the Public No. 2—Content and Format of Annual Reports* in 2021[20] and issued *Guidelines for the Management of Investor Relations of Listed Companies* in 2022[21], both of which encourage companies to disclose measures and achievements in carbon reduction. In April 2024, the Sustainable Development Report (Trial) launched by the Shanghai Stock Exchange, Shenzhen Stock Exchange, and Beijing Stock Exchange also covers the requirements for climate information disclosure. The State-owned Assets Supervision and Administration Commission of the State Council has put forward requirements for listed companies controlled by Chinese central state-owned companies to improve the work for environmental, social responsibility, and corporate governance (ESG), enhance ESG performance and professional governance capabilities, risk management capabilities, and disclose ESG reports[22]. The disclosure of environmental information as required in these regulations provide support for consolidating environmental, ecological, and climate data infrastructure, and assist in multi-stakeholder participation in climate governance.

Globally, Chinese steel and aluminum smelting companies are facing increasing 'constraints' in international trade. Under the Carbon Border Adjustment Mechanism (CBAM) adopted by the Council of the European Union, Chinese steel and aluminum companies will need to report product carbon emissions when exporting goods to the EU. Starting from January 1, 2026, they will also need to pay carbon tariffs, with the tax price linked to the EU

https://sc.hkex.com.hk/TuniS/www.hkex.com.hk/News/Regulatory-Announcements/2024/240419news?sc_lang=zh-HK.

[20] China Securities Regulatory Commission. [Announcement No. 15] Guidelines for the Content and Format of Information Disclosure by Companies Offering Securities to the Public No. 2—Content and Format of Annual Reports (Revised in 2021) [EB/OL]. [2024-05-21]. http://www.csrc.gov.cn/csrc/c101864/c6df1268b5b294448bdec7e010d880a01/content.shtml.

[21] China Securities Regulatory Commission. Guidelines for the Management of Investor Relations of Listed Companies [EB/OL]. [2024-05-21]. http://www.csrc.gov.cn/csrc/c100028/c2334692/content.shtml.

[22] State-owned Assets Supervision and Administration Commission. Work Plan for Improving the Quality of Central State-owned Companies' Controlled Listed Companies [EB/OL]. [2024-05-21]. https://www.gov.cn/xinwen/2022-05/27/content_5692621.htm.

Emissions Trading System.[23] In addition, the European Commission recently adopted European Sustainability Reporting Standards (ESRS), which requires that the sustainability statements disclosed by companies should include information on the significant impacts, risks, and opportunities generated by their direct and indirect operations in the upstream and/or downstream value chain.[24] This means that Chinese steel and aluminum smelting companies selling products to EU customers may be required to report relevant policies, measures, targets, and data.

[23]Liu Liangwei. The EU carbon tariff has been officially passed, how much tax does the steel industry have to pay? [EB/OL]. [2024-05-21]. https://mp.weixin.qq.com/s?__biz=MzAxMjU1ODAxOQ==&mid=2651025165&idx=1&sn=6f66e1f090d4fac1f6b18d24ea2570b9.

[24] European Commission. Implementing and delegated acts - CSRD[EB/OL]. [2024-05-21]. https://finance.ec.europa.eu/regulation-and-supervision/financial-services-legislation/implementing-and-delegated-acts/corporate-sustainability-reporting-directive_en.

3. Green Supply Chain and Information Disclosure Motivate Suppliers to Accelerate Green Transformation

In addition to policy guidance, case studies in promoting supply chain environmental and carbon management indicate that, in the context of full disclosure of environmental information, leveraging the mechanism of the supply chain and the incentive of market can effectively drive suppliers to collaboratively engage in carbon reduction actions, thereby accelerating the process of energy conservation and emission reduction.

For more than 50 years, with economic globalization, supply chains have been migrating and expanding on a large scale, bringing economic development and income growth to many regions of the world, but also causing serious pollution transfer, damaging the ecological environment in countries and regions that host major global supply chains, and even affecting the health and safety of local communities.

In 2007, IPE launched the Green Choice Initiative with 20 Chinese environmental groups, suggesting that attention should be paid to supervision records published by government agencies as an entry point for ensuring environmental compliance. In 2013, in response to the public's strong demand for clean air, China began to build a national air quality monitoring network and simultaneously launched an action plan for the prevention and control of air pollution, followed by an action plan for the prevention and control of water and soil pollution. In 2016, central environmental inspections were rolled out across the country. In 2018, the Decisions on Comprehensively Strengthening Environmental Protection and Resolutely Winning the Battle Against Pollution further put forward the three major battles for blue skies, clear water and clean soil.

The consistent increase of environmental law enforcement and the disclosure of environmental information has gradually torn down information barriers between upstream and downstream market players, and between market players and regulators and the public, helping all parties to join forces to build an environmental and carbon data infrastructure and develop a data-driven evaluation system and digital solutions. The green supply chain system built on this basis effectively promotes leading companies to incorporate environmental and climate standards into procurement, address supply chain environmental issues, enhance their own environmental information disclosure, and continuously extend to upstream supply chain.

The positive constraints and incentive mechanisms formed on this basis help suppliers improve their environmental and climate performance by promoting fair competition and the leveling the playfield.

Research conducted by IPE tracking the green supply chain performance of procurement companies in China from 2014 to 2023[25] shows that an increasing number of companies are committing to green procurement, disclosing supply chain environmental and climate risk management requirements through supplier codes of conduct or annual reports. Leading companies have motivated a cumulative total of more than 25,000 suppliers to communicate, remediate or disclose information regarding environmental performance over the past decade. More than 32,000 companies have used the Blue EcoChain tool to track their environmental risks. Suppliers have publicly disclosed thousands of Pollutant Release and Transfer Register (PRTR) data, and have begun to calculate and disclose carbon emissions and product carbon footprints, set emission reduction targets, and disclose emission reduction progress.

Moreover, an increasing number of investors are realizing that climate change exacerbates extreme weather and sea level rise, which may affect real estate and infrastructure investments, leading to supply chain disruptions, thereby reducing corporate income and expenditure, asset and liability values, or capital availability and cost, resulting in adverse financial impacts. [26] [27] In addition to physical risks, the Task Force on Climate-related Financial Disclosures (TCFD) [28] and institutions such as the World Economic Forum[29] also pointed out that climate change may bring various transition risks. These include policies and regulatory mechanisms related to greenhouse gas emission reduction and neutrality introduced at international, national, and regional levels, technological innovation and transformation driven by socio-economic low-

[25] IPE. 2023 Green Supply Chain CITI Evaluation Report [EB/OL]. [2024-05-21]. https://www.ipe.org.cn/reports/report_22008.html.

[26] Principles for Responsible Investment. Climate Risk Investor Resource Guide [EB/OL]. [2024-05-21]. https://www.unpri.org/download?ac=15884.

[27] Massachusetts Institute of Technology. Investors awaken to the risks of climate change [EB/OL]. [2024-05-21]. https://news.mit.edu/2022/investors-awake-risks-climate-change-0204#:~:text=Increasingly%2C%20Allonby%20said%2C%20investors%20are%20opening%20their%20eyes,beneficiaries%2C%20they%20are%20taking%20action%20to%20fight%20it.

[28] TCFD. TCFD Recommendations [EB/OL]. [2024-05-21]. https://www.fsb-tcfd.org/recommendations/.

[29] WORLD ECONOMIC FORUM. How much do investors care about carbon emissions? A new study sheds light [EB/OL]. [2024-05-21]. https://www.weforum.org/agenda/2023/03/investors-can-care-about-firms-regulated-carbon-emissions/.

carbon transition, changes in market demand, and impacts on corporate reputation. On the other hand, many investors have realized that new regulations on climate governance, low-carbon and negative-carbon technologies, and the demand from buyers and consumers for low-carbon or even zero-carbon products are creating business opportunities and are beneficial for enhancing the resilience of the supply chain. Investors can also contribute to the decarbonization process of energy and carbon intensive industries by reducing the greenhouse gas emissions of their investment portfolios, while increasing the investment in strategic industries such as new energy.

To further study how to promote collaborative carbon reduction in the automotive industry through green supply chain and information disclosure, and to incentivize carbon intensive industries such as steel and aluminum smelting to accelerate carbon reduction actions, IPE builds on its experience in promoting green supply chain and environmental information disclosure and launched the 'Automobile-Steel and Aluminum Green Supply Chain Collaborative Carbon Reduction' study in September 2023 with the support of the Energy Foundation. This study aims to: 1) identify and analyze best practices, main challenges, and key opportunities for automotive companies in promoting the low-carbon transition of carbon intensive industries such as steel and aluminum smelting; 2) guide automotive companies to publicly disclose supply chain carbon reduction targets, implement low-carbon procurement requirements, accelerate the application of low-carbon emission steel and aluminum; 3) incentivize steel and aluminum smelting companies to accelerate the production and supply of low-carbon materials, speed up the decarbonization process via market mechanisms such as green supply chains and green finance, as well as information disclosure and multi-stakeholder participation; 4) and contribute to China’s “Dual Carbon” goals, and showcase China's best practice in global climate governance.

Chapter II Automotive Industry Low-Carbon Transition Policy and Status Study

1. Analysis of China and International Automotive Industry Low-Carbon Transition Policies

Since the 14th Five-Year Plan, under the strategy of synergistic carbon reduction and pollution control, the Chinese government has successively introduced multiple policy regulations covering different stages of the automotive industry chain (Table 2-1-1, see Appendix 1 for the complete list). These policy requirements not only provide clear basis and constraints for automotive companies to carry out low-carbon transition across their life cycle but also offer support to guide the deep decarbonization of the automotive industry chain.

Table 2-1-1 Policies Related to the Automotive Industry Issued by Chinese Regulatory Authorities Since the '14th Five-Year Plan'

POLICY	RELATED REQUIREMENTS
IMPLEMENTATION PLAN FOR CARBON PEAKING IN THE INDUSTRIAL SECTOR	Support leading companies in the automotive sector to play a leading role in key areas such as supply chain integration and innovative low-carbon management. Integrate the green and low-carbon concept throughout the entire process of product design, raw material procurement, production, transportation, storage, usage, and recycling. Accelerate the establishment of a unified green product certification and labeling system, and promote the green and low-carbon development of the entire supply chain.
14TH FIVE-YEAR PLAN FOR INDUSTRIAL GREEN DEVELOPMENT	Encourage automotive companies to develop collaboratively through green industrial chains and green supply chains, enhance resource utilization efficiency, and improve the greening level of supply chains, and provide policy support to leading automotive companies to guide upstream and downstream companies in the industry towards a green low-carbon transition.
THE 14TH FIVE-YEAR PLAN FOR CIRCULAR ECONOMY DEVELOPMENT	Focuses on promoting the lifecycle management of automobile usage, building an information interaction system to ensure information interconnection and sharing throughout the entire process from automobile production to scrapping.

GUIDELINES FOR THE CONSTRUCTION OF CARBON PEAK AND CARBON NEUTRALITY STANDARD SYSTEMS	Clearly proposes accelerating the revision of standards for carbon emission accounting and reporting in the transportation industry, as well as standards related to data quality, carbon reduction standards for industrial production processes in the automotive field, and standards for the recycling of power batteries and automotive components, thereby providing technical and standard support for achieving the 'Dual Carbon' goals.
WORK PLAN FOR STABLE GROWTH IN THE AUTOMOTIVE INDUSTRY (2023–2024)	Committed to strengthening low-carbon development cooperation across the entire industry chain with key countries and regions, promoting the formation of mutually recognized carbon emissions and carbon footprint accounting systems, and creating a better environment for automotive companies to expand into overseas markets.

Globally, multiple countries and regions have begun to focus on managing the lifecycle emissions of automotives. Among them, EU's *Battery and Waste Battery Regulation* requires operators placing batteries on the EU market to conduct lifecycle management, including supply chain environmental due diligence and carbon footprint calculation[30]. The electric vehicle subsidy eligibility rules announced by France in 2023 set a cap on the carbon footprint of vehicles, aiming to promote lower emissions throughout the vehicle's lifecycle.[31] In 2023, Brazil officially launched the 'Green Mobility and Innovation Program (Mover)', which plans to encourage the automotive industry to accelerate technological innovation and the decarbonization process through tax incentives and other means.[32] Furthermore, increasingly stringent climate information disclosure regulations require automotive companies, especially publicly listed automotive companies, to focus on calculating and disclosing supply chain climate risks.

[30] THE EUROPEAN PARLIAMENT AND THE COUNCIL. Regulation on batteries and waste batteries [EB/OL]. [2024-05-10]. https://data.consilium.europa.eu/doc/document/PE-2-2023-INIT/en/pdf.

[31] Légifrance. Décret n° 2023-930 du 7 octobre 2023 relatif au conditionnement de l'éligibilité au bonus écologique pour les voitures particulières neuves électriques à l'atteinte d'un score environnemental minimal [EB/OL]. [2024-05-10]. https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000048167376.

[32] Ministry of Commerce. Brazil officially launches "Green Mobility and Innovation Plan" [EB/OL]. [2024-05-10]. http://br.mofcom.gov.cn/article/jmxw/202401/20240103465035.shtml.

2. Analysis of China and International Automotive Industry Low-carbon Transition Status

In 2023, the global automotive production and sales volume reached 92.72 million[33], with China's annual automotive production and sales exceeding 30 million for the first time, maintaining the global lead for 15 consecutive years[34]. The industrial added value of the automotive manufacturing industry above designated size increased by 13% year-on-year, making an important contribution to China's economy. China's production and sales of NEVs have ranked first in the world for several consecutive years[35]. According to data released by the National Development and Reform Commission, as of the end of June 2024, China's new energy vehicle ownership reached 24.72 million units, accounting for more than half of the global total.

Meanwhile, the automotive sector's 'contribution' to greenhouse gas emissions cannot be underestimated. Globally, emissions from the transportation industry account for approximately 16% of global greenhouse gas emission[36]. The 'Green Low-Carbon Development Roadmap 1.0' led by the China Society of Automotive Engineers and the China Automotive Technology and Research Center Co., Ltd. estimates that in 2022, carbon emissions from automobile operations in China accounted for about 8% of the country's carbon emissions and about 80% of transportation-related carbon emissions[37]. Among these, carbon emissions from passenger cars account for approximately 45% of automotive-related carbon emissions.

[33] OCIA. Global Sales Statistics 2019-2023 [EB/OL]. [2024-11-05]. https://www.oica.net/category/sales-statistics/

[34] People's Daily Online. Ministry of Industry and Information Technology: China's automobile production and sales have ranked first in the world for 15 consecutive years [EB/OL]. [2024-11-05]. http://finance.people.com.cn/n1/2024/0119/c1004-40162571.html

[35]National Development and Reform Commission. National Development and Reform Commission released important achievements in accelerating the comprehensive green transformation of economic and social development [EB/OL]. [2024-08-20]. https://www.ndrc.gov.cn/fggz/202408/t20240816_1392412.html.

[36] Our World in Data. Sector by sector: where do global greenhouse gas emissions come from? [EB/OL]. [2024-05-10]. https://ourworldindata.org/ghg-emissions-by-sector.

[37] China Society of Automotive Engineers China Automotive Technology & Research Center Co., Ltd. Automotive Industry Green Low-Carbon Development Roadmap 1.0 [EB/OL]. [2024-05-15]. https://www.catarc.net.cn/cms/picture/751987492168912896.pdf.

Currently, the global automotive industry is accelerating the transition to NEVs. Automakers are investing in cleaner energy technologies including advanced internal combustion engines and low-carbon liquid fuels, as well as electrification and hydrogen fuel cell technologies.[38] However, achieving the low-carbon transition requires not only the accelerated phase-out of gasoline vehicles but also collaborative emission reductions across the industry chain, especially raw material manufacturing. According to McKinsey & Company's estimates, as the share of clean energy in the usage phase gradually increases, the emissions hotspot will gradually shift from the use phase to the production process. By 2040, 85% of emissions are expected to come from the material production process.[39]

Research by China Automotive Data Co., Ltd. also shows that the carbon emissions of manufacturing phase of passenger cars increase with electrification, and at least 2/3 the manufacturing-related carbon emission come from raw material acquisition[40]. The position paper on carbon neutrality by 2050 released by the International Organization of Motor Vehicle Manufacturers (OICA) in November 2022 points out that carbon neutrality for motor vehicles cannot be achieved without CO_2 emissions reductions throughout their life cycle.[41]

In the manufacturing of raw materials, steel and aluminum are emissions hotspots. The report *Racing to 2030: Outlook on the Development of Global EV Industry* jointly released by the China EV100 and McKinsey & Company shows that the steel and aluminum emissions account for 45% to 65% in fuel vehicles, and 25% to 40% in new energy vehicles.[42] Thus, reducing emissions from steel and aluminum materials production plays a crucial role in achieving decarbonization throughout the entire lifecycle of automobiles.

---

[38] OICA. OICA RELEASES GLOBAL DECARBONIZATION FRAMEWORK[EB/OL]. [2024-05-10]. https://www.oica.net/oica-releases-global-decarbonization-framework/.

[39] McKinsey. From Electrification to Supply Chain, the Inevitable Path of Decarbonization for Chinese Automotive Companies [EB/OL]. [2024-05-10]. https://www.mckinsey.com.cn/%e4%bb%8e%e7%94%b5%e5%8a%a8%e5%8c%96%e5%88%b0%e4%be%9b%e5%ba%94%e9%93%be%ef%bc%8c%e4%b8%ad%e5%9b%bd%e8%bd%a6%e4%bc%81%e8%84%b1%e7%a2%b3%e7%9a%84%e5%bf%85%e7%94%b1%e4%b9%8b%e8%b7%af/.

[40]Data from China Automotive Data Co., Ltd. Research Report on China's Automotive Low-Carbon Action Plan (2021).

[41] OICA. OICA POSITION PAPER ON CARBON NEUTRALITY BY 2050[EB/OL]. [2024-05-10]. https://www.oica.net/oica-position-paper-on-carbon-neutrality-by-2050/.

[42] China EV100 and McKinsey & Company. Racing to 2030: Outlook on the Development of Global EV Industry [EB/OL]. [2024-05-10]. https://www.ev100online.com/research/detail/1628.

Chapter III Automotive-Steel and Aluminum Green Supply Chain Collaborative Carbon Reduction Evaluation

To assess the progress of low-carbon transition among automotive companies, identify challenges and best practices in promoting emission reduction in the production stages of carbon intensive raw materials such as steel and aluminum, IPE upgraded the Corporate Climate Action CATI Index to enhance its applicability to the automotive industry. Based on the upgraded Automotive Industry CATI Index, IPE conducted evaluation on the climate commitments, low-carbon transition progress and trends of 51 companies. The evaluation focuses on their practices in calculating and disclosing carbon emissions in the production of steel and aluminum, setting emission reduction targets covering steel and aluminum, and reducing emission from steel and aluminum materials production.

1. Evaluation Methodology

During the '14th Five-Year Plan' period, China's ecological civilization construction has entered a critical phase to promoting synergistic efficiency in pollution and carbon reduction. With a focus on carbon, it aims to facilitate a comprehensive green transformation of economic and social development, and achieving a qualitative improvement in ecological environment. On the other hand, an increasing number of multinational companies have made greenhouse gas emission reduction commitments in the 'post-Paris Agreement' era, striving to achieve the 1.5°C target.

In this context, with technical support from the Chinese Academy of Environmental Sciences, IPE upgraded the Supply Chain Climate Action SCTI Index developed in 2018 to the Corporate Climate Action CATI Index. In 2023, IPE once again upgraded the CATI Index by improving disclosure indicators related to product carbon footprint. IPE aims to guide

companies to pay attention to greenhouse gas emissions from product design, raw material extraction, production, distribution, storage, usage to disposal or recycling, calculate greenhouse gas emissions, set greenhouse gas emission reduction targets, and build credible monitoring, reporting, and verification (MRV) systems to accelerate low-carbon transition.

To assess the progress of collaborative carbon reduction in the automotive industry, identify the challenges and best practices of in reducing emission from the production of raw materials such as steel and aluminum, IPE conducted research on the work by Lead the Charge Leaderboard [43], World Economic Forum, and McKinsey & Company [44] and developed Automotive Industry Corporate Climate Action CATI Index (hereinafter referred to as the 'Automotive Industry CATI Index', Appendix III).

The Automotive Industry CATI Index benchmarks against the United Nations Sustainable Development Goals, China and overseas mainstream disclosure guidelines frameworks, and climate-related initiatives. It comprises five dimensions: Policy & Governance, Measurement & Disclosure, Carbon Targets Setting, Performance against Targets, and Climate Actions. It includes automotive industry-specific indicators such as 'Commitment to Phasing Out Fuel Vehicles', 'Promoting emission reduction with steel, aluminum, batteries, other materials or components suppliers, and disclose emission reduction performance', 'Recycling and utilization of scrapped automobiles, used batteries, or other components', 'Investing in low-carbon emission steel and aluminum technology', 'Promoting steel and aluminum, battery and battery material, and other material or component suppliers to calculate and publicly disclose annual emissions data, and set and publicly disclose targets and progress'.

The evaluation is conducted based on publicly assessable documents, including but not limited to: the automotive companies' annual reports, CSR reports, ESG reports, sustainable development reports, and other periodic reports, information released through public channels such as the company's official website, data collected from credible sources by the Blue Map Database, publicly disclosed CDP questionnaire responses, and environmental information and emissions data disclosed by suppliers as required by the company.

[43] Lead the Charge. The Race to Cleaner Automotive Supply Chains: A comparative analysis of automaker performance in building equitable, sustainable and fossil-fuel free supply chains. [EB/OL]. [2024-10-2] https://leadthecharge.org/resources/2024-report-leading-the-charge/.

[44] WEF and McKinsey & Company. Forging Ahead: A materials roadmap for the zero-carbon car. [EB/OL]. [2024-10-2]

Based on the evaluation, the Automotive Industry CATI Index aims to construct a carbon management roadmap for the automotive industry, guiding automotive companies to reduce emission from the production of steel, aluminum, and batteries in the value chain:

1. Improve corporate governance, commit to stopping the sale of gasoline vehicles, and transition to NEVs. Incorporate supplier emission reduction and greenhouse gas data reporting into supplier codes of conduct and other written documents, set quantifiable green procurement requirements for suppliers, and guide suppliers to reduce emission through capacity building, innovative projects, and financial incentives;
2. Conduct Scope 1, 2, and 3 carbon emissions and product carbon footprint accounting and disclosure, understand the emissions baseline and hotspots in raw material extraction, production, distribution, usage, and waste recycling. Prioritize the collection of data from core material suppliers of steel, aluminum, batteries, etc. to enhance the data accuracy.
3. Set science-based Scope 1, 2, and 3 greenhouse gas reduction and neutrality targets, break emission reduction targets into the production of materials such as steel, aluminum, and batteries, and encourage core material suppliers to set emission reduction targets.
4. Track the emission reduction of Scope 1, 2, 3, and the embedded carbon in materials, and adjust targets and low-carbon transition plans accordingly.
5. Implement emission reduction projects targeting emission sources in scopes 1, 2, and 3, in collaboration with steel, aluminum, and batteries suppliers. Accelerate low-carbon transition through the use of renewable energy, energy conservation and low-carbon metallurgical technology, and recycled materials. Extend supply chain carbon management further upstream, encouraging core suppliers to engage in carbon management and climate disclosure. Enhance the transparency of climate information in the supply chain, demonstrate the progress of the low-carbon transition to stakeholders through data disclosure.

2. Scope of Evaluation

Based on the Automotive Industry CATI Index, IPE selected 51 automotive companies (Table 3-2-1) which meet the following criteria for evaluation:

1. Automotive companies with manufacturing activities in China, or procure steel, aluminum, or other raw materials from China, AND whose wholesale volume ranked in the Top 15 of the China Automobile Dealers Association's Automotive Market Research Branch in 2022 and 2023;
2. Passenger car manufacturing companies that are publicly listed or whose parent company is included in the 2023 Fortune Global 500;
3. Since some joint venture automotive companies may set separate emission reduction targets or carry out low-carbon procurement actions under the requirements of their parent companies, this evaluation also includes joint venture automotive companies with sales exceeding 100,000 units in 2023.[45]

Table 3-2-1 Automotive Companies incorporated into the Evaluation

No.	Automotive Company	Country	Listed	Main Product[46]	Reasons for Inclusion
1	BYD	China	Yes	NEV[47]	2023 Fortune Global 500
2	Tesla	US	Yes	NEV	2023 Fortune Global 500
3	Xpeng Motors	China	Yes	NEV	Sales Leader
4	Li Auto	China	Yes	NEV	Sales Leader
5	NIO	China	Yes	NEV	Sales Leader
6	Leapmotor	China	Yes	NEV	Sales Leader
7	Hozonauto	China	No	NEV	Sales Leader

[45]The 2023 sales figures referenced data such as the 2023 annual wholesale volume released by the China Automobile Dealers Association's Automobile Market Research Branch, and may have omissions.

[46]According to the 'Regulations on the Administration of Access to New Energy Vehicle Manufacturers and Products', NEV include plug-in hybrid (including extended-range) vehicles, electric vehicles, and fuel cell vehicles.

[47] According to BYD's 2023 social responsibility report, it ceased the production of fuel vehicle complete units in 2022, and is therefore evaluated as a new energy vehicle company.

No.	Automotive Company	Country	Listed	Main Product[46]	Reasons for Inclusion
8	Polestar	Sweden	Yes	NEV	Listed Company
9	Seres	China	Yes	NEV	Listed Company
10	Rivian	US	Yes	NEV	Listed Company
11	Toyota Motor	Japan	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
12	Ford	US	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
13	Honda Motor	Japan	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
14	Mercedes-Benz	Germany	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
15	General Motors	US	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
16	Volkswagen Group	Germany	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
17	Stellantis	Netherlands	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
18	Great Wall Motors	China	Yes	Gasoline Vehicles + NEV	Sales Leader
19	BMW	Germany	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
20	Hyundai[48]	South Korea	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
21	Changan Automobile	China	Yes	Gasoline Vehicles + NEV	Sales Leader
22	Chery	China	No	Gasoline Vehicles + NEV	Sales Leader
23	Volvo Cars	Sweden	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
24	Mazda	Japan	Yes	Gasoline Vehicles + NEV	Listed Company
25	Kia	South Korea	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500

[48] Hyundai and Kia are two automotive brands that belong to the Hyundai Kia Group, but they operate independently and disclose reports separately, thus they are evaluated separately.

No.	Automotive Company	Country	Listed	Main Product[46]	Reasons for Inclusion
26	Nissan[49]	Japan	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
27	Renault	France	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
28	Subaru	Japan	Yes	Gasoline Vehicles + NEV	Listed Company
29	Jaguar Land Rover	UK	Yes	Gasoline Vehicles + NEV	Listed Company
30	Geely Auto[50]	China	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
31	China FAW Group	China	No	Gasoline Vehicles + NEV	2023 Fortune Global 500
32	GAC Group	China	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
33	BAIC Group	China	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
34	SAIC Group	China	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
35	Dongfeng Motor Corporation	China	Yes	Gasoline Vehicles + NEV	2023 Fortune Global 500
36	JAC Motors	China	Yes	Gasoline Vehicles + NEV	Listed Company
37	JMC Motors	China	Yes	Gasoline Vehicles + NEV	Listed Company
38	SAIC Volkswagen	China	No	Gasoline Vehicles + NEV	Joint Venture
39	FAW-Volkswagen	China	No	Gasoline Vehicles + NEV	Joint Venture
40	GAC Honda	China	No	Gasoline Vehicles + NEV	Joint Venture
41	GAC Toyota	China	No	Gasoline Vehicles + NEV	Joint Venture
42	FAW Toyota	China	No	Gasoline Vehicles + NEV	Joint Venture
43	Dongfeng Nissan	China	No	Gasoline Vehicles + NEV	Joint Venture

[49] In the Renault - Nissan - Mitsubishi Alliance, the operations, policies, and reports of the three brands are largely independent, thus they are evaluated separately.

[50] Geely Auto, Volvo Cars, and Polestar all belong to the Geely Holding Group, but they operate independently and disclose reports separately, thus they are evaluated separately.

No.	Automotive Company	Country	Listed	Main Product[46]	Reasons for Inclusion
44	Dongfeng Honda	China	No	Gasoline Vehicles + NEV	Joint Venture
45	SAIC Motors	China	No	Gasoline Vehicles + NEV	Joint Venture
46	SGMW	China	No	Gasoline Vehicles + NEV	Joint Venture
47	Beijing Benz	China	No	Gasoline Vehicles + NEV	Joint Venture
48	Brilliance BMW	China	No	Gasoline Vehicles + NEV	Joint Venture
49	Yueda Kia	China	No	Gasoline Vehicles + NEV	Joint Venture
50	DPCA	China	No	Gasoline Vehicles + NEV	Joint Venture
51	Beijing Hyundai	China	No	Gasoline Vehicles + NEV	Joint Venture

During the evaluation, IPE attempted to establish contact with the 51 automotive companies via the email published on their official websites. As of July 30, 2024, IPE communicated with 6 via email or phone regarding the low-carbon transition of the supply chain; 1 company replied stating they would not wish to communicate with IPE. Among others: 1 email bounced back; 30 emails did not bounce back but IPE received no response; 13 automotive companies did not disclose contact emails. These indicate that automotive companies' communication and interaction with stakeholders on low-carbon transition need further improvement.

3. Evaluation Results

The evaluation of 51 companies based on the Automotive Industry CATI Index[51] (Figure 3-3-1) shows that 11 are proactive in climate actions and information disclosure, with CATI scores over 50 and 1 scored over 70. 12 scored between 30-50 points. 55% of the companies evaluated scored less than 30 points, indicating an urgent need to improve their climate actions and information disclosure.

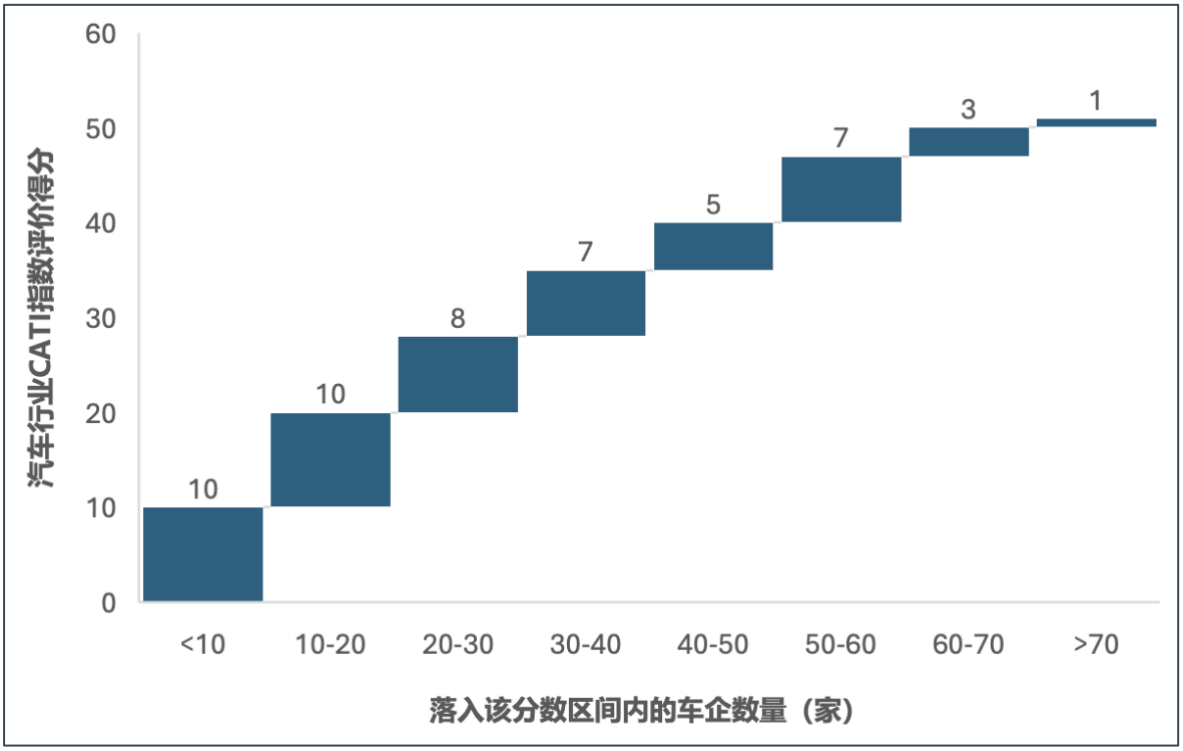


Figure 3 -3- 1 Distribution of Scores in the Automotive Industry C ATI Index

(Axis X – Automotive Industry CATI Score, Axis Y- Number of Automotive Companies)

50 automotive companies have publicly made climate commitments and have taken climate actions. 41 of them have calculated and disclosed their Scope 1&2 emissions data. 40 of them have publicly disclosed Scope 1&2 emission reduction targets and performance against the targets. 50 of them have disclosed emission reduction actions for their owned operation.

However, the automotive companies have shown insufficient climate actions to reduce their Scope 3 emissions, especially that in the supply chain. 20 of them have publicly disclosed supply chain emissions data. 13 of them disclosed Scope 3 emission reduction targets covering the

[51]The evaluation data is updated as of July 30, 2024.

supply chain. 26 of them have extended climate actions to the steel and aluminum supply chain. Among them, Mercedes-Benz, General Motors, Volvo Cars, Ford, Geely Auto, BMW, Rivian, and Polestar have explicitly proposed emission reduction targets for core raw materials such as steel and aluminum.

In terms of the scoring rate of the major indicators (Table 3-3-1)[52]:

1. 12 companies, including Mercedes-Benz, Volvo Cars, BMW, Geely Auto, and Changan Automobile have scored across all indicators, indicating that they have taken actions in their own operations, and supply chain including that of steel and aluminum production.
2. The scoring rate for Scope 3 emissions calculation and disclosure indicators of Mercedes-Benz and Tesla is 100%. They not only disclosed supply chain emissions data and revealed the proportions of key raw materials such as steel, aluminum, and batteries emissions, but also began collecting emissions data from their suppliers to improve data accuracy;
3. 19 automotive companies publicly disclosed the carbon footprint of their products. Among them, Mercedes-Benz, Volvo Cars, BMW, Geely Auto, Polestar, and Rivian released multiple product carbon footprints that have been certified by third parties, covering emissions or proportions at each stage of the product life cycle, achieving full marks in this indicator;
4. Mercedes-Benz and BMW are significantly ahead in their scores in steel and aluminum emission reduction actions. They not only publicly disclosed their steel and aluminum emission reduction targets and signed low-carbon procurement agreements with suppliers, but also disclosed the emission reduction projects carried out by steel and aluminum suppliers, including details on emission reduction pathways, scale, progress, and amounts;
5. All automotive companies scored relatively low in guiding suppliers to conduct carbon management. As explained in Chapter 2, steel and aluminum are emission hotspots in the manufacturing of raw materials. Automotive companies should guide steel and aluminum suppliers to start with calculating and disclosing emissions data, setting emission reduction targets, and collaboratively advancing low-carbon transition.

[52] Score rate = Actual score of the automotive company on this indicator / Total score of the indicator.

Table 3-3-1 Automotive Industry CATI Index Total Score of and the Scoring Rate of Major Indicators

No.	Automotive Company	Country	Listed	Main Product	Total Score	Governance	Scope 1&2			Scope 3			Steel and Aluminum Climate Actions	Guide Supplier on Carbon Management	Product Carbon Footprint Calculation & Disclosure
							Calculation & Disclosure	Targets & Performance	Climate Action	Calculation & Disclosure	Targets & Performance	Climate Action			
1	Mercedes-Benz	Germany	Yes	Gasoline Vehicles + NEV	73.1	95%	100%	92%	69%	100%	87%	75%	100%	28%	100%
2	Volvo Cars	Sweden	Yes	Gasoline Vehicles + NEV	65.2	95%	80%	92%	54%	92%	87%	50%	67%	25%	100%
3	BMW	Germany	Yes	Gasoline Vehicles + NEV	62.9	85%	90%	92%	38%	75%	70%	80%	100%	13%	100%
4	Geely Auto	China	Yes	Gasoline Vehicles + NEV	61.9	85%	70%	85%	62%	83%	63%	65%	33%	13%	100%
5	Kia	South Korea	Yes	Gasoline Vehicles + NEV	59.7	95%	90%	85%	62%	75%	63%	50%	33%	13%	83%
6	Polestar	Sweden	Yes	NEV	59.5	100%	70%	77%	15%	83%	77%	55%	33%	16%	100%
7	General Motors	United States	Yes	Gasoline Vehicles + NEV	58.8	80%	80%	92%	46%	75%	73%	50%	33%	19%	75%
8	Hyundai	South Korea	Yes	Gasoline Vehicles + NEV	55.9	95%	90%	85%	35%	75%	60%	50%	33%	19%	67%
9	Renault	France	Yes	Gasoline Vehicles + NEV	53.9	75%	100%	92%	42%	75%	73%	50%	33%	13%	0%
10	Nissan	Japan	Yes	Gasoline Vehicles + NEV	52.9	85%	80%	100%	50%	83%	67%	45%	33%	19%	0%
11	Ford	United States	Yes	Gasoline Vehicles + NEV	51.7	85%	90%	92%	35%	75%	77%	35%	33%	19%	0%
12	Volkswagen Group	Germany	Yes	Gasoline Vehicles + NEV	49.5	85%	90%	92%	38%	75%	53%	45%	33%	13%	17%
13	Toyota Motor	Japan	Yes	Gasoline Vehicles + NEV	49.4	85%	90%	100%	35%	83%	53%	30%	0%	19%	0%
14	Honda Motor	Japan	Yes	Gasoline Vehicles + NEV	46.4	95%	60%	92%	23%	75%	60%	30%	33%	13%	0%
15	Stellantis	Netherlands	Yes	Gasoline Vehicles + NEV	46	80%	60%	92%	62%	58%	60%	35%	17%	25%	0%
16	Mazda	Japan	Yes	Gasoline Vehicles + NEV	44.2	85%	80%	62%	31%	75%	53%	40%	33%	13%	0%
17	Rivian	United States	Yes	NEV	39.3	90%	80%	23%	12%	92%	23%	30%	33%	13%	100%

No.	Automotive Company	Country	Listed	Main Product	Total Score	Governance	Scope 1&2			Scope 3			Steel and Aluminum Climate Actions	Guide Supplier on Carbon Management	Product Carbon Footprint Calculation & Disclosure
							Calculation & Disclosure	Targets & Performance	Climate Action	Calculation & Disclosure	Targets & Performance	Climate Action			
18	Subaru	Japan	Yes	Gasoline Vehicles + NEV	39.3	80%	90%	62%	50%	50%	23%	45%	33%	13%	0%
19	Brilliance BMW	China	No	Gasoline Vehicles + NEV	38.6	65%	80%	27%	38%	75%	7%	75%	67%	13%	67%
20	Jaguar Land Rover	United Kingdom	Yes	Gasoline Vehicles + NEV	37.8	70%	60%	77%	12%	75%	60%	10%	0%	0%	0%
21	Tesla	United States	Yes	NEV	35.6	100%	70%	0%	23%	100%	0%	55%	33%	13%	58%
22	NIO	China	Yes	NEV	30.3	100%	80%	0%	65%	0%	0%	70%	67%	13%	0%
23	Changan Automobile	China	Yes	Gasoline Vehicles + NEV	30.1	70%	40%	23%	62%	8%	13%	40%	33%	13%	83%
24	GAC Group	China	Yes	Gasoline Vehicles + NEV	29.8	85%	70%	15%	46%	8%	13%	30%	0%	13%	67%
25	Seres	China	Yes	NEV	28.8	90%	60%	54%	27%	25%	0%	30%	17%	13%	50%
26	GAC Honda	China	No	Gasoline Vehicles + NEV	28.4	60%	50%	12%	35%	17%	33%	20%	0%	13%	67%
27	Li Auto	China	Yes	NEV	27.8	90%	60%	0%	62%	0%	0%	45%	33%	13%	58%
28	Xpeng Motors	China	Yes	NEV	26.3	90%	70%	0%	42%	50%	0%	40%	33%	13%	0%
29	Great Wall Motors	China	Yes	Gasoline Vehicles + NEV	24.1	80%	60%	54%	54%	0%	0%	25%	0%	13%	0%
30	Chery	China	No	Gasoline Vehicles + NEV	22.3	65%	30%	0%	35%	8%	0%	40%	33%	0%	83%
31	Leapmotor	China	Yes	NEV	22.1	80%	60%	0%	42%	0%	0%	30%	0%	0%	50%
32	GAC Toyota	China	No	Gasoline Vehicles + NEV	19	60%	50%	8%	23%	0%	7%	40%	0%	13%	0%
33	SAIC Group	China	Yes	Gasoline Vehicles + NEV	18.5	55%	60%	46%	58%	0%	0%	5%	0%	13%	0%
34	Dongfeng Motor	China	No	Gasoline Vehicles + NEV	16.9	40%	20%	23%	58%	8%	0%	25%	0%	0%	0%
35	BAIC Group	China	No	Gasoline Vehicles + NEV	16.4	30%	10%	54%	23%	0%	0%	40%	33%	0%	0%

No.	Automotive Company	Country	Listed	Main Product	Total Score	Governance	Scope 1&2			Scope 3			Steel and Aluminum Climate Actions	Guide Supplier on Carbon Management	Product Carbon Footprint Calculation & Disclosure
							Calculation & Disclosure	Targets & Performance	Climate Action	Calculation & Disclosure	Targets & Performance	Climate Action			
36	BYD	China	Yes	NEV	16.3	55%	60%	0%	50%	0%	0%	15%	0%	0%	0%
37	FAW-Volkswagen	China	No	Gasoline Vehicles + NEV	15.2	50%	20%	12%	35%	0%	3%	25%	0%	13%	0%
38	SAIC Volkswagen	China	No	Gasoline Vehicles + NEV	15	40%	40%	12%	27%	0%	7%	30%	0%	13%	0%
39	Beijing Benz	China	No	Gasoline Vehicles + NEV	11.9	50%	10%	12%	15%	0%	7%	20%	0%	13%	0%
40	Dongfeng Honda	China	No	Gasoline Vehicles + NEV	11.8	60%	0%	12%	27%	0%	7%	10%	0%	13%	0%
41	Dongfeng Nissan	China	No	Gasoline Vehicles + NEV	11.4	20%	0%	12%	46%	0%	7%	25%	0%	0%	0%
42	FAW Group	China	No	Gasoline Vehicles + NEV	8.9	20%	50%	0%	23%	0%	0%	15%	0%	0%	0%
43	SAIC-GM	China	No	Gasoline Vehicles + NEV	8.5	20%	0%	12%	27%	0%	7%	15%	0%	0%	0%
44	DPCA	China	No	Gasoline Vehicles + NEV	8.3	20%	0%	12%	15%	0%	7%	20%	0%	0%	0%
45	JMC	China	Yes	Gasoline Vehicles + NEV	7.8	10%	30%	0%	46%	0%	0%	10%	0%	0%	0%
46	Beijing Hyundai	China	No	Gasoline Vehicles + NEV	6.5	30%	0%	12%	15%	0%	7%	0%	0%	0%	0%
47	SGMW	China	No	Gasoline Vehicles + NEV	5.8	20%	0%	23%	8%	0%	7%	0%	0%	0%	0%
48	Yueda Kia	China	No	Gasoline Vehicles + NEV	5.2	20%	0%	12%	12%	0%	7%	0%	0%	0%	0%
49	JAC Motors	China	Yes	Gasoline Vehicles + NEV	4.7	10%	0%	0%	38%	0%	0%	5%	0%	0%	0%
50	FAW Toyota	China	No	Gasoline Vehicles + NEV	4.5	20%	0%	12%	12%	0%	3%	0%	0%	0%	0%
51	Hozonauto	China	No	NEV	2	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4. Evaluation Findings

(1) Chinese Automotive Companies Scale up the Transition to New Energy Vehicles, but 'Manufacturing Green' also Needs 'Green Manufacturing'

The evaluation shows that 17 automotive companies, including 8 from China have committed to stop selling gasoline vehicles. 31 disclosed the proportion of NEVs in their product sales in 2023. Among them, Li Auto, NIO, Leapmotor, and Xpeng are now selling NEVs only. Another 6 Chinese automotive have more than 20% of their product sales from NEVs in 2023, indicating that Chinese automotive companies are actively transitioning to NEVs (Table 3-4-1). With the advancement of global energy transition, the carbon emissions of NEVs during their usage phase will continue to decrease. Thus, Chinese automotive companies are expected to play a greater role in assisting the decarbonization of transportation in China and globally.

Table 3-4-1 Proportion of NEV Sales by Automotive Companies in 2023[53]

Automotive Company	Country of Origin	Main Product	Commitment to Stop Selling Gasoline Vehicles	Proportion of NEV Sales
NIO	China	NEV	Yes	100%
BYD	China	NEV	Yes	100%
Xpeng Motors	China	NEV	Yes	100%
Li Auto	China	NEV	Yes	100%
LEAPMOTOR	China	NEV	Yes	100%
Hozonauto	China	NEV	Yes	100%
Polestar	Sweden	NEV	Yes	100%
Rivian	US	NEV	Yes	100%
Tesla	US	NEV	Yes	100%
Seres	China	NEV	Yes	60%

[53]The data is sourced from the sales data disclosed by companies through official websites, annual reports, sustainability reports, production and sales bulletins, and industry information channels in 2023. Some proportions are calculated by IPE based on public data. Joint venture automotive companies are not included.

Renault	France	Gasoline Vehicles+ NEV	No	40%
Volvo Cars	Sweden	Gasoline Vehicles+ NEV	Yes	38%
JAC Motors	China	Gasoline Vehicles+ NEV	No	31%
Nissan	Japan	Gasoline Vehicles+ NEV	No	29%
Geely Auto	China	Gasoline Vehicles+ NEV	No	29%
Toyota Motor	Japan	Gasoline Vehicles+ NEV	No	26%
Honda Motor	Japan	Gasoline Vehicles+ NEV	Yes	25%
BMW	Germany	Gasoline Vehicles+ NEV	No	25%
SAIC Group	China	Gasoline Vehicles+ NEV	No	22%
GAC Group	China	Gasoline Vehicles+ NEV	No	22%
Great Wall Motors	China	Gasoline Vehicles+ NEV	No	21%
Mercedes-Benz	Germany	Gasoline Vehicles+ NEV	Yes	19%
Changan Automobile	China	Gasoline Vehicles+ NEV	No	19%
Ford	US	Gasoline Vehicles+ NEV	No	18%
Hyundai	South Korea	Gasoline Vehicles+ NEV	Yes	13%
Subaru	Japan	Gasoline Vehicles+ NEV	No	10%
Jaguar Land Rover	UK	Gasoline Vehicles+ NEV	Yes	10%
Kia	South Korea	Gasoline Vehicles+ NEV	Yes	8%
Chery	China	Gasoline Vehicles+ NEV	No	8%
General Motors	US	Gasoline Vehicles+ NEV	No	8%
JMC	China	Gasoline Vehicles+ NEV	No	2%
Dongfeng Motor Corporation	China	Gasoline Vehicles+ NEV	Yes	No Disclosed Data Found

On the other hand, the emissions from raw materials in the production process is relatively high regardless of gasoline or electric vehicle; making it one of the key areas for automotive companies to achieve net-zero emissions.

Based on the China Products Carbon Footprint Factors Database (CPCD) and the Product Carbon Footprint Disclosure and Catalogue (PCFD) constructed in collaboration with the China City Greenhouse Gas Working Group, IPE has collected emission factors and product carbon footprint data. The two platforms aim to assist all parties in screening, obtaining, and conducting product carbon footprint analysis and carbon accounting. Through collaboration with the China Automobile industry chain carbon publicity platform (CPP), the PCFD platform has included carbon footprint data for over 7,000 models publicly disclosed through CPP.

Applying these data and the average carbon emissions of steel and aluminum used in gasoline and pure electric vehicles produced by 40 new energy and traditional automotive companies and provided by China Automotive Carbon Digital Technology Center Co., Ltd., IPE conducted a quantitative analysis of the carbon emission of steel and aluminum in different vehicle models. The results show that the higher the vehicle level[54], the higher the carbon emissions of materials such as steel and aluminum during the production stage, and the higher the vehicle carbon footprint. Thus, IPE confirms that although electric vehicles have lower carbon footprint as it avoids carbon emissions during the use phase, the carbon emissions from the processing and manufacturing of raw materials such as steel and aluminum for both electric and gasoline vehicles cannot be overlooked. As the automotive industry moves towards electrification, it must focus on reducing Scope 3 and raw material-related carbon emissions, and strengthen collaborative carbon reduction with steel and aluminum suppliers.

Further analysis shows that, the carbon emissions of steel (18.87-29.74 gCO_2e/km) and aluminum (21.77-33.10gCO_2e/km) from pure electric vehicles produced by NEV companies such as NIO, Seres, Xpeng Motors, GAC Aion, Tesla, Leapmotor, Hozonauto, and BYD are all higher than that from pure electric vehicles produced by traditional automotive companies (steel: 11.10-29.20gCO_2e/km, aluminum: 11.04-31.23gCO_2e/km), see Figure 3-4-1.

[54] The vehicle classes from low to high are: microcar, subcompact car, compact car, midsize car, upper midsize car, and full-size car

However, less than 50% of NEV companies calculate and disclose Scope 3 and supply chain emissions, or collect actual data from suppliers, significantly lower than that of traditional automotive companies in the CATI evaluation. In terms of disclosing carbon emissions of raw materials such as steel, aluminum, and batteries, both new energy and traditional automotive companies need improvement. Only Tesla, Rivian, Polestar, Ford and Volvo Cars have disclosed emissions data or proportions for steel and aluminum. In setting Scope 3 carbon neutrality targets and emission reduction targets, NEV companies are also significantly lagging behind: Rivian and Polestar have set emission reduction targets for upstream steel and aluminum stages, but have not disclosed progress towards achieving these targets.

With the advancement of the energy transition, the proportion of carbon emissions from production processes will further increase. This requires automotive companies, especially NEV companies, to pay more attention to low-carbon manufacturing, focusing on reducing carbon emissions during the production and manufacturing stages of raw materials such as steel and aluminum smelting. Automotive companies should also encourage steel and aluminum smelting suppliers to collaboratively implement energy conservation and emission reduction measures, thereby reducing carbon emissions in the production stage.

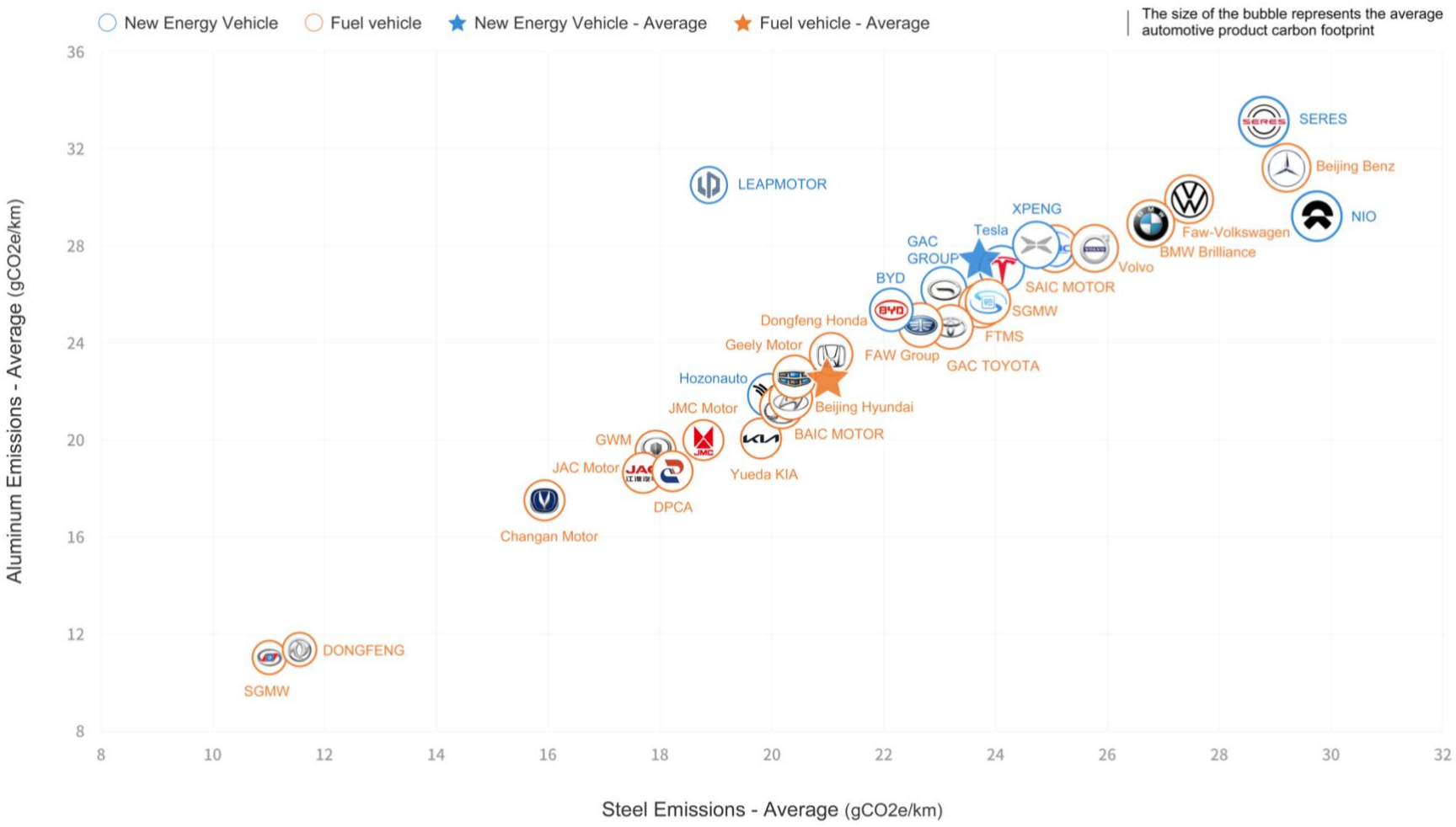


Figure 3-4-1 Carbon emissions from steel and aluminum in pure electric vehicles produced by selected automotive companies

(2) Overseas Automotive Companies Set Scope 3 Targets, but Insufficient Supply Chain Data is Shared Challenge for All

A comparison of climate actions by Chinese and overseas automotive companies (Figure 3-4-2) shows that companies headquartered in Europe, North America, Japan, and South Korea have engaged in Scope 3 and supply chain greenhouse gas accounting. This is because these regions are relatively mature in Environmental, Social and Governance (ESG), and their climate actions started relatively early. Among Chinese automotive companies, Geely Auto, Xpeng Motors, and Seres have disclosed Scope 3 data, while Geely Auto and Xpeng Motors have disclosed supply chain emissions data. GAC Group and Geely Auto disclosed that raw materials like steel, aluminum, and batteries are emissions hotspots in their value chains, but have yet to disclose the emissions data for materials like steel and aluminum.

European automotive companies have all set scope 3 carbon neutrality targets, with nearly 90% disclosing emission reduction targets covering the supply chain. Japanese and Korean automotive companies have proposed Scope 3 carbon neutrality and carbon reduction targets, but more than half of these emission reduction targets have not yet extended to the supply chain. Over 70% of American automotive companies have disclosed Scope 3 emission reduction targets, but less than 30% have been extended to the supply chain while the rest only covering the product use.

Although Chinese automotive companies started their climate actions relatively late, with the advancement of China's “Dual Carbon” goals, companies such as Great Wall Motors, GAC Group, BAIC Group, Changan Automobile, and Geely Auto, have proposed Scope 1&2 carbon neutrality or carbon reduction targets. Geely Auto and Changan Auto took the lead in disclosing Scope 3 emission reduction targets covering the supply chain. Targeting emissions hotspots in raw materials, Mercedes-Benz, BMW, Geely Auto, and Polestar have set and disclosed emission reduction targets related to steel and/or aluminum, and have implemented procurement requirements in the Chinese market. Based on evaluation results and interviews with some automotive companies, IPE believes that insufficient grasp of supply chain emissions data is the main reason why most automotive companies have not yet set and disclosed supply chain emission reduction targets.

In terms of reducing steel and aluminum emissions, all American automotive companies have launched low-carbon emission steel and aluminum projects. Nearly 90% of European,

Japanese and Korean automotive companies have disclosed steel and aluminum emission reduction projects. Chinese automotive companies are still in a catching-up phase. 8 have disclosed their steel and aluminum emission reduction actions. Changan Auto, Geely Auto, Ideal Auto, Xpeng Auto, NIO, and Seres have disclosed emission reduction actions targeting aluminum materials. Geely Auto, Chery, and BAIC Group have publicly mentioned steel emission reduction pilot projects. Other Chinese automotive companies have chosen to reduce emission from batteries, interior parts and plastics.

IPE believes that overseas automotive companies, all of which are listed in their the country of origin, face stricter climate information disclosure requirements and oversight from stakeholders. They tend to reference the disclosure frameworks of the Task Force on Climate-related Financial Disclosures (TCFD), the Global Reporting Initiative (GRI), SASB® Standards, and other internationally recognized disclosure frameworks or guidelines. These standards all explicitly require the disclosure of Scope 3 data. Coupled with the continuous rise of ESG investment in the capital market, overseas automotive companies are driven by the capital market to engage in greenhouse gas accounting and disclosure. Although more than 70% of the Chinese automotive companies included in the evaluation are listed on the A-share or H-share markets, the reporting guidelines do not mandate Scope 3 disclosure. The Climate Information Disclosure Guidelines issued by the Hong Kong Stock Exchange in 2021 only recommend the disclosure of Scope 3 emissions data. The Sustainable Development Report (Trial) launched by the Shanghai Stock Exchange, Shenzhen Stock Exchange, and Beijing Stock Exchange in 2024 also only encourages companies to disclose Scope 3 data.

Despite increasingly stringent climate disclosure requirements, the capital market and mainstream ESG ratings have not yet explicitly required the disclosure of supply chain emissions in Scope 3, nor have they required the disclosure entities to identify and disclose emissions hotspots in raw materials. Therefore, both Chinese and overseas automotive companies exhibit a lack of willingness and motivation to disclose emissions data of raw material production such as steel and aluminum, which results in an unclear understanding of emissions baseline.

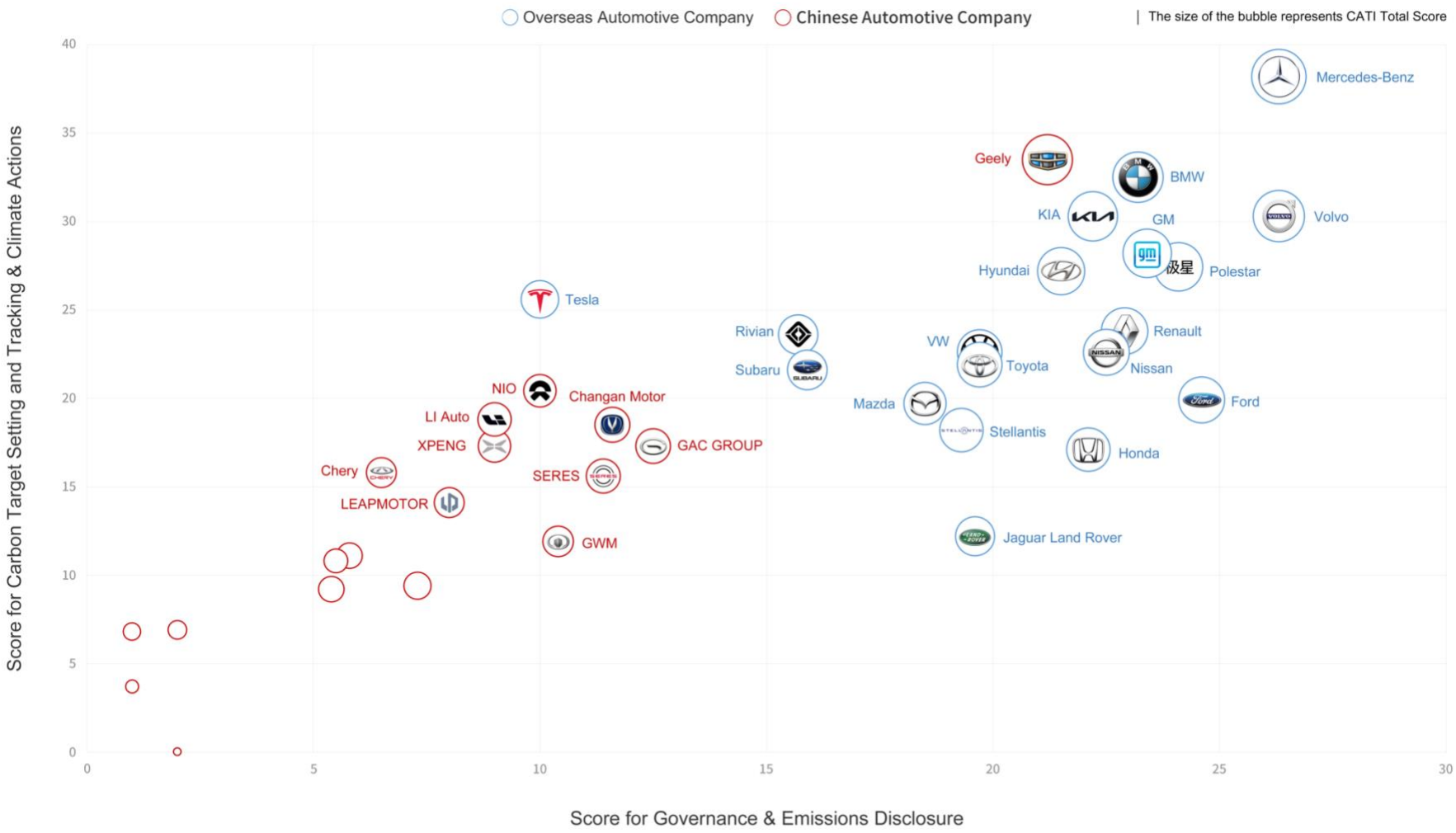


Figure 3-4-2 CATI Performance of Chinese and Overseas Automotive Companies

(3) Over 60% of Automotive Companies Initiated Steel and Aluminum Carbon Reduction Projects, but the Scale of Procurement is Insufficient to Incentivize Transition

IPE's analysis shows progress in green procurement for raw materials. 27 companies have begun to focus on the impact of supply chain emissions and have publicly disclosed employing capacity building, purchasing order, or collaborative projects to guide and motivate suppliers to reduce carbon emission. 24 companies have started collecting data from suppliers; 20 have disclosed emissions data of their supply chain. Volvo Cars, Ford, Polestar, Tesla, and Rivian have disclosed the emissions of major raw materials such as steel and aluminum or their proportion of emissions in the lifecycle.

Based on calculations, 19 automotive companies have proposed carbon neutrality targets for the lifecycle or entire value chain, with target years ranging from 2038 to 2050. 19 automotive companies disclosed emission reduction targets, including Scope 3, among which 13 companies' targets cover the supply chain (purchased goods and services). Mercedes-Benz, General Motors, Volvo Cars, Ford, BMW, Geely Auto, Rivian, and Polestar have set targets related to steel and aluminum (Table 3-4-2), explicitly proposing to procure low-carbon emission steel and aluminum materials, stipulate the recycling ratio of steel and aluminum materials, and require suppliers to use renewable energy electricity, etc.

In terms of emission reduction actions, 30 automotive companies have disclosed the development of low-carbon product designs, achieving emission reductions by reducing the weight of vehicle materials. 26 have disclosed carbon reduction actions targeting raw materials such as steel and aluminum and components (for details on the methods, actions, and progress of automotive companies in reducing emissions for steel and aluminum, see Table 3-4-3). Among these, 17 have begun exploring emission reduction actions for steel materials, including considering the recycling requirements of steel at the design stage to enhance the recyclability of steel, promoting suppliers to obtain Responsible Steel certification, encouraging suppliers to use renewable energy in the smelting process, signing green steel agreements with steel suppliers, recycling and reusing steel from scrapped vehicles and retired components, and using recycled steel materials. 21 disclosed emission reduction actions for aluminum materials, mostly focusing on the use of recycled aluminum. Mercedes-Benz, BMW and Volvo, are also

conducting research on low-carbon metallurgical technology through investment or collaboration with suppliers.

Traditional automotive companies are more inclined to adopt emission reduction measures for both steel and aluminum materials. For NEVs, the electric motor, power battery, electronic control system increases the overall vehicle weight. Reducing the weight of the car body materials, while keeping the overall vehicle weight unchanged, helps NEV accommodate larger batteries, reducing the number of times users need to charge, and increasing the driving range. Moreover, ensuring the strength and safety performance of the automobile while reducing the weight of the vehicle also helps improve the dynamic performance and reduce greenhouse gas emissions during the use phase. Therefore, NEV demand for lightweighting and often use aluminum alloys, aluminum-magnesium alloys, steel-aluminum hybrid structures, and all-aluminum structures to replace traditional steel structures (Figure 3-4-3 and 3-4-4[55]).

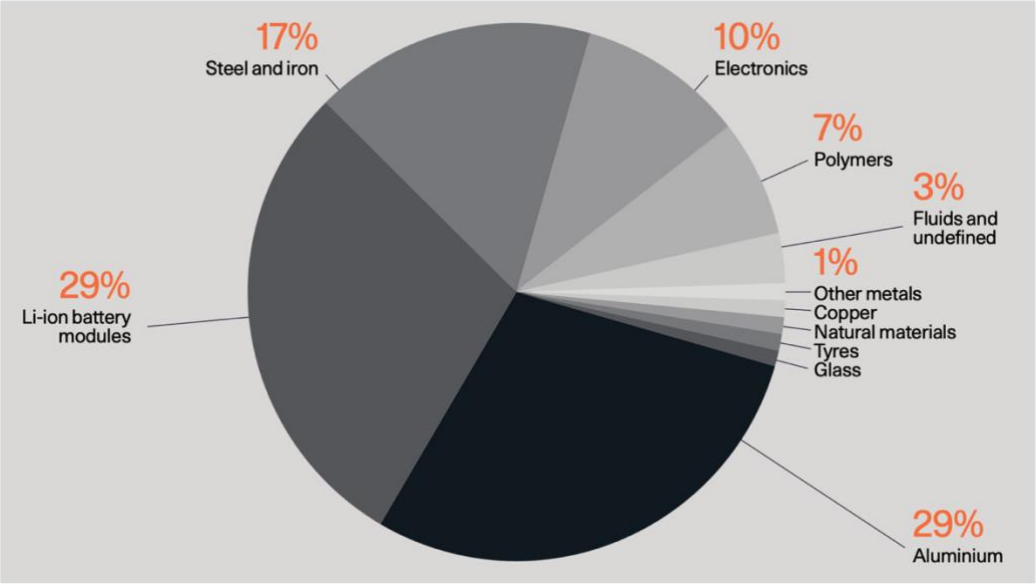


Figure 3-4-3 Proportion of Raw Material Emissions for NEV Polestar 2

[55] Polestar. Polestar 2 LCA report [EB/OL]. [2024-07-31]. https://www.polestar.com/global/news/polestar-2-lca-report/.

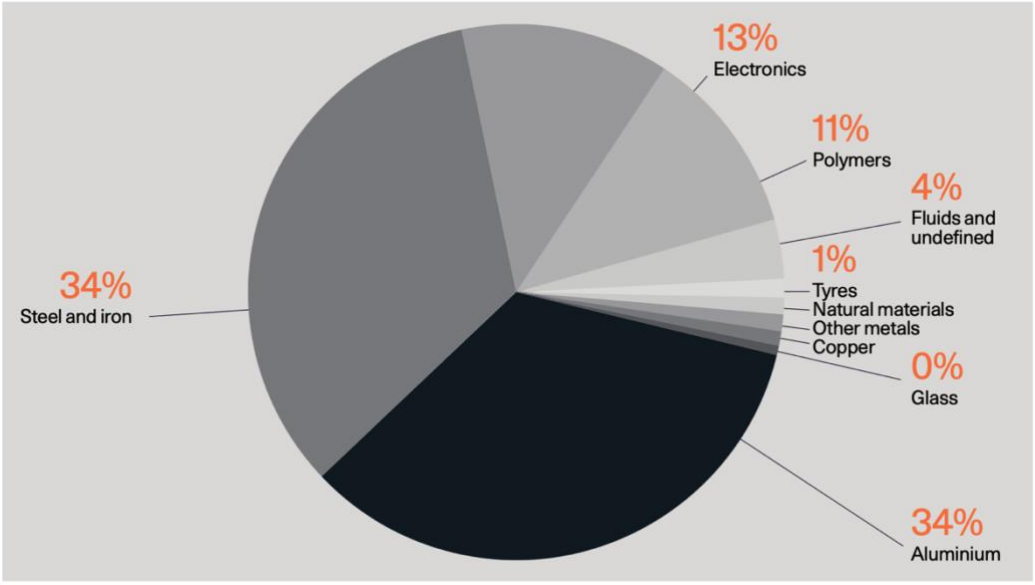


Figure 3-4-4 Proportion of Raw Material Emissions for Gasoline Car Volvo X C40

To reduce the carbon emissions of aluminum materials, the emission reduction measures disclosed by automotive companies include: promoting the increase of renewable energy usage in the aluminum smelting process, recycling aluminum materials in the production process, increasing the proportion of recycled aluminum used, and optimizing aluminum alloy melting, melt refining, and melt degassing processes. In addition to metal materials, the non-metal materials used in automobile interior parts and some exterior covering parts, especially high-performance plastics and composite materials, are also key for lightweighting. The evaluation shows that more than 80% of NEV companies have disclosed emission reduction actions targeting plastics, interior parts, etc., which is significantly higher than traditional automotive companies. However, in terms of emission reduction actions for power batteries used in pure electric vehicles, 20% of NEV companies have disclosed relevant measures, slightly lower than traditional automotive companies, highlighting that NEV companies urgently needing to shift from focusing on 'manufacturing green' to balancing 'manufacturing green' and 'green manufacturing'.

In addition, IPE found in the evaluation that automotive companies' disclosure of emission reduction projects for steel and aluminum lacks quantitative data, making it difficult for stakeholders to understand the scale of emission reduction projects and their contribution to the reduction of greenhouse gases in the supply chain. Most of the steel and aluminum emission reduction projects currently undertaken by automotive companies are still in the pilot

stage, and the effectiveness of emission reduction and the sustainability of the projects remain unclear. Therefore, although some leading automotive companies have set emission reduction targets related to steel and aluminum and have begun to focus on Scope 3 emissions, the emission reduction projects disclosed so far is insufficient to achieve their set targets. The scale of procurement for low-carbon emission steel and aluminum is limited, and insufficient to incentivize suppliers to accelerate the decarbonization process.

Table 3-4-2 Steel and Aluminum-related Targets and Progress Disclosed by Automotive Companies[56]

Automotive Company	Steel-related Targets		Aluminum-related Targets	
	Targets	Progress	Targets	Progress
Mercedes - Benz	By 2026, the carbon footprint of purchased low-carbon emission steel will be reduced by 50%-80% compared to traditional steel, gradually achieving a carbon reduction of over 95%[57]	Signed agreements with multiple steel suppliers such as H2 Green Steel, ThyssenKrupp, Salzgitter AG, and Baosteel	Mercedes-Benz AG is aiming to use aluminium in its vehicles by 2030 with a carbon footprint that is up to 90% lower than the European average	Signed a procurement agreement for low-carbon emission aluminum with Hydro
General Motors Automobile	At least 10% of the crude steel used in manufacturing the sheet steel products that GM directly purchases for our U.S., Canada and Mexico manufacturing facilities will be near-zero emissions by 2030, if prices are no more than 20% higher than current commercial prices and/or as approved by GM leadership	Sign low-emission steel procurement agreements with Nucor, U.S. Steel, and ArcelorMittal	At least 10% of the primary aluminum used in manufacturing the sheet aluminum products GM directly purchases for our U.S., Canada and Mexico manufacturing facilities will be low carbon by 2030, if prices are no more than 20% higher than current commercial prices and/or as approved by GM leadership	Not disclosed
Volvo Cars	Transition to using 50% lower emission steel by 2030, setting a clear pathway to using 100% net zero steel by 2050.	Signed an agreement with S SAB to procure net zero emission steel starting from 2026	Volvo Cars will commit to at least 10 per cent (by volume) of all our primary aluminium procured annually will be near-zero emissions primary aluminium by 2030	Require suppliers to procure from Volvo-approved aluminum smelters (these smelters

[56] Due to slight differences in the naming of low-carbon emission steel and aluminum materials in the steel and aluminum targets by automotive companies, and the lack of a unified industry standard, the table uniformly translates them as low-carbon emission steel and low-carbon emission aluminum, while retaining the original English text.

[57] This target is quoted from the Mercedes-Benz Group - China Sustainability Blue Book - 2022-2023.

Automotive Company	Steel-related Targets		Aluminum-related Targets	
	Targets	Progress	Targets	Progress
				use electricity with lower carbon emissions)
	From 2025, use 25% of recycled steel in new vehicle models	In 2023, the proportion of recycled steel used is 15%	From 2025, use 40% of recycled aluminum in new vehicle models	In 2023, the proportion of recycled aluminum used is 10%
Ford	Ford committed that at least 10% of primary aluminum and steel purchases will have near-zero carbon emissions by 2030	Signed a memorandum of understanding (non-binding) with 3 European steel suppliers	Ford committed that at least 10% of primary aluminum and steel purchases will have near-zero carbon emissions by 2030	Signed a memorandum of understanding (non-binding) with strategic aluminum suppliers
BMW	From 2025, it will use CO_2-reduced steel, which is produced using only natural gas, hydrogen and green electricity	Signed a low-carbon emission steel procurement agreement with HBIS Group, Salzgitter AG, and H2 Green Steel	From 2024, all cast aluminium wheels for BMW and MINI vehicles will be produced exclusively with green electricity	Signed over 400 contracts with wheel and aluminum suppliers, requiring them to use green electricity
Geely Auto	By 2025, T1 core suppliers will use 20% recyclable steel	Not disclosed	By 2025, T1core suppliers will use 30% recyclable aluminum	Not disclosed
Rivian	For a minimum of 70% recycled content in steel by 2033	Not disclosed	For a minimum of 70% recycled content in aluminum by 2033	Not disclosed
Polestar	Transition to using 50% lower emission steel by 2030, setting a clear pathway to using 100% net zero steel by 2050	Not disclosed	Not disclosed	Not disclosed

Table 3-4-3 Steel and Aluminum Emission Reduction Actions Disclosed by Automotive Companies

Raw Material	Emission Reduction Method		Automotive Company	Scale and Progress
Steel	Enhance steel recyclability	Consider recyclability at the design stage	General Motors, Polestar, BMW, Mazda	Not disclosed
	Responsible Steel Certification	Require steel suppliers to obtain Responsible Steel certification	Mercedes-Benz	Not disclosed
	Low-carbon smelting	Require steel suppliers to use renewable energy electricity	Polestar	Not disclosed
			BMW	We have established a supply chain system for low-carbon emission steel and successfully promoted the use of renewable energy electricity by over 40% of local suppliers.
		Sign a low-carbon emission steel procurement agreement	Mercedes-Benz	Sign low-carbon emission steel procurement agreements with H2 Green Steel, ThyssenKrupp Steel, Salzgitter, Arvedi, SSAB, Steel Dynamics, and Baosteel Co., Ltd., to supply low-carbon emission steel to Mercedes-Benz factories starting from 2025-2026.
			BAIC Group	Beijing Mercedes-Benz signs a low-carbon emission steel procurement agreement with Baosteel.
			General Motors	Sign low-emission steel procurement agreements with Nucor, U.S. Steel, and ArcelorMittal.
			Nissan	In collaboration with Kobe Steel, starting from January 2023, green steel will be used in Nissan vehicles.
			BMW	In collaboration with HBIS Group, jointly developing low-carbon emission steel. Compared to traditional steel, the production process of these low-carbon automotive steels will generate 10% to 30% less carbon dioxide. Starting from 2026, BMW's Shenyang production base will use this low-carbon emission steel in the mass

Raw Material	Emission Reduction Method		Automotive Company	Scale and Progress
				production of vehicles, expecting to reduce approximately 230,000 tCO2e annually.
			Chery	Signed a memorandum of cooperation with Baosteel to procure low-carbon emission steel with a carbon reduction of 30% to 80% starting from 2024.
		Use of low-carbon emission steel (specific processes not mentioned)	Volkswagen Group	Not disclosed
	Use of recycled steel materials[58]	Recycling and reuse of steel from scrapped vehicles/retired components	Ford	In 2023, we reclaimed 4,077 metric tons of steel from transmission material. We also reclaimed 1,128 metric tons of cast iron, 534 metric tons of steel from engine material.
		Use of recycled steel materials (source of recycled steel materials not mentioned)	BMW	BMW China recycled 48,160 tons of scrap steel in 2022.
			Volvo Cars	In 2023, the proportion of recycled steel used in vehicles was 15%.
			Stellantis	Already up to 30% of the steel used by Stellantis comes from scraps.
			Polestar	Polestar 4 used 12% recycled steel.

[58]Definition of recycled steel raw material: Recycled materials that have been sorted and processed can be used as furnace charge products that can be directly used as iron resources in the furnace (Recycled Steel Raw Material GB/T 39733-2020). Since automotive companies use different names such as recycled steel, scrap steel, recovered steel, and circular steel to refer to furnace charge products that can be directly used as iron resources after recycling, this report uniformly refers to them as recycled steel raw materials.

Raw Material	Emission Reduction Method		Automotive Company	Scale and Progress
			Renault	Among the materials used in the plants in the Europe and North Africa Regions, it is estimated that the portion of recycled steel materials ranges from 17 % for flat steel to more than 90 % for steel bars and cast iron.
			Mazda	In the fiscal year 2023, 21,251 tons of steel scrap were used.
			Nissan, Volkswagen Group, Rivian, General Motors, Hyundai, Geely Auto, Kia	Not disclosed
Aluminum	Enhancing Aluminum Recyclability	Consideration of recyclability during the design phase	Polestar	For the Polestar 6 LA Concept Edition to be released in 2026
			NIO	NIO's entire vehicle lineup achieves a recyclability rate of 95% and a reuse rate of 85%, providing a foundation for creating a circular model of 'scrap vehicle - disassembly - classified recycling - new vehicle.'
			General Motors, Mazda, BMW, Ideal Auto	Not disclosed
	Aluminium Stewardship Initiative (ASI) Certification	Require aluminum suppliers to obtain ASI certification	Mercedes-Benz, Tesla	Not disclosed
	Low-carbon smelting/casting	Require aluminum suppliers to use renewable energy electricity	BMW	100% of BMW China's aluminum ingot suppliers use renewable energy electricity. From 2024, BMW and MINI brands will adopt cast aluminum wheels produced with 100% green energy, which can reduce up to 500,000 tCO2e annually on the supply chain side.
			Polestar, Nissan, Seres	Not disclosed

Raw Material	Emission Reduction Method		Automotive Company	Scale and Progress
	Use recycled aluminum[59]	Recycle and reuse aluminum and aluminum alloy waste from the production process	Ford	We currently recycle up to 20 million pounds of aluminum each month at our Dearborn Stamping, Kentucky Truck and Buffalo Stamping facilities. This represents approximately 25% of our aluminum sheet coil purchases.
			Volvo Cars	During 2023 we also introduced closed-loop recycling systems for aluminium scrap at our factories in Taizhou and Chengdu, China.
			Polestar	Polestar 4 uses 18% recycled aluminium.
			Volkswagen Group	The process itself and the resultant net CO% savings of more than 633,881 metric tons of CO% since 2017 have been verified by independent third parties.
			Renault	Among the materials used in the plants in the Europe and North Africa Regions, it is nearly 100 % for aluminum foundries and secondary smelting and nearly 40 % for pressed aluminum parts manufactured internally.
			NIO	Small-scale 'OEM - Aluminum Plant' Waste Aluminum Recycling Pilot Project
			Li Auto	In 2022, Li Auto actively promoted the closed-loop recycling of aluminum sheet stamping waste at its manufacturing base, reducing carbon emissions from aluminum sheet material usage by more than 50%.
			Xpeng Motors	The stamping scraps from the original production line of the factory are 100% recycled, and after melting and rolling, aluminum

[59] Definition of recycled aluminum: Aluminum waste that has been sorted and recovered for use in recycled aluminum and aluminum alloys (Terminology for Aluminum and Aluminum Alloys Part 4: Recycled Aluminum GB/T 8005.4-2022).

Raw Material	Emission Reduction Method		Automotive Company	Scale and Progress
				sheets with equivalent performance are developed and reapplied to automobiles.
			Seres	Some aluminum alloy part scraps and sprues are recycled and rated as 'recycled aluminum.' It is used in a downgraded manner to replace some 'primary aluminum,' maximizing the carbon reduction benefits of aluminum materials.
		Recycling and reuse of aluminum materials from scrapped vehicles/retired components/retired battery packs	Ford	In 2023, we reclaimed 3,058 metric tons of aluminum from transmission material. We also reclaimed 741 metric tons of aluminum from engine material.
			NIO	Closed-loop management of aluminum materials in power battery packs, through recycling battery pack casings and remelting allocation, has obtained approximately 600 tons of die-cast aluminum alloy materials.
		Use of recycled aluminum raw materials (source of raw materials not mentioned)	Volvo Cars	In 2023, the proportion of recycled aluminum used was 10%.
			BMW	BMW China recycled 14,536 tons of scrap aluminum in 2022. In 2023, the new generation MINI Countryman will be the first to use light alloy wheels made of 70% recycled aluminum materials.
			Honda, Nissan, Rivian, General Motors, Geely Auto, Changan Automobile, Subaru, Tesla, Kia	Not disclosed

5. Case Studies

(1) Mercedes-Benz Collaborates with Suppliers to Reduce Steel and Aluminum Emissions

Mercedes-Benz leads in steel and aluminum emission reduction actions. Its publicly disclosed targets show that Mercedes plans to achieve carbon neutrality for the lifecycle of new vehicles by 2039 and has set a goal to reduce the emissions from the value chain of new vehicles by at least 50% by 2030 (Figure 3-5-1). To achieve its goals, Mercedes-Benz will focus on carbon-intensive materials and components, such as steel, aluminum, plastics, and batteries. The company is collaborating with suppliers from different countries and regions to explore the application of low-carbon emission steel and aluminum, and by securing some green resources in advance, it aims to gradually reduce the carbon footprint of raw materials in the future. As of 2023, 84% of suppliers have committed to providing Mercedes-Benz with carbon-neutral materials by 2039.

Target	Target horizon	Status as of 2023
Climate protection		
A fleet of new Mercedes-Benz vehicles that is net carbon-neutral along all stages of the value chain	2039	According to plan
Climate protection for vehicles		
Reduction of the CO_2 emissions per car in the new vehicle fleet up to 50% along all stages of the value chain[1,2]	By the end of the decade	According to plan
Climate protection in the supply chain		
All production materials procured by Mercedes-Benz Cars and Mercedes-Benz Vans are net carbon-neutral	2039	84% of suppliers[5]

1 The pace of transformation is determined by market conditions and customers.
2 Compared to 2020 (value chain stages: procured goods, production, logistics, fuel and energy generation, driving operation, disassembly and treatment processes).

Figure 3-5-1 Mercedes-Benz Climate Goals and 2023 Progress[60] [61]

According to Mercedes-Benz's calculations, carbon dioxide emissions from steel production account for 20% of total emissions during the production of electric vehicles. Mercedes-Benz is collaborating with multiple global steel suppliers to support its low-carbon transition (Table 3-5-1). In Europe, Mercedes-Benz plans to purchase over 200,000 tons of low-

[60] Mercedes-Benz. Sustainability Report 2023[EB/OL]. [2024-05-18]. https://group.mercedes-benz.com/responsibility/sustainability/sustainability-report.html.

[61] Mercedes-Benz. Mercedes-Benz Group China Sustainability Blue Book - 2022-2023 [EB/OL]. [2024-07-31]. https://www.mercedes-benz.com.cn/csr.html.

carbon emission steel annually from European suppliers by 2030 for its stamping plants. It has already signed low-carbon procurement agreements or letters of intent with several steel companies, including H2 Green Steel, Thyssenkrupp Steel, Salzgitter, Arvedi, and Voestalpine. In the United States, Mercedes-Benz collaborates with Steel Dynamics, Inc. to purchase over 50,000 tons of low-carbon emission steel annually. In China, Beijing Benz has reached a collaboration with Baosteel to procure low-carbon emission steel with significantly reduced carbon emission intensity starting from 2023. The plan is to utilize Baosteel's hydrogen-based shaft furnace-electric furnace technology path from 2026 onwards, reducing the carbon footprint of low-carbon emission steel by 50% to 80% compared to traditional steel, and gradually achieving more than 95% carbon reduction.

Table 3-5-1 Mercedes-Benz Low-carbon Emission Steel Collaboration[62]

Country	Steel Supplier	Status	Cooperation	Time to Provide Low-carbon Emission Steel
Sweden	H2 Green Steel	Sign the contract	Supply of around 50,000 tonnes of virtually CO_2-free steel per year for the company' s own European press plants	2025
		Sign a letter of intent for cooperation	Joint development of a sustainable steel supply chain in North America	/
	SSAB	Already purchased	Hydrogen produced from water and fossil-free energy, hydrogen-based direct reduction of iron ore	Pilot supply in 2022, formal supply in 2026
Germany	Thyssenkrupp Steel	Sign a letter of intent	The two companies have agreed that the entire production process for CO_2-reduced steel products will be carried out almost CO_2-free in future, using direct reduction systems in conjunction with innovative smelting units – subject to the availability of green hydrogen	2026
	Salzgitter Flachstahl GmbH	Already purchased	It is produced from 100% scrap in an electric arc furnace (EAF). This allows CO_2 emissions to be reduced by more	Provided

[62] The content in the table is organized by IPE based on the disclosures in the Mercedes-Benz Sustainability Report.

			than 60% compared to conventional blast furnace production	
		Sign a letter of intent	Purchase products manufactured using green electricity	Not Mentioned
		Plan	Supply the Mercedes-Benz Cars plants with CO_2-reduced steel, which is produced using a combination of direct reduction processes and EAF	2026
Italy	Arvedi	Already purchased	Arvedi has partly converted its production to renewable energies	Provided
Austria	Voestalpine	Sign a letter of intent	Voestalpine plans to recycle scrap steel from the stamping workshop of its German plant by rail, using an electric arc furnace + scrap steel to produce low-carbon emission steel	2027
United States	Steel Dynamics, Inc.	Already purchased	The steel supplied by Steel Dynamics, Inc. is produced in an EAF that runs on 100% green electricity. In addition, the flat steel has a scrap content of at least 70% and is used in all Mercedes-Benz models produced in Tuscaloosa (USA).	September 2023
China	Baosteel Co., Ltd.	Already purchased	With the help of hydrogen-based shaft furnace-electric furnace technology, the carbon footprint of low-carbon emission steel purchased in 2026 is planned to be reduced by 50%-80% compared to traditional steel, and gradually reach more than 95%	2023

In terms of aluminum emission reduction, Mercedes-Benz has engaged in dialogues with multiple suppliers (Table 3-5-2), planning to reduce the carbon emissions of aluminum by promoting the use of renewable energy electricity among suppliers and increasing the recycling rate of the aluminum supply chain.

In 2022, Mercedes-Benz established a partnership with aluminum manufacturer Hydro. Starting from 2023, Hydro will supply Mercedes-Benz's German plants with aluminum that reduces carbon emissions by 70% compared to traditional processes, through the use of renewable energy, improved energy efficiency, and recycled aluminum. Based on this collaboration, Mercedes-Benz is aiming to use aluminium in its vehicles by 2030 with a carbon footprint that is up to 90% lower than the European average. Furthermore, Mercedes-Benz

continues to promote the increase of renewable energy usage among European aluminum suppliers and plans to have at least a third of the primary aluminium used in Europe for future electric models is to be produced using renewable energies.

Table 3-5-2 Mercedes-Benz Low-Carbon Emission Aluminum Collaboration[63]

Country	Aluminum Supplier	Status	Cooperation	Time to Provide Low-Carbon Emission Aluminum
Norway	Hydro	Already purchased	Using renewable energy electricity + improving energy efficiency + no less than 25% of post-consumer recycled aluminum materials, reducing aluminum carbon emissions by 7 0% compared to the European average level.	June 2023
China	Yunnan Aluminum	Signed a Memorandum of Understanding	Procurement of aluminum materials with a low carbon footprint certified by the ASI Aluminum Stewardship Initiative Chain of Custody (CoC) standard, reducing aluminum carbon emissions by 55%-60% compared to the industry average.	Not Mentioned

In China, Mercedes-Benz has signed a memorandum of understanding with Yunnan Aluminum Co., Ltd., planning to increase the application of low carbon footprint aluminum certified by the Aluminum Stewardship Initiative (ASI) Chain of Custody (CoC) standard in the production line, and gradually extend it to the production process of other components[64]. Mercedes-Benz indicates that the carbon footprint of this low-carbon emission aluminum material can be reduced by 55% to 60% compared to the industry average. Mercedes-Benz also disclosed that it has engaged in discussions with multiple aluminum material suppliers and hopes to collaborate with aluminum suppliers in the future to further reduce the carbon emissions of aluminum materials and continuously optimize the recycling mechanism of the aluminum supply chain.

[63] The content in the table is organized by IPE based on the disclosures in the Mercedes-Benz Sustainability Report.

[64] ASI. ASI Chain of Custody (CoC) Standard – Guidance [EB/OL]. [2024-05-18]. https://aluminium-stewardship.org/wp-content/uploads/2023/04/4.CoC-Guidance 监管链标准指南 V2.1.pdf.

In spite of these, Mercedes-Benz rarely disclose specific emission reductions of the low-carbon products, making it difficult for stakeholders to assess the actual reduction effects. Suppliers providing low-carbon materials to Mercedes-Benz in Table 3-5-1 and Table 3-5-2 have also not disclosed the carbon footprint of their low-carbon products. Due to the limited access and high costs of renewable energy, suppliers usually choose to use energy attribute certificates to offset the emissions from purchased energy. When automotive companies commit to using low-carbon emission steel and aluminum materials, they often purchase carbon credits to offset the remaining carbon emissions in the products. This brings up the issues of emission allocation, carbon credit ownership and double counting. Therefore, Mercedes-Benz needs to fully disclose supply chain emission information to reduce the risk of 'greenwashing.'

In addition, the scope 3 data disclosed in the Mercedes-Benz 2023 Sustainability Report (Figure 3-5-2) shows that during the fiscal years 2021 to 2023, the emissions generated from the procurement of goods and services per vehicle have shown an increasing trend year by year. Although most of Mercedes-Benz's low-carbon emission steel, aluminum, and other products have been supplied since 2023, the company should further calculate and disclose the potential emission reduction effects of low-carbon materials based on low-carbon procurement. It should also promote steel and aluminum suppliers to calculate and disclose the carbon footprint of low-carbon products, and disclose quantitative data to demonstrate to stakeholders the emission reduction effectiveness of using low-carbon emission steel and aluminum materials.

CO_2 emissions Scope 1, Scope 2 and selected Scope 3 categories worldwide for Mercedes-Benz Cars

GRI 305-1/-2/-3

	2023[1,10]		2022[10]		2021[10]	
Activities (Scope 3 category as per GHG Protocol)	**specific** CO_2 in t/car	**absolute** CO_2 in million t	**specific** CO_2 in t/car	**absolute** CO_2 in million t	**specific** CO_2 in t/car	**absolute** CO_2 in million t
Purchased goods (3.1)[2]	**9.0**	**18.0**	8.7	17.7	8.4	17
Logistics[3]	**1.0**	**2.0**	1.1	2.2	1.1	2.2
Upstream logistics (3.4)	**0.35**	**0.7**	-	-	-	-
Downstream logistics (3.9)	**0.65**	**1.3**	-	-	-	-
Waste (3.5)[4]	**0.1**	**0.2**	-	-	-	-
Business travel (3.6)[5]	**0.03**	**0.07**	0.028	0.057	0.009	0.019
Employee traffic (3.7)[6]	**0.05**	**0.11**	0.052	0.107	0.053	0.107
Use phase of our products – well-to-tank (3.11)[7]	**6.6**	**13.1**	6.6	13.6	6.3	12.7
Use phase of our products – tank-to-wheel (3.11)[8]	**29.1**	**58.2**	30.7	62.7	32.2	65.5
Dismantling and treatment process (3.12)[9]	**0.4**	**0.8**	0.4	0.8	0.4	0.8
Scope 1, 2						
Manufacture	**0.3**	**0.4**	0.3	0.4	0.7	0.7
Total	**46.5**	**93.0**	**47.9**	**97.8**	**49.1**	**99.2**

Figure 3-5-2 Mercedes-Benz 2021-2023 Fiscal Year Scope 3 Emissions[65]

[65] Mercedes-Benz. Sustainability Report 2023[EB/OL]. [2024-05-18]. https://group.mercedes-benz.com/responsibility/sustainability/sustainability-report.html.

(2) Polestar Advances Aluminum Emission Reduction Based on Carbon Footprint Analysis

Polestar is one of the six automotive companies with the highest score in product carbon footprint disclosure. It not only disclosed the product carbon footprint of all models on sale but also revealed the emission proportions of major raw materials such as steel and aluminum.

Its "Polestar 0 project" commits to create a climate-neutral car by 2030, by reducing emissions throughout supply chain and production[66]. Through Life Cycle Analysis (LCA), Polestar identified and pointed out in the Polestar 2 LCA Report released in 2021 that aluminum and lithium battery materials are the largest sources of emissions, accounting for 29% and 29% of its product carbon footprint respectively, while steel materials account for 17% of emissions (Figure 3-5-3), and set emission reduction pathways based on different materials (Figure 3-5-4).

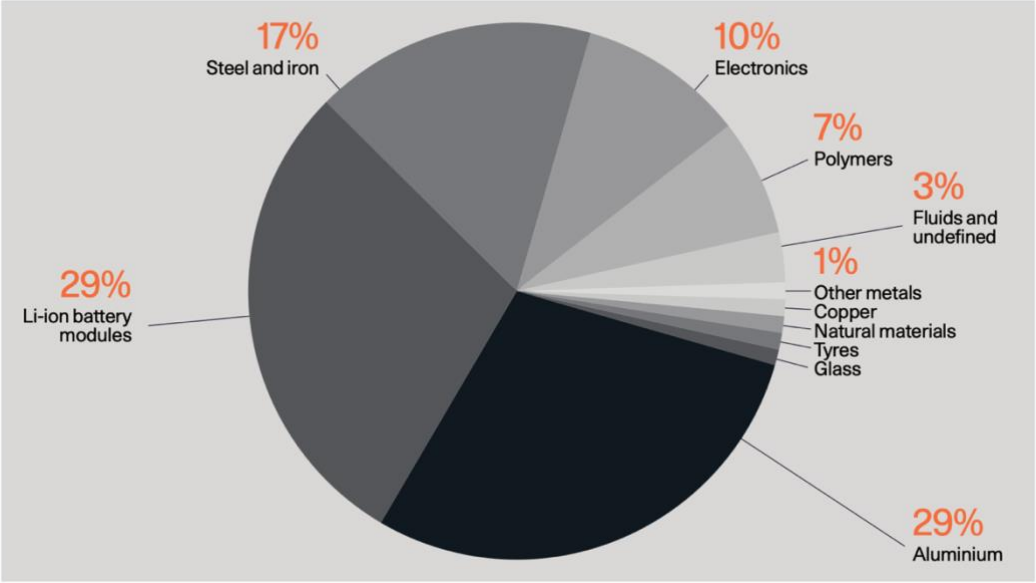


Figure 3-5-3 Contribution from different material groups to the carbon footprint from "Materials production and refining" for Polestar 2

[66] Polestar. Striving for Zero Emissions: Polestar 2030 Climate Neutral Car Plan [EB/OL]. [2024-07-31]. https://www.polestar.cn/zh-cn/news/striving-for-zero-the-2030-climate-neutral-car-plan/.

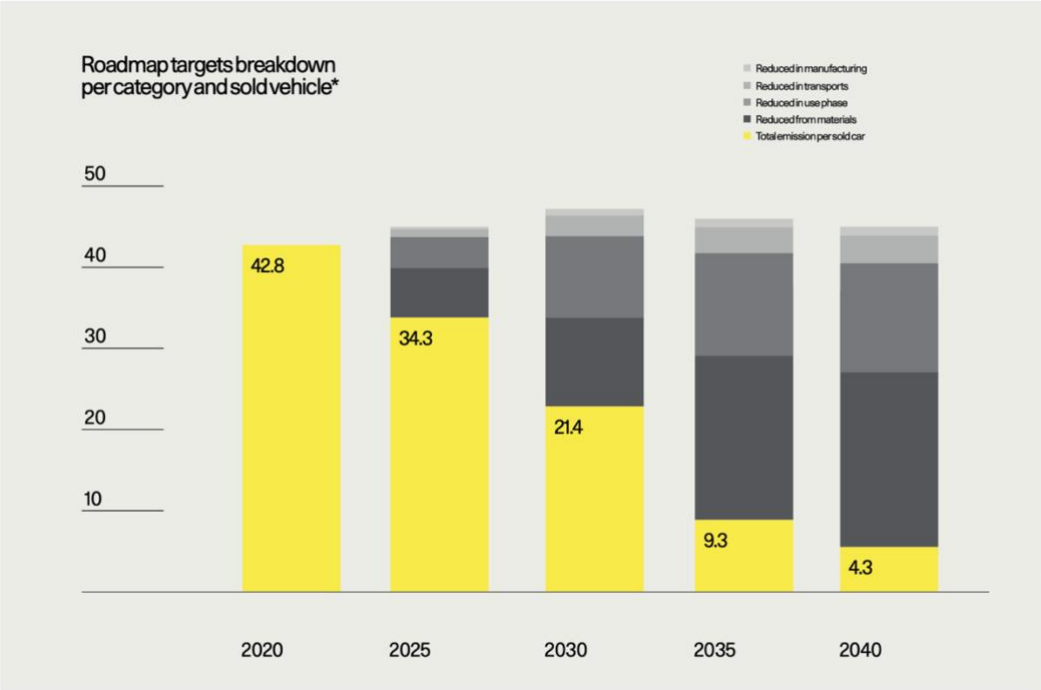


Figure 3 - 5 - 4 Polestar Material and Sold Vehicles Emission Reduction Pathway[67]

To achieve the maximum emission reduction potential of aluminum materials, Polestar has taken the following measures at the stages of design, aluminum supply chain, and vehicle manufacturing:

1. Enhancing aluminum recyclability at the design stage: To improve recyclability at the end of the vehicle's life, in 2022, Polestar presented a potential solution for distinguishing between different aluminium grades. All of the aluminium in the concept was labelled and colour-coded to provide recyclers with a visual method of differentiating between different grades, which would enable them to recycle the materials in separate streams. This would lead to a closed material loop in which aluminium is recycled back to its original quality.
2. Use of renewable energy on the aluminum supply side: Over 70% of carbon emissions in aluminum smelting come from the electricity consumption of the electrolytic aluminum process, so Polestar is promoting aluminum suppliers to increase the proportion of renewable energy usage. In the Polestar 2, both the battery aluminum

[67] Polestar. Polestar 2023 Sustainability Report [EB/OL]. [2024-05-16]. https://www.polestar.cn/zh-cn/sustainability/reports/.

tray and the 19-inch wheels are supplied by aluminum suppliers using renewable energy, reducing carbon emissions by 1.2 tons per vehicle. In the production process of the Polestar 3, 81% of the aluminum production process already uses 100% renewable energy electricity. Polestar 4 further increases the proportion of hydropower usage in the aluminum smelting process.

3. Reducing aluminum usage at the manufacturing and using recycled aluminum: Polestar's R&D center continues to promote the design of lightweight materials. Publicly disclosed data shows that the Polestar 4 dual-motor long-range version, reduces aluminum usage by 69 kilograms per vehicle compared to the same version of the 2021 Polestar 2. Moreover, Polestar considers increasing the proportion of recycled materials as a key measure to reduce the consumption of virgin materials, with the Polestar 4 using a recycled aluminum proportion of up to 18%.

An analysis by IPE shows that the 'cradle-to-gate' product carbon footprint of Polestar 2 LRDM-MY24 and the carbon intensity per kilogram of steel and aluminum material have both shown a downward trend compared to Polestar 2 LRDM-MY21. In the Polestar 4 LRDM-MY25, the emission proportion of aluminum material decreased to 24%, with the 'cradle-to-gate' carbon footprint reduced by 4.7 tCO_2e, and the carbon intensity per unit of aluminum material decreased by 0.0034 tCO_2e (Table 3-5-3).

Table 3-5-3 Steel and Aluminum Emission Intensity between Polestar 2 and Polestar 4

	Polestar 2 LRDM-MY21	**Polestar 2 LRDM-MY24**	**Polestar 4 LRDM-MY25**
"Cradle to Gate" Carbon Footprint (tCO_2e)	26.1	23.1	21.4
Proportion of Aluminum Emissions	29%**	26%	24%
Aluminum Weight (kg/vehicle)	391	347	322
Emission Intensity per Unit (tCO_2e/kg Aluminum)*	**0.0194**	**0.0173**	**0.0160**
Proportion of Steel Emissions	17%	19%	20%
Steel Weight (kg/vehicle)	880	908	806
Emission Intensity per Unit (tCO_2e/kg Steel)*	**0.0050**	**0.0048**	**0.0053**

* Calculated by IPE based on data disclosed in Polestar's reports. All other data are from Polestar's publicly disclosed information.

**This data comes from the 2021 Polestar 2 LCA report, representing the average emissions of aluminum material for Polestar 2MY21.

Nevertheless, the steel carbon intensity of Polestar 4 LRDM-MY25 shows a slight increase compared to Polestar 2 LRDM-MY24. According to the Polestar product carbon footprint analysis, the emission reduction potential of steel is also crucial for long-term emission reduction in the vehicle product. Therefore, IPE believes that Polestar also needs to collaborate with steel suppliers to implement emission reduction projects to fulfill its commitment to net-zero products.

(3) Geely Sets Supply Chain Carbon Reduction Target, Empowering Suppliers to Conduct Carbon Accounting

As the only Chinese company entering TOP10 in the evaluation and the only one to disclose steel and aluminum emission reduction targets, Geely Auto has set a goal to reduce carbon emissions per vehicle by 25% over the entire lifecycle by 2025 compared to 2020. According to Geely Auto's calculations, supply chain emissions are the second largest source of emissions in the vehicle lifecycle, accounting for 21.6% of emissions in 2023. Steel, aluminum, and power batteries are the main sources of carbon emissions for its pure electric vehicle materials (Figure 3-5-5).

To achieve emission reduction targets, Geely Auto has initiated supply chain emission reductions by promoting the use of renewable energy electricity among suppliers and using recycled materials, setting an 'action plan' to achieve '100% renewable electricity usage by core tier-one suppliers by 2025, and using 20% recycled steel, 30% recycled aluminum, and 25% recycled plastic.'[68]

[68] Geely Auto. 2023 Environmental, Social, and Governance Report [EB/OL]. [2024-07-31]. http://www.geelyauto.com.hk/en/environmental-social-and-corporate-governance/.

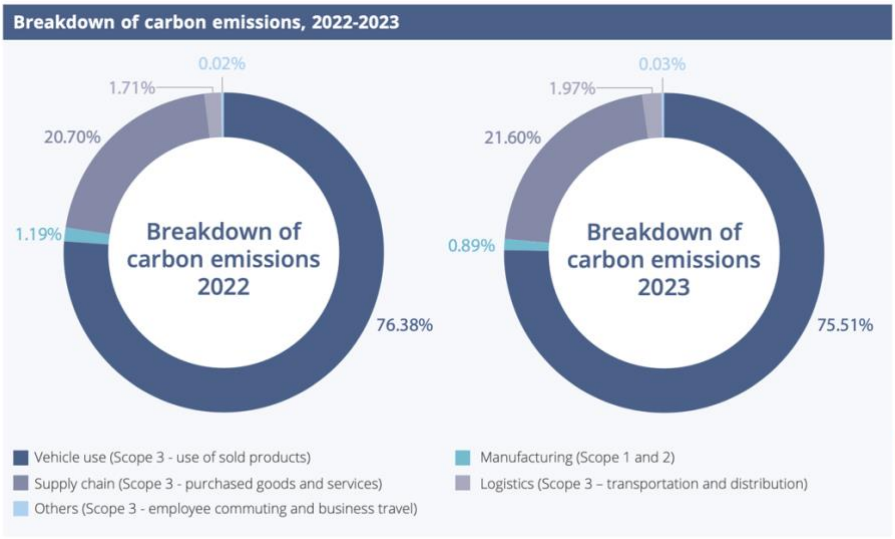
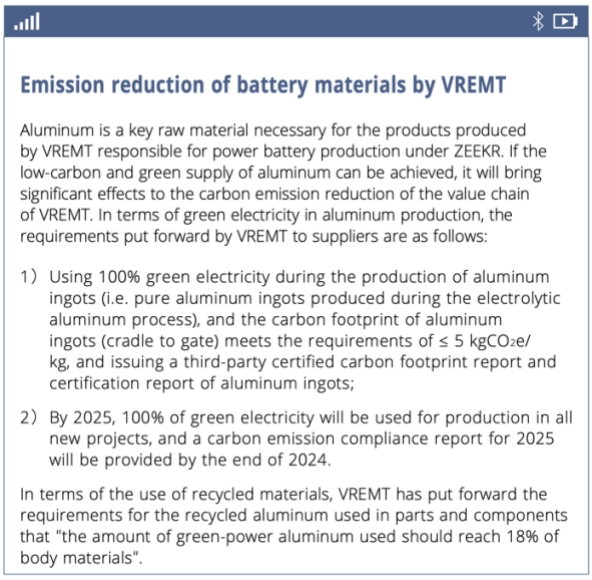


Figure 3-5-5 Geely Auto 2022-2023 Greenhouse Gas Emissions Breakdown[69]

Geely Auto has also increased the proportion of green electricity usage in supplier admission reviews and performance evaluations, encouraging suppliers to use recycled materials and guiding them to establish green procurement mechanisms. Under its promotion, battery supplier VREMT has initiated low-carbon procurement actions, referencing Geely Auto's emission reduction path, and has set clear requirements for aluminum ingot suppliers to use renewable energy electricity and product carbon footprint (Figure 3-5-6).



Emission reduction of battery materials by VREMT

Aluminum is a key raw material necessary for the products produced by VREMT responsible for power battery production under ZEEKR. If the low-carbon and green supply of aluminum can be achieved, it will bring significant effects to the carbon emission reduction of the value chain of VREMT. In terms of green electricity in aluminum production, the requirements put forward by VREMT to suppliers are as follows:

1) Using 100% green electricity during the production of aluminum ingots (i.e. pure aluminum ingots produced during the electrolytic aluminum process), and the carbon footprint of aluminum ingots (cradle to gate) meets the requirements of ≤ 5 $kgCO_2e$/kg, and issuing a third-party certified carbon footprint report and certification report of aluminum ingots;

2) By 2025, 100% of green electricity will be used for production in all new projects, and a carbon emission compliance report for 2025 will be provided by the end of 2024.

In terms of the use of recycled materials, VREMT has put forward the requirements for the recycled aluminum used in parts and components that "the amount of green-power aluminum used should reach 18% of body materials".

Figure 3-5-6 Geely Auto Supplier VREMT Low-carbon Emission Aluminum Procurement Requirements

[69] Geely Automobile Holdings Limited. Geely Auto: 2023 Environmental, Social, and Governance Report [EB/OL]. [2024-05-13]. http://static.cninfo.com.cn/finalpage/2024-04-26/1219845503.PDF.

In addition to requiring suppliers to adopt low-carbon procurement practices, Geely Auto has developed the JITAN Cloud digital carbon management platform to enhance suppliers' greenhouse gas accounting capabilities. By leveraging T1 suppliers, the company's carbon management requirements are extended to upstream suppliers. Through data collection, it assists suppliers in formulating emission reduction plans. Geely Auto's 2023 ESG report indicates that 160 T1 suppliers and 67 T2 suppliers are currently using JITAN Cloud to submit product carbon footprint data. However, Geely Auto has not disclosed emissions data for its supply chain under Scope 3.

On the first National Ecology Day （August 15, 2023）, the Ministry of Industry and Information Technology Center for International Economic and Technological Cooperation launches the "Green Supply Chain Corporate Assisting Program". As a pro bono activity, the Program aims to assist companies to build and improve green supply chain management systems, form a collaborative low-carbon development mode across large, medium, and small companies in the supply chain, and enhance supply chain resilience. In September 2023, the Program visited the Geely Auto Research Institute where in-depth exchanges on improving green supply chain management was conducted. IPE was invited along with green supply chain experts, industry experts, and enterprise representatives, such as the China Environmental United Certification Center and China Automotive Data Co., Ltd.

Figure 3-5-7 Green Supply Chain Corporate Assisting Program held in Geely Auto

In 2023, as one of the first Chinese automotive companies to obtain the Environmental Product Declaration (EPD) certification for automotive products, Geely disclosed the product carbon footprint data of a plug-in hybrid vehicle, the 'Lynk & Co 01' (Figure 3-5-8). According to the EPD report, the 'Lynk & Co 01' has a 'cradle-to-grave' carbon footprint of 0.201 kg CO_2e per kilometer over a lifecycle mileage of 150,000 kilometers, with raw material production emissions accounting for 0.0913 kg CO_2e, 45% of its lifecycle footprint. The carbon footprint of Geely's Lynk & Co 01 is significantly lower than the average carbon footprint of compact SUV plug-in hybrid vehicles displayed on the China Automobile industry chain carbon publicity platform (CPP) (0.237 kgCO_2e/per kilometer). Although the EPD report of discloses that the vehicle seats use post-consumer PET material ECONYL® made from recycled fishing nets and other waste, it does not disclose the emission reduction work and progress related to steel, aluminum, and battery materials, nor does it break down the emission data for the lifecycle stages of steel, aluminum, and battery materials.

Geely Automobile Research Institute (Ningbo) Co., Ltd

Lynk & Co 01 plug-in hybrid electric vehicle

Carbon footprint

0.201 kgCO_2e

Update at: 2025-01-09 (UTC+8)

Basic information

Category

Unit
km

Methodology
EPD

Year
2022

Source
The International EPD System

https://www.environdec.com/library/epd11540

Functional Unit/Declared Unit
Transport of 1 passenger for 1 km through the lifetime (150,000km) of the passenger car.

Functional unit — The functional unit defines the qualitative and quantitative aspects of the function(s) and/or service(s) provided by the product being evaluated. The functional unit definition answers the questions "what?", "how much?", "how well?", and "for how long?".

(Quote from The EU Product Environmental Footprint (PEF) Methodology)

System Boundary
Cradle to Grave

Manufacturing Location
China-Zhejiang-Ningbo

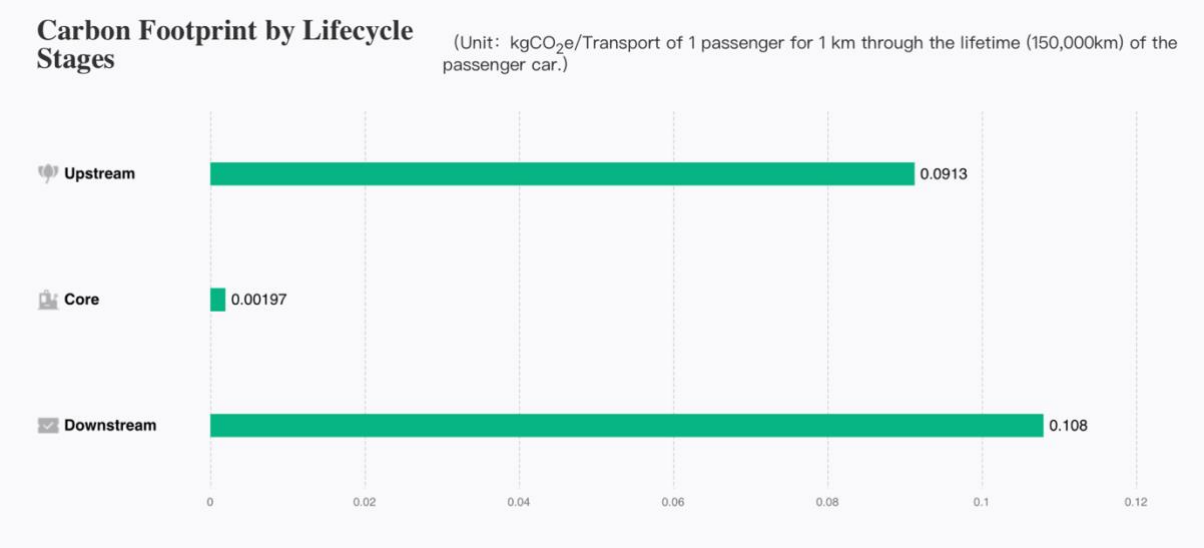


Figure 3-5-8 'Lynk & Co 01' Product Carbon Footprint[70]

In view of this, the IPE believes that Geely should further disclose the annual emissions data of the supply chain, demonstrate to stakeholders the progress of the company's implementation of climate commitments, and, on the basis of empowering suppliers to conduct calculations, promote the disclosure of greenhouse gas emissions data and carbon footprint. In addition, Geely should further clarify the definitions and requirements of materials such as recyclable steel, recyclable aluminum, renewable steel, and renewable aluminum in its proposed supply chain targets, so that suppliers can clearly understand and implement its procurement requirements.

[70] This image is from the IPE website's Product Carbon Footprint Disclosure and Catalogue, with data sourced from the 'Lynk & Co 01' EPD Report.

Chapter IV Automotive-Steel and Aluminum Green Supply Chain Collaborative Carbon Reduction Challenges and Opportunities

1. Major Challenges

From the analysis above, it is evident that although some automotive companies have begun to explore emission reduction actions targeting steel and aluminum production, collaboration with steel and aluminum suppliers is generally in the initial or pilot stage. No automotive company has disclosed emission reduction results, and some automotive companies remain in a wait-and-see state. To understand the reasons, IPE conducted interviews with automotive companies, auto parts companies, and steel companies, and identified several challenges and obstacles.

(1) Measurement Data is Difficult to Obtain, Emission Factors Need Improvement

The evaluation results of the Automotive Industry CATI Index show that there is still room for improvement in climate information disclosure. Only a few leading companies have disclosed supply chain targets or procurement requirements, as well as the quantitative results of emission reduction projects. The steel and aluminum industries' climate disclosure are even more insufficient. The evaluation conducted by IPE on steel and aluminum smelting companies shows that the disclosure rate of scope 1&2 carbon emissions data for steel companies is only 60%, and for aluminum smelting companies, it is less than 40%. Apart from the insufficient public availability of carbon data from steel and aluminum companies, the number of upstream suppliers in the automotive industry chain is vast, making it difficult for automotive companies to implement low-carbon procurement requirements across all stages of the supply chain. Collecting data directly from upstream raw material suppliers through targeted reporting and

other methods is also one of the main obstacles for automotive companies in calculating and disclosing supply chain emissions data.

In addition, the standards for calculating the product carbon footprint in the automotive industry chain and the emissions factor database have not been established, and there is a lack of mutual recognition and trust between industries and internationally. These further increase the difficulty for automotive companies in calculating and disclosing supply chain emissions data. Currently, the methodologies for product carbon footprint in China is under development, so the automotive industry chain are referring to international standards. This means that there is no uniform standard in terms of selecting calculation boundaries, choosing emissions factor database, defining core processes, and allocating emissions for recycled materials. In addition, in the internationally recognized emissions factor databases, some factors do not have regional representativeness for China. Moreover, outdated factors cannot reflect the actual energy and resource consumption levels in the production processes of Chinese companies. In the evaluation, IPE also found that many companies that have disclosed their supply chain and vehicle product carbon footprints rely heavily on default LCA factors in their calculations, which may lead to discrepancies between the calculated results and the actual situation.

In summary, challenges in calculating and disclosing Scope 3 supply chain carbon emissions for automotive companies include the difficulty in obtaining actual data from suppliers and the need to improve the representativeness of emission factors. The lack of clarity in automotive companies' supply chain emissions not only hinders the establishment of emission baselines, the setting of reduction and neutrality targets, and breaking these targets down to upstream emission hotspots, but also makes it difficult to impose quantitative emission reduction requirements on suppliers of steel, aluminum, battery materials, etc. Furthermore, it impedes stakeholders from tracking and supervising the progress of decarbonization efforts in key areas such as steel and aluminum.

(2) Lack of Consensus on Low-carbon Emission Steel and Aluminum Makes it Difficult to Confirm the Green Product Attributes

Currently, there is no consensus among parties on the definitions of 'low-carbon emission steel/green steel' and 'low-carbon emission aluminum/green aluminum'. This results in a vague definition of green product attributes, a lack of uniform standards for the emission limits of

low-carbon or zero-carbon products, and an insufficient transparency in certification processes. These increase the difficulty for automotive companies in selecting low-carbon materials and bring higher uncertainty to the planning of supply chain emission reduction pathways.

IPE' s analysis of mainstream green labels, certifications, and initiatives in the steel and aluminum industries (Table 4-1-1 and Table 4-1-2) shows that in the steel industry, the Responsible Steel™, recognized by many automotive companies, defines 'Near Zero Steel' as having a carbon footprint of 0.05-0.4 tons CO_2e per ton of steel (from cradle to gate), but does not make requirements on metallurgical processes, scrap usage, or the proportion of renewable energy. The SteelZero Initiative proposes that 50% of steel used by 2030 should be low-emission, but does not define what constitutes low-emission steel. The Climate Bonds Initiative issued its criteria for Steel Industry, focusing primarily on the carbon emission intensity per ton of steel for facilities or companies using different processes, rather than the lifecycle carbon footprint. Meanwhile, some steel companies like Baosteel Co., Ltd., ArcelorMittal, have released their own definitions of low-carbon emission steel products.

Table 4 -1-1 Definitions, Initiatives, and Labels of Mainstream 'Zero Carbon' and 'Low Carbon Emissions ' Steel[71]

Initiatives, standards, and definitions related to low-carbon emission steel in the steel industry		
Initiative/Standard Name	**Main Content or Requirements**	**Initiator**
Responsible Steel	Basic/Level 1: 0.35-2.8 (tCO2 per ton of steel) (100% - 0% scrap) Level 2: 0.25-2.0 (100%-0% scrap) Level 3: 0.15-1.2 (100%-0% scrap) **Level 4 (Near Zero): 0.05-0.4 (100%-0% scrap)**	The ResponsibleSteel™ International Standard
First Movers Coalition-Steel commitment	Crude steel from breakthrough technology production facilities. Per IEA guidance, the steel should emit **<0.4 (0% scrap inputs) to <0.05 t (100% scrap inputs)** of CO2e per tonne of crude steel produced At least 10% (by volume) of all our steel purchased per year will be near-zero emissions (as per FMC definition) by 2030"	Weforum & First Movers Coalition

[71] The content in the table is collected, organized, and translated by IPE through public information. Some initiatives/standards do not have an official Chinese name, so the English name is retained.

SteelZero Initiative	Organisations that join SteelZero make a public commitment to **buy and use 50% low emission steel by 2030, setting a clear pathway to using 100% net zero steel by 2050**.	The Climate Group
NET-ZERO STEEL INITIATIVE	The Net-Zero Steel Initiative (NZSI) aims to put the global steel sector on a path to reach net-zero emissions by 2050 by: Partnering with an international group of steel industry leaders Bringing zero-carbon primary steel production technologies to market by 2030 Accelerating the growth of scrap-based production Focusing on supply dimensions Demonstrating how steel can be a key part of a net-zero economy	Mission Possible Partner
Climate Bonds Initiative's Criteria for Climate Bonds for the Steel Industry	Facility standards: Taking 2022 as the boundary, the emission reduction paths and evaluation standards for facilities commissioned before and after 2022 are different. For example, if an electric arc furnace (EAF) primarily using scrap steel for steelmaking is commissioned after 2022, the scrap steel used by the facility must account for 70% of the total annual raw material. Alternatively, the combined usage of scrap steel and (100%) hydrogen direct reduced iron should account for at least 70% of the total annual raw material smelted by the electric arc furnace. For DRI production lines commissioned before 2022, if the plant primarily uses coal: a series of decarbonization measures have been or will be implemented on the facility, and the emission intensity of the facility (ton CO2/ton steel) has been or will be reduced by 40% during the period from 2022 to 2030. Corporate Standard: Corporate emission reductions must at least meet the IEA emission reduction pathway thresholds: Primary Steel (Primary Steel) in 2020 is 2.38, and by 2050 it is 0.12 tons of steel carbon dioxide equivalent; Secondary Steel (Secondary Steel) from 0.75 in 2020 to 0.12 tons of steel carbon dioxide equivalent by 2050	Climate Bonds Initiative

Industrial Deep Decarbonization Initiative (IDDI)	IDDI is advocating for **governments to set procurement targets** for the purchasing of decarbonized steel and cement and creating the tools to do so	UNIDO
STEEL STANDARDS PRINCIPLES	Common emissions measurement methodologies to accelerate the transition to near zero; consistent with the IEA "Net Zero Principles"	World Trade Organization
Science-Based Targets for the Steel Industry	Absolute emission reduction targets, reducing 4.2% of the baseline annually	Science-Based Targets Initiative
Net Zero Carbon Steel/Carbon Neutral Steel	The greenhouse gases emitted into the atmosphere during steel production can be balanced with the emissions collected from the atmosphere using carbon sink facilities	World Steel Association
Corporate Low Carbon Product Labeling and Definition		
Label Name	**Main Content**	**Initiating Company**
BeyondECO™ Low-carbon emission steel	BeyondECOTM is a low-carbon product brand officially launched by Baosteel in 2022, including low-carbon and zero-carbon steel products. For example, 'BeyondECO-30%' refers to steel that has a 30% reduced carbon footprint compared to Baosteel's equivalent product in 2020. Baosteel Co., Ltd. explores low-carbon process paths for automotive steel and has completed trial production of low-carbon cold-rolled and hot-dip galvanized automotive products; The product carbon footprint has been verified by a third party, and the product reduces carbon by more than 60% compared to conventional processes.	Baosteel Co., Ltd.
XCarb™	XCarb™ green steel certificates are specifically designed for ArcelorMittal' s flat steel products made from iron ore in a blast furnace. These initiatives range from our flagship Smart Carbon projects, such as Torero and Carbalyst, to capturing **hydrogen-rich waste gases** from the steelmaking process and injecting them **into the blast furnace to reduce our use of coal.**EPDs are available for six products which are manufactured via the **Blast Furnace route** and are eligible for XCarb® green steel certificates. Three EPDs for Flat Products are available with XCarb® r**ecycled and renewably produced**	ArcelorMittal

ECONIQ STEEL	Econiq™ NZ is the world' s first **net-zero carbon steel at scale**, certified for Scopes 1 and 2, with the option of Scope 3. Econiq™ RE certifies that your steel or steel products were made with **100% emission-free and/or renewable electricity**. Econiq steel will extend that leadership even further, utilizing 100% renewable electricity and high-quality carbon offsets to negate any remaining Scope 1 and 2 emissions.	Nucor
GREENSTEEL	GREENSTEEL aims to **recycle and upcycle the growing amount of scrap steel, using electric arc furnaces powered by renewable energy**.	LIBERTY Steel UK
Fossil-free steel	Fossil-free steel will be made by a completely new technology using fossil-free electricity and hydrogen	Volvo Cars
Green steel	Green steel: Low-CO2 blast furnace steel with sianificantly reduced C02 emissions in the blast furnace process	Nissan

In the aluminum industry, there is a significant difference in the emission reduction targets among different initiatives. The Aluminum Stewardship Initiative (ASI) imposes limits on the average emissions per ton of aluminum from mine to metal ingot, such as requiring entities that started production in or before 2020 to have average emissions per ton of aluminum below 11tCO_2e, or to demonstrate at least a 10% reduction in the past three years, and to set targets of below 13tCO_2e by the end of 2025 and below 11tCO_2e by the end of 2030. The Pioneer Alliance - Aluminum Initiative calls for companies to have cradle-to-gate carbon dioxide emissions per ton of aluminum less than 3 tons by 2030.

Table 4 -1-2 Mainstream 'Zero Carbon', 'Low Carbon Emission ' Aluminum Definitions, Initiatives, and Labels[72]

Initiatives, Standards, and Definitions Related to Low-carbon Emission Aluminum in the Aluminum Industry		
Initiative/Standard Name	**Main Content**	**Initiator**
Aluminum Stewardship Initiative (ASI) Certificate	It is recommended to conduct greenhouse gas-related disclosures according to GRI; the disclosed data must be verified; Clearly state the need to disclose emissions data (including Scope 3) and energy usage; There are emission reduction requirements for greenhouse gas emission intensity: for entities starting production after the year 2020, the average ton of aluminum emissions from mine to metal aluminum ingot should be less than 11tCO_2e/t Al ; Entities that began production before 2020 (including 2020) have an average aluminum emission from mine to metal ingot of less than 11 tCO_2e /t Al, or have demonstrated at least a 10% emission reduction over the past three years, and have set targets to be below 13 tCO_2e /t Al by the end of 2025, and below 11 tCO_2e /t Al by the end of 2030.	Aluminum Stewardship Initiative
Low Carbon Products	Refers to products whose carbon emissions data meet the low carbon evaluation criteria compared to similar products or products with the same function. Carbon emission indicators can be confirmed based on the advanced carbon emission intensity values of the industry or can be determined by referring to the advanced level of the industry.	Specification for the Evaluation of Green Low-Carbon Products: Electrolytic Aluminum

[72] The content in the table is collected, organized, and translated by IPE through public information. Some initiatives/standards do not have an official Chinese name, so the English name is retained.

		Products (Aluminum Ingot)
Green Electricity Aluminum	Electrolytic aluminum products produced using green electricity, including primary aluminum liquid and aluminum ingots for remelting.	China Nonferrous Metals Industry Association Group Standard: Guidelines for the Evaluation and Trading of Green Electricity Aluminum
First Movers Coalition-Aluminum	At least 10% (by volume) of all our primary aluminium procured per year will be low-carbon (as per FMC definition) by 2030 **Emitting <3 t of CO2 per tonne of aluminium produced, including all emissions from cradle to gate** In addition to our primary aluminium commitment, we commit to ensuring that **at least 50% of all aluminium we procure per year is sourced from secondary aluminium by 2030**	World Economic Forum and First Movers Coalition
Science-Based Targets - Aluminum Industry	Absolute emission reduction targets, reducing by 4.2% annually	Science-Based Targets Initiative
Corporate low-carbon product labels and definitions		
Label Name	**Main Content**	**Initiating Company**
Revolution-Al™	Revolution-Al™' s main improvement is that it is 15-20% stronger than the traditional - and less colourfully named - wheel alloy, A356.2. This translates to a 7% weight reduction and better fuel efficiency or battery range. The	Rio Tinto

	lighter, stronger wheels also mean better performance and handling and reduced tire wear——**are easy to recycle.**	
ELYSISTM	The ELYSIS technology effectively **puts an end to the use of carbon anode** in the aluminium smelting process. It features the newly developed breakthrough proprietary materials that are stable and do not react during the process. Thus, **it eliminates all direct greenhouse gas (GHG) emissions from the aluminium smelting process** and is the first technology ever that emits oxygen as its by-product	ELYSIS
Hydro REDUXA	Hydro REDUXA is our brand of low-carbon aluminium. Using renewable energy from water (hydro power), wind and solar, we can produce cleaner aluminium, **reducing the carbon footprint per kg of aluminium to 4.0 which is less than a quarter of the global average.**	Hydro
Hydro CIRCAL	Hydro CIRCAL is our brand of premium, low-carbon and recycled aluminium containing **at least 75% post-consumer scrap**. Through the use of such a high share of post-consumer scrap, Hydro CIRCAL has a market-leading average carbon footprint of 2 kilo CO2-equivalents (CO2e) per kilo aluminium. The production process is fully traceable from scrap to the recycled metal per batch, and the product is verified by DNV, an independent third party.	Hydro
Near-zero carbon aluminum	The ambition is to deliver first commercial volumes of aluminium with 0.5-1 kg CO2/kg aluminium, through the value chain, already next year	Hydro
Recycled aluminum	We aim to use 40 per cent recycled aluminium in our new models, from 2025, and have a carbon footprint target of 4 kg CO2 per kg on ingot level for our consumption of primary aluminium.	Volvo Cars
Green aluminum	Green aluminum: Aluminum that is electrolytically smelted using only electricity generated by solar power	Nissan

Apart from the unclear definition of low-carbon emission steel and aluminum, most steel and aluminum companies have not disclosed product carbon footprint information. Even in disclosed product carbon footprints, there is no explanation of the use of green electricity in

the steel and aluminum smelting process, nor the proportion of recycled materials. This not only hinders automotive companies from understanding the implicit carbon levels in raw materials and choosing steel and aluminum products with lower carbon emissions, but also prevents all parties from reaching consensus on the standards for 'low-carbon emission steel' and 'low-carbon emission aluminum,' thereby assisting automotive companies in planning the optimal path for supply chain emission reduction.

(3) Limited Recycled Materials and the Need for Improvement in Recycling Mechanisms Hinder Low-carbon Transition

One of the core paths for emission reduction in the steel and aluminum industries is the use of recycled materials, which reduces the fossil energy and electricity in the metal smelting process.

The *Implementation Plan for Carbon Peaking in the Industrial Sector*, *Implementation Plan for Accelerating the Comprehensive Utilization of Industrial Resources*, *Guiding Opinions on Promoting High-Quality Development of the Steel Industry*, and *Work Plan for Stable Growth in the Non-Ferrous Metals Industry* have proposed several requirements for the steel and aluminum industry, including improving the recycling and processing system, increasing the utilization level of recycled metals, and promoting carbon peaking in the industry. However, the supply of recycled steel and aluminum in China is still insufficient. Data disclosed by the National Development and Reform Commission shows that in 2023, China recycled approximately 260 million tons of scrap steel, which ensured more than 20% of the crude steel production needs[73]. According to data released by the International Aluminium Institute (IAI)[74] in October 2020, China is the world's largest producer and consumer of recycled aluminum, producing over 10 million tons of aluminum metal annually from scrap, accounting for about

[73] China Steel News Network. At the press conference of the National People's Congress, the recycling and utilization of scrap steel received attention from the National Development and Reform Commission [EB/OL]. [2024-05-21]. http://www.csteelnews.com/xwzx/djbd/202403/t20240308_85682.html.

[74] International Aluminium. Aluminium Recycling Factsheet [EB/OL]. [2024-10-2]. https://international-aluminium.org/wp-content/uploads/2021/01/wa_factsheet_final.pdf .

one-third of the global annual output. Nevertheless, recycled aluminum in China accounts for approximately 20% of primary aluminum.[75]

The average lifespan of steel products is 40 years[76], while aluminum products have an expected lifespan of 15 to 18 years[77]. With the continuous increase in the accumulation of scrap steel and aluminum in recent years, as well as the peaking of product scrapping, it is expected that the scrapping for steel and aluminum materials will arrive after 2025[78] [79]. In addition, under the relatively stringent technical requirements of the recommended national standards *Recycled Steel Materials* and *Recycled Cast Aluminum Alloy Materials*, issues such as the difficulty in customs inspection operations, long port detention times, and tight raw material supply for companies still exist. To enhance the operability of the standards, the revised version of *Recycled Cast Aluminum Alloy Materials* was implemented in 2023, and a technical seminar on the revision of 'Recycled Steel Materials' will be held in July 2024, focusing on how to ensure the quality of recycled metals while meeting the expanding market demand for recycled materials. On the other hand, the price of recycled materials circulating in the international market remains high, resulting in the import volume of recycled metal materials remaining low in recent years.

---

[75] Hainan Province Green Finance Research Institute. Recycled Aluminum, the Future of the Aluminum Industry and a New Force in Carbon Reduction [EB/OL]. [2024-05-21]. https://mp.weixin.qq.com/s?__biz=MzI3NzQ1OTA3Ng==&mid=2247514914&idx=1&sn=bfc19a8ee703650ce7006df085d6f15b&chksm=eb6702c9dc108bdf21d725e3edf244c76f4f49f71739f8e4123b263b691e41176d55083a545a&scene=27#wechat_redirect.

[76] World Steel Association. Application of Scrap Steel in the Steel Industry [EB/OL]. [2024-05-13]. https://worldsteel.org/wp-content/uploads/%E5%BA%9F%E9%92%A2%E5%9C%A8%E9%92%A2%E9%93%81%E8%A1%8C%E4%B8%9A%E7%9A%84%E5%BA%94%E7%94%A8.pdf.

[77] Zhiyan Consulting. 2023 Supply and Demand Status and Prospects of China's Recycled Aluminum Industry: "Dual Carbon" Goals Bring New Opportunities for Recycled Aluminum Development [EB/OL]. [2024-05-21]. https://www.chyxx.com/industry/1159280.html.

[78] China Metallurgical News Agency. The 2022 National Scrap Steel Conference and the Fourth Enlarged Meeting of the Seventh Council of the China Scrap Steel Application Association proposed—Accelerate the improvement of scrap steel resource utilization to support the implementation of the Steel 'Cornerstone Plan' [EB/OL]. [2024-05-21]. https://mp.pdnews.cn/Pc/ArtInfoApi/article?id=34129882.

[79] Zhiyan Consulting. 2023 Supply and Demand Status and Prospects of China's Recycled Aluminum Industry: "Dual Carbon" Goals Bring New Opportunities for Recycled Aluminum Development [EB/OL]. [2024-05-21]. https://www.chyxx.com/industry/1159280.html.

With the lack of an integrated industrial chain from recycling to reuse, which results in economically valuable recycled materials not being utilized, some leading automotive companies are attempting to collaborate directly with automobile dismantling suppliers to explore the establishment of a recycling mechanism for scrap steel and aluminum. However, compared to scrap steel materials, the closed-loop recycling and reuse of scrap aluminum require more comprehensive mechanisms. In the interviews with automotive companies, IPE learned that multiple grades and different performance characteristics of aluminum alloys are used in automotive materials, and there is no unified standard for aluminum alloy grades among different automotive companies. Therefore, most scrap aluminum recyclers find it difficult to distinguish aluminum alloys containing different metal elements dismantled from scrapped automobiles, resulting in only a small portion of the recycled scrap aluminum meeting the performance requirements for automotive aluminum, while the majority can only be downgraded for use. This means that automotive companies need to focus on enhancing the recyclability of aluminum materials from the design stage, particularly on improving the same-grade recycling. Polestar for example, has proposed to label and color-code all aluminum materials at the design stage, providing recyclers with an intuitive method to differentiate between grades of aluminum materials, enabling them to sort and recycle these materials, thereby achieving closed-loop recycling and utilization of aluminum materials.

(4) 'Green Premium' for Low-carbon Automobiles Needs to be Addressed by Internalizing the Costs

In the book 'How to Avoid a Climate Disaster,' Bill Gates uses the term 'green premium' to describe the cost difference between using zero-emission fuels (or technologies) and using current fossil fuels (or technologies). For the automotive sector, the green premium between electric vehicles and gasoline vehicles has significantly decreased with technological advancements[80]. However, promoting emission reductions in steel and aluminum materials production still result in green premium at this stage. The issue can be addressed by increasing

[80] China Clean Transportation Partnership. Expert Opinion | Liu Bin: Opportunities and challenges coexist in the development of the new energy vehicle industry, reducing the green premium is key [EB/OL]. [2024-05-21]. http://www.cctp.org.cn/guandianguandian2023/2582.html.

the cost of carbon-intensive emission materials through carbon pricing mechanisms[81]. This includes promptly incorporating key raw materials such as steel and aluminum into the carbon emissions trading market, gradually reducing free allowances, and increasing carbon taxes on automobiles and carbon-intensive raw materials. Financial institutions and investors can support the large-scale use of advanced technologies by automotive, steel and aluminum companies through green finance or transition finance tools. This helps bridge the technical funding gap for industrial decarbonization[82] [83] while increasing the financing costs of existing high-carbon emission technologies. This will incentivize steel and aluminum companies to promote, iterate, and scale up the application of advanced low-carbon technology, thereby increasing the supply of low-carbon emission steel and aluminum.

In addition, raising public environmental awareness and encouraging consumers to make green choices is also an important means to address the 'green premium' for low-carbon automobile. According to McKinsey & Company's survey, nearly 70% of Chinese consumers have begun to develop an awareness of low-carbon automobiles and are willing to bear the costs for it. However, this decreases in 2023. Some automotive companies mentioned in interviews with IPE that in recent years, intense competition among automotive companies has squeezed profit margins, and consumers have become more price-sensitive. The cost will rise from low-carbon procurement, and when reflected in product prices, will directly affect the short-term competitiveness of automotive companies. This is not conducive to internalizing the negative externality costs.[84]

[81] Central University of Finance and Economics. Gao Ping et al.: Reflections on the introduction of a carbon tax in China from the perspective of carbon pricing [EB/OL]. [2024-05-21]. https://spft.cufe.edu.cn/info/1061/5770.htm.

[82] China Clean Development Mechanism Fund. Leveraging Private Investment: The Role of Public Funds in a Low-Carbon Economy [EB/OL]. [2024-05-21]. https://www.cdmfund.org/index.php/10857.html.

[83] Ministry of Finance. Fiscal Policies Steering the Development of Green Finance [EB/OL]. [2024-05-21]. https://www.gov.cn/xinwen/2017-04/18/content_5186805.htm.

[84] McKinsey. 2024 McKinsey China Automotive Consumer Insights Report [EB/OL]. [2024-05-13]. https://www.mckinsey.com.cn/wp-content/uploads/2024/03/2024%E9%BA%A6%E8%82%AF%E9%94%A1%E4%B8%AD%E5%9B%BD%E6%B1%BD%E8%BD%A6%E6%B6%88%E8%B4%B9%E8%80%85%E6%B4%9E%E5%AF%9F%E6%8A%A5%E5%91%8A.pdf.

2. Major Opportunities

Despite numerous obstacles and challenges in automotive companies' procurement of low-carbon materials, IPE has also identified significant opportunities for collaborative carbon reduction in the automotive industry.

(1) The Expansion of Renewable Energy in China and the Implementation of Dual Carbon Policies Support the Low-carbon Transition of the Automotive Industry

To address the severe climate challenges and achieve the targets set by the Paris Agreement, approximately 150 countries and regions worldwide have made carbon neutrality commitments. More than 13,000 non-state members have joined the United Nations Framework Convention on Climate Change's 'Race to Zero' campaign, including over 9,000 businesses and 600 financial institutions. Against the backdrop of a strengthening global consensus on addressing climate change, COP28 proposed a transition from fossil fuels globally, aiming to double the installed capacity of renewable energy worldwide by 2030.

As one of the key pathways to achieving global net-zero emissions, the new energy sector is rapidly developing under the impetus of the global Race to Zero. According to the report *Renewables 2023* released by the International Energy Agency (IEA)[85], the newly installed renewable energy capacity in 2023 reached nearly 510 gigawatts globally[86]. Three-quarters of them are photovoltaic installations, mainly due to the contribution of China's photovoltaic increment. The continuous expansion of China's renewable energy products and services is making a significant contribution to the global energy transition, and it is also providing solutions for emission reduction actions in the automotive industry chain, particularly in carbon-intensive industries such as steel and aluminum smelting.

In addition, the implementation of China's carbon peaking and carbon neutrality '1+N' policy system not only proposes a roadmap and targets for the low-carbon transition of the

[85] IEA. Renewables 2023 [EB/OL]. [2024-09-2]. https://www.iea.org/news/massive-expansion-of-renewable-power-opens-door-to-achieving-global-tripling-goal-set-at-cop28

[86] 1 gigawatt = 1 million kilowatts

automotive industry chain but also provides policy support for the implementation of emission reduction actions by automotive and steel and aluminum companies. The *Implementation Plan for Carbon Peaking in the Industrial Sector*, the *14th Five-Year Plan for Green Industrial Development*, and the *14th Five-Year Plan for Circular Economy Development* all indicate supporting the automotive companies to play a leading role in key areas such as supply chain integration and innovative low-carbon management. They aim to integrate the low-carbon concept from product design, raw material procurement, production, transportation, storage, usage, and recycling. This will accelerate the establishment of a unified green product certification and labeling system and promote low-carbon development across the entire supply chain. The National Development and Reform Commission and ten other departments jointly issued the *Green & Low-Carbon Transition Industry Guidance Catalog (2024 Edition)*, encouraging financial institutions to provide funding for low-carbon manufacturing technologies and process upgrades in the 'manufacturing of key components for NEV' and low-carbon transition in key industrial sectors.' In May 2024, the Ministry of Industry and Information Technology issued the *Guidelines for Enhancing Supply Chain Management Levels of Manufacturing Companies (Trial)*, once again emphasizing the leading role of key companies, promoting the integrated development of the industry chain, enhancing the level of the supply chain, and proposing that leading supply chain companies actively explore the calculation of product carbon footprints, encouraging upstream and downstream supply chain companies to openly share carbon emissions data.

In addition, current policies have also put forward transformation requirements for energy consumption levels, technological paths, and pollution reduction and carbon reduction coordination in carbon-intensive industries upstream of the automotive industry chain. Since the end of 2022, the China Iron and Steel Association has released the *Three-Year Action Plan for Energy Efficiency Benchmarking in the Steel Industry (2022–2025)*, planning to submit three sets of lists (technical directory list, technical capability list, policy list), two standards, and a top-level design plan and implementation path for a data governance system to the industry over three years, guiding companies to carry out technological transformation and process flow structure optimization, reduce unit energy consumption, and promote low-carbon technology innovation. The Ministry of Ecology and Environment, the Ministry of Industry and Information Technology, the National Development and Reform Commission, and the National Energy

Administration also proposed that steel companies should continuously carry out ultra-low emission transformation, promote the level of electrification, reduce the energy consumption per unit of added value for companies above a designated size, improve the comprehensive utilization rate of smelting slag, enhance the processing capacity of scrap steel, and increase the proportion of short-process steelmaking, reduce the water consumption per ton of steel etc. (see Appendix II).

The *Carbon Peak Implementation Plan for the Non-ferrous Metal Industry*, the *Energy Conservation and Carbon Reduction Transformation and Upgrade Implementation Guide for Key Areas of High Energy Consumption Industries (2022 Edition)*, and the *Carbon Peak Action Plan before 2030* propose transformation paths for the aluminum smelting industry, requiring an increase in the utilization rate of renewable energy in the electrolytic aluminum process, an increase in the proportion of recycled metal supply, the development of low-carbon emission aluminum smelting technology, the promotion of green industry certification and carbon footprint accounting, etc., as the focus of the industry's carbon peak work before 2030 (see Appendix II). In April 2024, the Ministry of Ecology and Environment compiles the *Guidelines for Accounting and Reporting of Corporate Greenhouse Gas Emissions in the Aluminum Smelting Industry* and the technical guidelines for verification, which standardize accounting boundaries and methods, and verification processes for smelting companies. These guideline documents provide support for aluminum smelting companies to be included in the national carbon emissions trading market, which is conducive to promoting the improvement of greenhouse gas management levels in aluminum smelting companies through carbon market compliance work, thereby accelerating the emission reduction process.

(2) The Automotive Carbon Footprint Methodology and Emission Factor are being Expedited to Support Emissions Accounting

In recent years, as global climate action accelerates, the demand for low-carbon industrial products in the international market has been increasing, and the requirements for the calculation and disclosure of the carbon footprint of automotive products and upstream products such as batteries, steel, and aluminum materials are also becoming stricter. To address the 'green barriers' in international trade, promote the acceleration of carbon peaking and

carbon neutrality in China's industrial sectors, and to assist key industries such as automobiles, steel, and non-ferrous metals in standardizing product carbon footprint accounting, multiple ministries, industry associations, and research institutions are accelerating the development of product carbon footprint accounting methodologies and the construction of the emissions factor database.

In April 2022, the National Development and Reform Commission, the National Bureau of Statistics, and the Ministry of Ecology and Environment issued the *Implementation Plan for Accelerating the Establishment of a Unified and Standardized Carbon Emission Statistical Accounting System*, aiming to promote the carbon emission accounting methods for products in key industries such as steel and electrolytic aluminum. In April 2024, the National Center for Climate Change Strategy and International Cooperation held the inaugural meeting of the National Greenhouse Gas Emission Factor Database Technical Working Group[87], introducing the construction of the National Greenhouse Gas Emission Factor Database. In June, the Ministry of Ecology and Environment and 15 other ministries released the *Implementation Plan for Establishing a Carbon Footprint Management System*, proposing to formulate accounting rules for export products such as NEV, lithium batteries, and carbon-intensive bulk raw materials such as steel, aluminum, and fuel oil, establish a product carbon labeling certification system and gradually align with international standards. This provides a policy foundation for the industry to promote product carbon footprint accounting and meet green requirements from the market. During the same period, the Automotive Industry Energy Conservation and Green Development Evaluation Center released the *Product Carbon Footprint Product Category Rules for Road Vehicles Passenger Cars* for comments, aiming to promote the declaration and information exchange of passenger car product carbon footprints, and increases their comparability. In August, the General Office of the State Council issued the *Work Plan for Accelerating the Establishment of a Dual Control System for Carbon Emissions*, proposing the formulation of product carbon footprint accounting rules and standards, strengthening the construction of a carbon footprint background database, and establishing a product carbon labeling certification system.

[87] National Center for Climate Change Strategy and International Cooperation. The National Climate Strategy Center Organizes the Inaugural Meeting of the National Greenhouse Gas Emission Factor Database Technical Working Group [EB/OL]. [2024-05-21]. http://www.ncsc.org.cn/xwdt/zxxw/202404/t20240403_1070012.shtml.

Meanwhile, industry associations and research institutions in the automotive, steel, and aluminum sectors are continuously advancing the development of China's product carbon footprint methodology and promoting the establishment of a product carbon footprint disclosure platform. Among them, China Automotive Carbon Digital Technology Center Co., Ltd. developed the China Automobile industry chain carbon publicity platform (CPP, Figure 4-2-1), aiming to enhance the carbon emission management of the automotive industry, empower low carbon transition through digitalization, assist China in achieving the "Dual Carbon" goals, and promote international mutual recognition of carbon footprint information. As of August 2024, the CPP platform has disclosed the product carbon footprints of over 7,000 passenger cars from more than 60 automotive companies. It has piloted the application of carbon labels (Figure 4-2-2) to showcase the low-carbon attributes of automotive products, providing decision-making references for consumers, corporate procurement, and financial institution loans[88]. China Automotive Carbon Digital Technology Center Co., Ltd. also co-established the 'Automotive Industry Chain Green Finance Joint Innovation Center' with China Minsheng Bank Wuhan Branch to explore green finance innovation in the automotive field. They attempt to link procurement loans for passenger cars with carbon footprint, guiding automotive companies to reduce carbon emissions and incentivize reductions in emission hotspots.

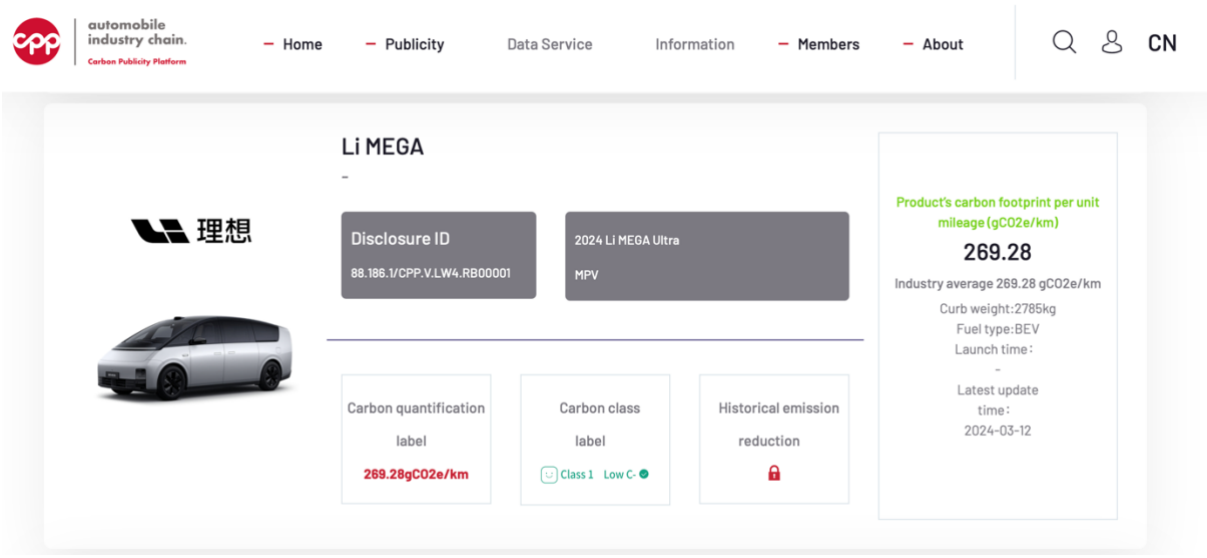


Figure 4 -2-1 China Automobile industry chain carbon publicity platform (CPP)

[88] China.com Automotive. 2024 China Automotive Low Carbon Leaders and Carbon Label Release [EB/OL]. [2024-07-31]. https://auto.china.com/trade/32386.html.

Figure 4 -2-2 China Automotive Product Carbon Footprint Label[89] [90]

Under the organization and leadership of the China Iron and Steel Association, companies such as China Baowu participated in the construction of the China Iron and Steel Industry EPD Programme (Figure 4-2-3), aiming to encourage Chinese steel companies to accelerate low-carbon development, respond new international trade regulations, and assist customers in conducting carbon emission accounting of steel products based on measured data. As of August 2024, Baosteel Co., Beijing Shougang Co.,Ltd., Gansu Jiu Steel Group Hongxing Iron & Steel Co.,Ltd. and 18 other listed steel companies or their affiliated companies have calculated the carbon footprint of steel products and publicly disclosed 135 steel product EPD reports through the China Iron and Steel Industry EPD Programme, covering products such as hot-rolled steel strips for automobiles and continuously annealed cold-rolled steel strips for automobiles.[91]

89China Automotive Industry Chain Carbon Disclosure Platform. 2024 Annual Low Carbon Leader Model Showcase—Xiaomi SU7 [EB/OL]. [2024-08-12]. http://www.auto-cpp.com/News/Read/39.

90 China Daily Chinese Edition. 2024 China Automotive Low Carbon Leaders and Carbon Label Release [EB/OL]. [2024-08-12]. http://ex.chinadaily.com.cn/exchange/partners/82/rss/channel/cn/columns/sz8srm/stories/WS6690f785a3107cd55d26b1c1.html.

[91]Statistics as of August 12, 2024.

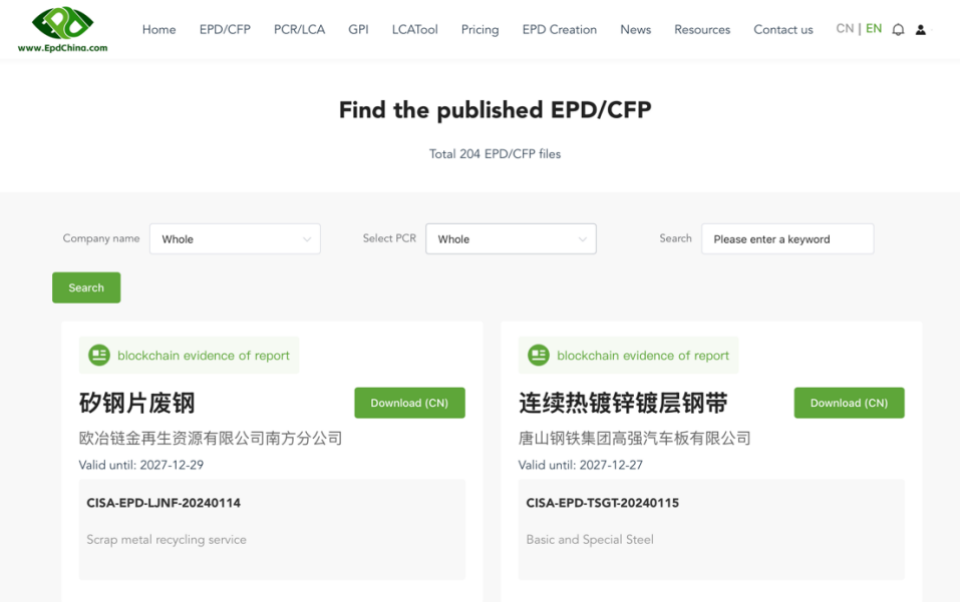


Figure 4 -2-3 China Iron and Steel Industry EPD Programme

Led by the Aluminum Corporation of China and the China Nonferrous Metals Industry Association, 18 entities formed a consortium to jointly establish the China Nonferrous Metals Industry EPD Platform (Figure 4-2-4), aiming to assist all parties to understand product carbon footprint. As of August 2024, the platform has cumulatively released 9 EPD documents for aluminum ingots, alumina, zinc ingots, prebaked anodes, and 6 Product Category Rule (PCR) documents for aluminum, zinc, lead, and copper. It continues to advance the development of accounting methodologies for nonferrous metal products, as well as data accounting and disclosure work.[92]

Figure 4 -2-4 China Nonferrous Industry EPD Platform

[92]Statistics as of August 12, 2024.

The vehicle carbon footprint and key material emissions data collected by these platform have been applied in this study. Moreover, IPE believes that the establishment of the EPD systems in China's steel and aluminum industries is beneficial for steel and aluminum companies to conduct data calculation and disclosure according to unified, systematic, and internationally benchmarked accounting methods and disclosure standards. It also facilitates the automotive industry in conducting supply chain and product carbon footprint accounting and allows stakeholders to track the implementation of their climate commitments through the public disclosure of quantified data.

In addition to accelerating the development of product carbon footprint accounting methodologies and LCA factor databases, in July 2024, the *Decision of the Central Committee of the Communist Party of China on Further Deepening Reform and Advancing Chinese-style Modernization* proposed to deepen the reform of the environmental information disclosure system according to law. To implement the major strategic decisions on carbon peaking and carbon neutrality, standardize and guide corporate greenhouse gas emissions information disclosure activities, and enhance corporate greenhouse gas management capabilities, the China Ecological Civilization Research and Promotion Association proposed to compile the standard *Guidelines for Corporate Greenhouse Gas Information Disclosure Part 1: General Principles*. Experts from the Chinese Research Academy of Environmental Sciences, China Environmental United Certification Center (CEC), National Center for Climate Change Strategy and International Cooperation, Environmental Planning Institute of the Ministry of Ecology and Environment, Environmental Economics and Policy Research Center of the Ministry of Ecology and Environment, and IPE jointly contribute to this work.

(3) Digital Solutions Empower the Automotive Industry Chain to Enhance Carbon Management Capabilities and Enable Multi-stakeholder Participation

Since 2020, IPE has developed and continuously optimized a series of digital tools for carbon data accounting, carbon target setting, and information disclosure. These tools aim to assist companies in efficiently and cost-effectively collecting supply chain data, empower suppliers to set emission reduction targets, enhance the level of information disclosure on

supply chain and product carbon footprints, and assist public supervision. Given the challenges faced by the automotive industry chain, IPE believes that these digital solutions can help automotive, steel and aluminum companies to enhance their carbon management capabilities, while assisting the public to track the implementation of carbon targets by companies in the automotive industry chain.

Tool 1: Enterprise GHG Emissions Accounting Platform

To address the lack of accounting capacity in small and medium-sized companies (SMEs), IPE, in collaboration with partners, developed and continuously upgrades the Enterprise GHG Emissions Accounting Platform in 2020 (Figure 4-2-5). The platform was developed based on the *Corporate GHG Emissions Accounting Methodologies and Reporting Guidelines (Trial)* for 24 industries issued by the National Development and Reform Commission. It incorporates automatic parameters for various types of fossil fuels, electricity, and heat emission factors applicable to Chinese companies. The platform guides suppliers through the calculation process to identify emission sources, improving the completeness and accuracy of accounting data, and helps companies efficiently and cost-effectively conduct carbon accounting, providing a clear understanding of their emissions baseline.

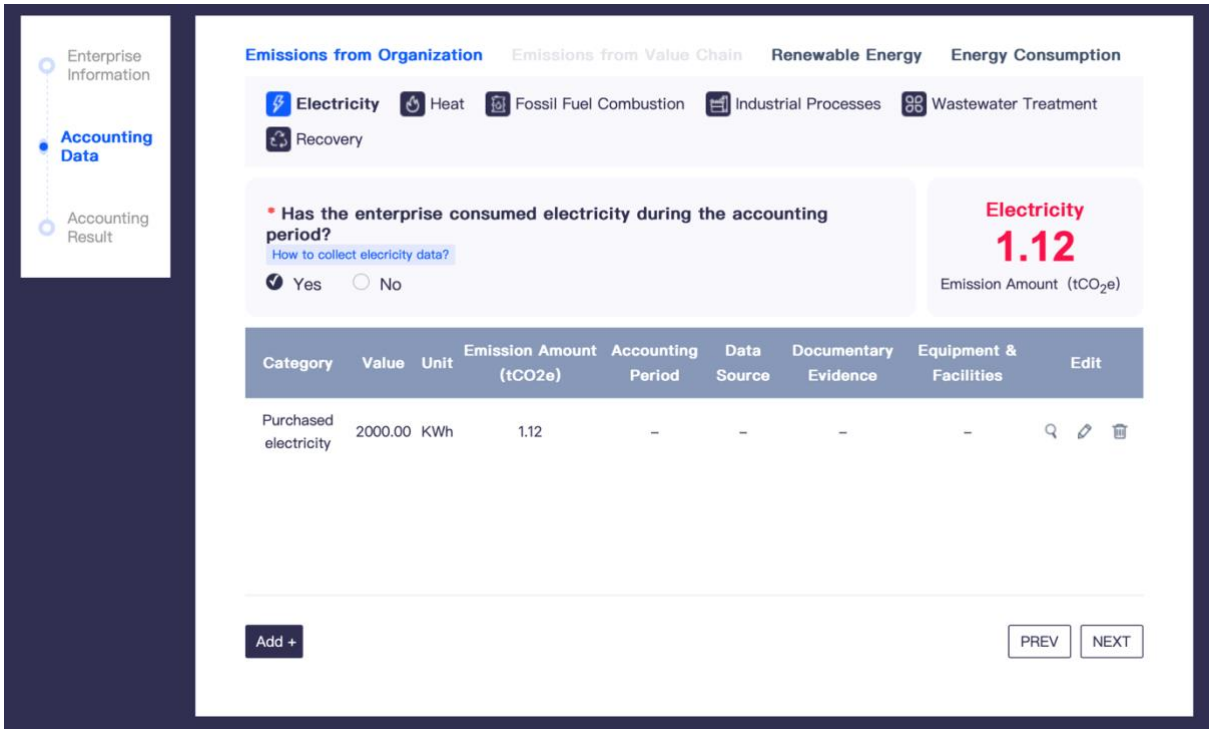


Figure 4-2-5 Enterprise GHG Emissions Accounting Platform

Tool 2: Enterprise GHG Emissions Disclosure Platform

Driven by global climate governance and China's "Dual Carbon" target, more and more companies are undertaking carbon accounting and disclosing their carbon data to regulators, governments, or stakeholders. IPE, in collaboration with professional organizations, has developed and continually upgraded the enterprise carbon data disclosure platform (Figure 4-2-6). This platform aligns with mainstream greenhouse gas disclosure mechanisms in both China and internationally, providing companies with a data disclosure platform to showcase their emissions performance and progress on reductions.

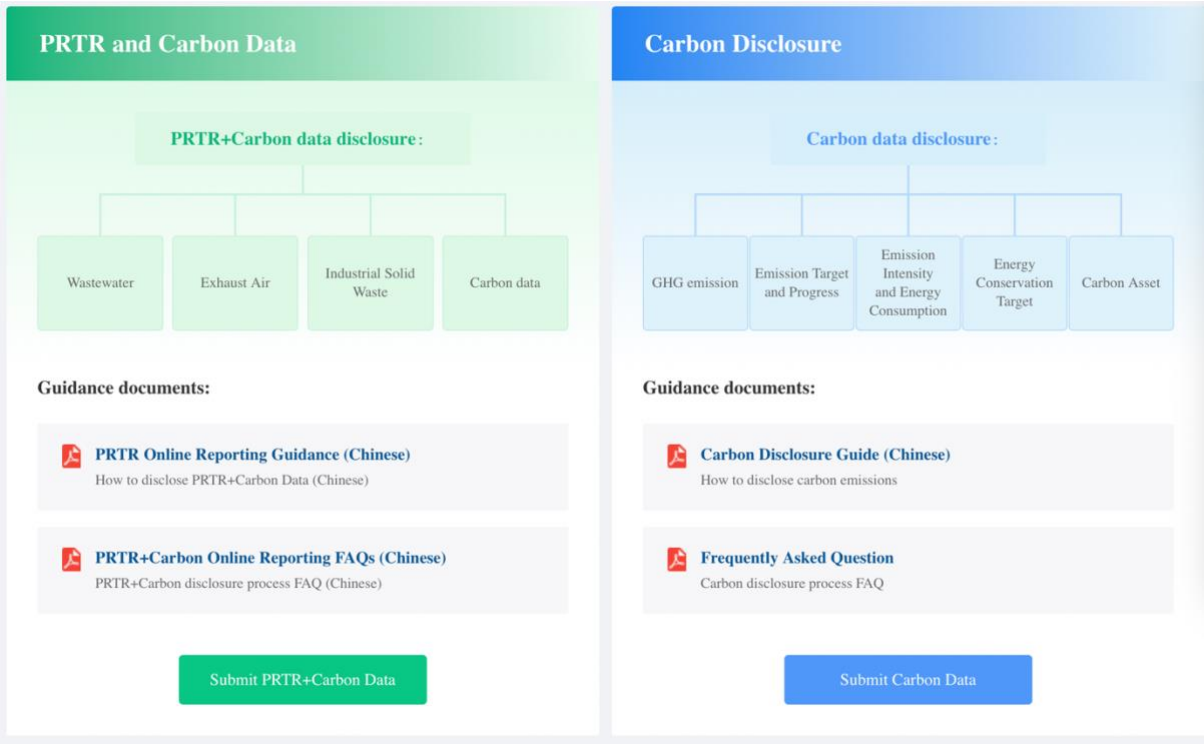


Figure 4-2-6 Enterprise GHG Emissions Disclosure Platform

Tool 3: Enterprise Carbon Target Setting Tool

To assist companies in setting climate targets based on climate science and aligned with international mainstream mechanisms such as the Science Based Targets Initiative (SBTi), IPE developed and launched the Enterprise Carbon Emission Reduction Target Setting Tool in 2023(Figures 4-2-7, 4-2-8). This tool generates various emissions reduction target options for companies using science-based target methodologies. It empowers SMEs to set appropriate science-based emission reduction targets (aligned with pathways of 1.5°C, well below 2°C, and

2°C). Companies only need to input baseline year emission data, and by combining industry, region, policy requirements, etc., the tool can easily help companies simulate their Scope 1&2, as well as Scope 3 emission reduction targets.

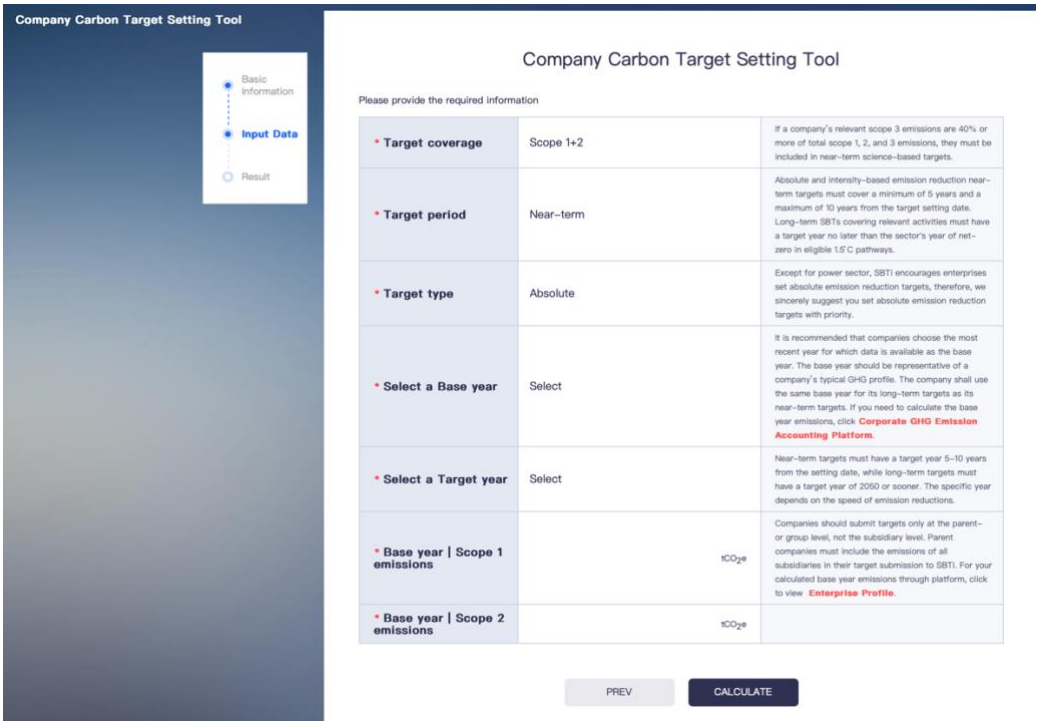


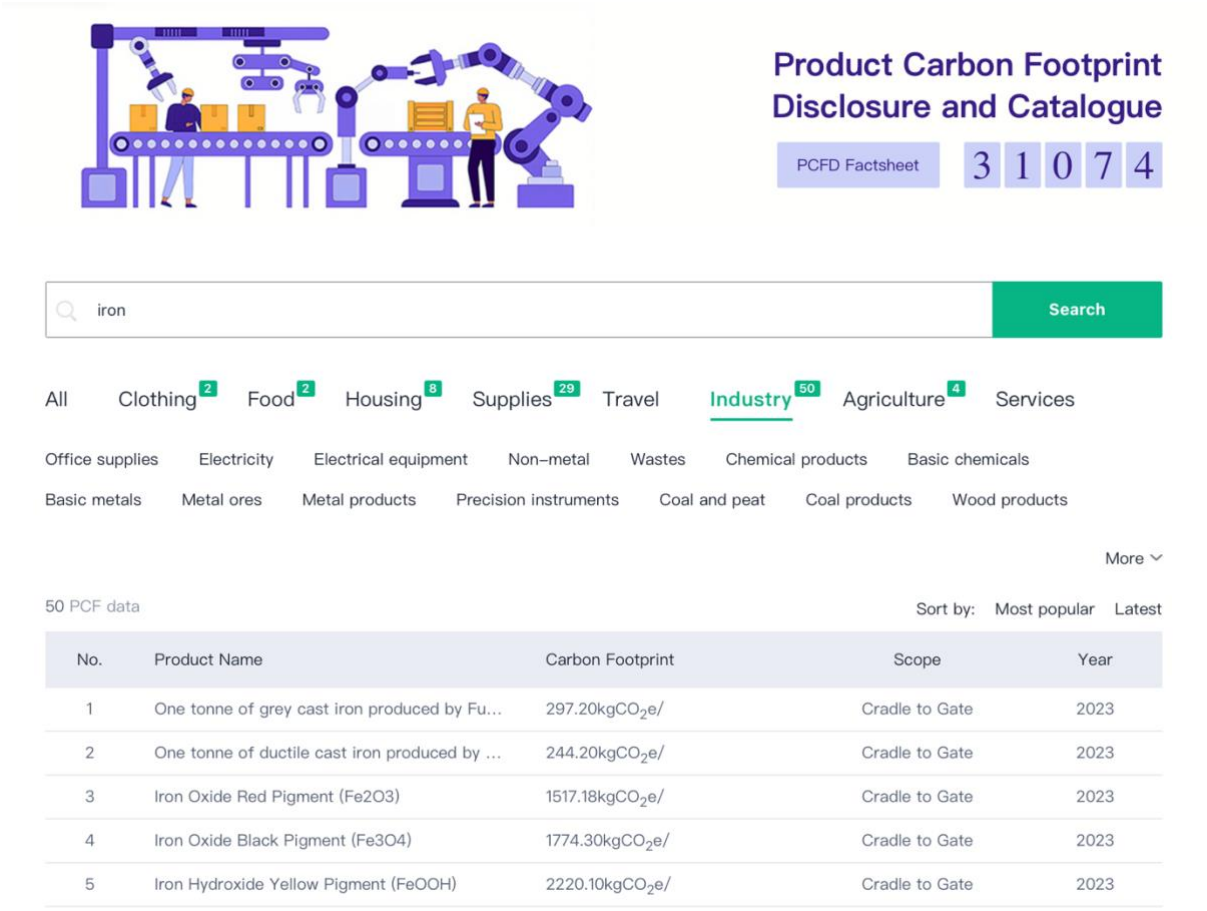
Figure 4-2-7 Enterprise Carbon Emission Reduction Target Setting Tool

Figure 4-2-8 Example of Enterprise Carbon Emission Reduction Target Setting

Tool 4: GHG Emission Factor Database (CPCD) and Product Carbon Footprint Platform (PCFD)

To assist companies in calculating product carbon footprints, conducting lifecycle analysis, and assessing Scope 3 emissions, IPE, in collaboration with the China City Greenhouse Gas Working Group, launched the China Products Carbon Footprint Factors Database (CPCD, Figure 4-2-9) in 2022 and the Product Carbon Footprint Disclosure and Catalogue Platform (PCFD, Figure 4-2-10) in 2023. IPE hopes to guide stakeholders to pay attention to the carbon footprint of the products and services they purchase or invest in through the public disclosure of product carbon footprints, and to incorporate product carbon footprints into procurement, investment, and consumption decisions.

Figure 4-2-9 China Products Carbon Footprint Factors Database (CPCD)



No.	Product Name	Carbon Footprint	Scope	Year
1	One tonne of grey cast iron produced by Fu...	297.20kgCO_2e/	Cradle to Gate	2023
2	One tonne of ductile cast iron produced by ...	244.20kgCO_2e/	Cradle to Gate	2023
3	Iron Oxide Red Pigment (Fe2O3)	1517.18kgCO_2e/	Cradle to Gate	2023
4	Iron Oxide Black Pigment (Fe3O4)	1774.30kgCO_2e/	Cradle to Gate	2023
5	Iron Hydroxide Yellow Pigment (FeOOH)	2220.10kgCO_2e/	Cradle to Gate	2023

Figure 4-2-10 Product Carbon Footprint Disclosure and Catalogue Platform (PCFD)

Tool 5: Global Business Accountability Map

To promote corporate responsibility in pollution reduction and decarbonization and curb "climate greenwashing," IPE developed and launched the Global Business Accountability Map (Figure 4-2-11, Figure 4-2-12). As of October 2024, the map records and presents 1,950 well-known Chinese and overseas brands, listed companies, and large companies' public commitments, progress towards targets, greenhouse gas emission levels, and actions to promote emission reduction in their supply chains in China in response to climate change.

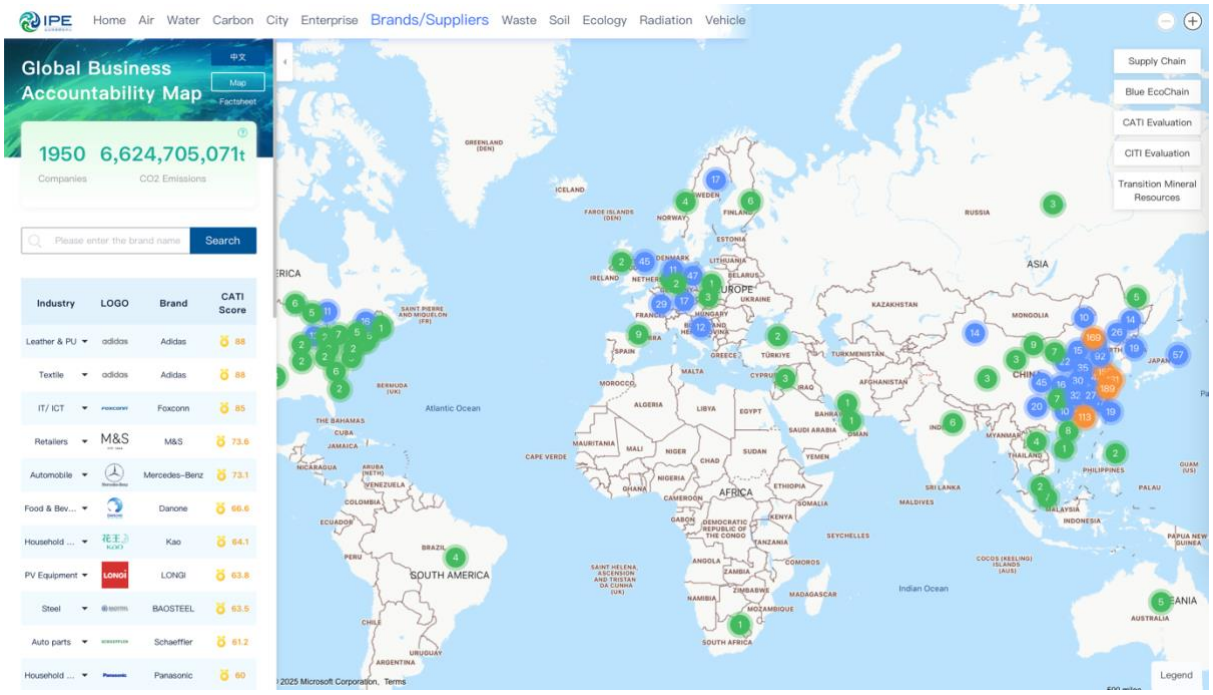


Figure 4-2-11 Global Business Accountability Map

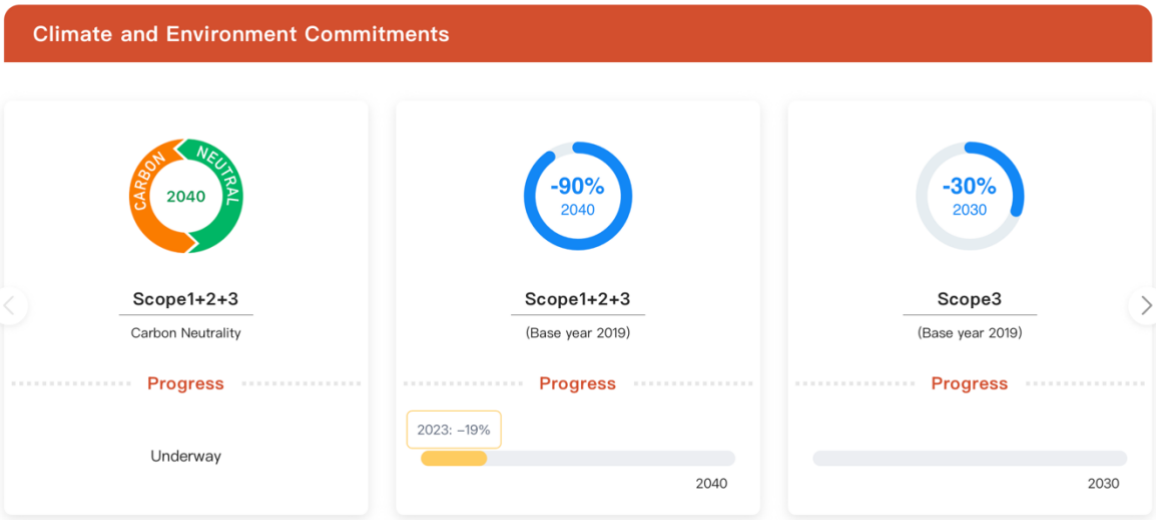


Figure 4-2-12 Corporate Target Progress Tracking Details Page

Tool 6: Carbon Easy Check

Accounting and evaluating the greenhouse gas emissions of the lifecycle of a product are of significant importance for managing greenhouse gas emissions from the consumer end and promoting carbon reduction based on the industrial chain. Based on the China Products Carbon Footprint Factors Database (CPCD), IPE and its partners have developed the 'Carbon Easy Check' tool, incorporating the publicly disclosed product carbon footprints of automotive companies, as well as the product carbon footprints of over 7,000 vehicle models publicized on the CPP

platform (Figure 4-2-13). The public/consumers only need to take a photo and upload it to the app, where the built-in AI technology can identify the car model and the corresponding product carbon footprint data. This assists consumers in efficiently and conveniently obtaining information, allowing them to choose and purchase more low-carbon cars.

Figure 4-2-13 'Carbon Easy Check' Recognizes Passenger Car Product Carbon Footprint

(4) Leading Steel and Aluminum Companies are Initiating Climate Actions alongside Automotive Companies to Accelerate the Decarbonization of the Industry Chain

The zero-carbon transformation of the automotive industry chain requires not only automotive companies to play a leading role through green procurement, but also requires steel and aluminum suppliers to engage, develop, and promote advanced technologies to accelerate their own decarbonization process. The climate action assessment conducted by IPE in 2023 on 30 steel companies and 13 aluminum smelting companies shows that a group of leading steel and aluminum companies in China have already initiated climate action.

In the steel industry, Baosteel Co., Ltd., TISCO Stainless Steel, Beijing Shougang Group, Zhongnan Co., Ltd., Shandong Iron and Steel, etc., have already conducted accounting for their own operations (Scope 1 & 2). 18 steel companies have carried out product carbon footprint measurement and disclosure to meet regulatory requirements such as CBAM. 21 steel companies have disclosed climate targets, among which 16 companies have set and disclosed their carbon peak target year no later than 2025, and 7 companies have even announced to achieve a peak in greenhouse gas emissions by 2023. The target year for carbon neutrality disclosed by 9 steel companies is 2050, which is 10 years earlier than the carbon neutrality target proposed by China (Table 4-2-1). All steel companies included in the evaluation have initiated energy conservation and emission reduction projects, with 70% of the companies disclosing the use of renewable energy, and 97% of the companies disclosing the implementation of energy efficiency improvement projects such as waste heat steam recovery, microcrystalline adsorption deep purification of coke oven gas, and dry quenching (CDQ) power generation. Baosteel Co., Ltd., Ansteel Co., Ltd., Bayi Iron & Steel, and Hesteel Co., Ltd. have launched hydrogen metallurgy pilot projects of varying scales, while Baosteel Co., Ltd., Maanshan Iron & Steel Co., Ltd., and 8 other companies have disclosed that they are constructing short-process electric arc furnace steelmaking production lines.

Table 4-2-1 Summary of Climate Targets for Steel Companies

Enterprise Name	Carbon Reduction Targets	Carbon Peak Year	Carbon Neutrality Year
Xinjiang Ba Yi Iron & Steel Co.,Ltd.	By 2025, achieve a 30% carbon reduction technology capability, and strive for a 30% carbon reduction by 2035	2023	2050
Inner Mongolia Baotou Steel Union Co.,Ltd	By 2030, achieve a 30% carbon reduction technology capability; strive to reduce carbon emissions by 50% from the peak by 2042	2023	2050
Guangdong Zhongnan Iron & Steel Co., Ltd.	By 2025, reduce carbon by 10% or more compared to 2020; by 2030, reduce carbon by 30% or more compared to 2020; by 2035, reduce carbon by 40% compared to 2020	2023	2050

Chongqing Iron & Steel Company Limited	Established carbon reduction targets for three phases: 'near-term, mid-term, and long-term' (achieving peak total emissions by 2023, reducing carbon by 29% compared to 2020 by 2030, and reducing carbon by 37% compared to 2020 by 2035)	2023	2050
Maanshan Iron & Steel Company Limited	By 2025, achieve a 30% carbon reduction technology capability, and strive for a 30% carbon reduction by 2035	2023	2050
Baoshan Iron & Steel Co.,Ltd.	Using 2020 as the base year, reduce carbon by 8% by 2025, 15% by 2030, and 30% by 2035	2023	2050 (including the bulk raw material supply chain)
Shanxi Taigang Stainless Steel Co., Ltd.	Using 2020 as the base year, achieve a 6% carbon reduction by 2025, 16% by 2030, and 30% by 2035	2023	2050
China Oriental Group Co. Ltd.	/	2025	2050
Angang Steel Company Limited	/	2025	/
Fushun Special Steel Co.,LTD.	Achieve carbon peak by 2025, reduce carbon emissions by more than 10% from the peak by 2030, reduce carbon emissions by more than 30% from the peak by 2050, with the ultimate goal of carbon neutrality by 2060	2025	2060
Beijing Shougang Co.,Ltd.	By 2030, the low-carbon product line will have the capability to reduce CO_2 emissions intensity per ton of steel by 30% compared to 2020; by 2035, the total CO_2 emissions will be reduced by 30% from the peak	2025	2050-2060
Xinyu Iron & Steel Co.,Ltd	In 2029, steel production emissions per ton of steel will not exceed 1.79tCO_2e/t, creating a new model and benchmark for factory-city integration.	2025	/
Shandong Iron and Steel Company Ltd	By 2025, carbon emission intensity will decrease by 5% compared to 2020. By 2030, the company will have the resources and technical capabilities to reduce carbon dioxide emission intensity by 30% compared to 2020, with a 20% reduction in carbon emission intensity compared to 2020.	2030	/

Xiwang Special Steel Company Limited	/	2030	/
Hunan Valin Steel Co., Ltd.	/	2030	2060
Citic Pacific Special Steel Group Co., Ltd	Achieve a reduction of approximately 20% in carbon emission intensity by 2035 compared to the peak year	2030	2060
Hbis Company Limited	HBIS Group... aims to achieve a 10% reduction from the carbon emission peak by 2025, a 30% reduction by 2030, and ultimately achieve carbon neutrality by 2050 through the '6+2' low-carbon technology pathway, laying a methodological foundation for green development practices	/	2050
Hang Zhou Iron & Steel Co.,Ltd.	In 2025, the carbon dioxide emission intensity per ton of steel is 1.60 tCO_2/t; In 2030, the carbon dioxide emission intensity per ton of steel is 1.43 tCO_2/t; In 2035, the carbon dioxide emission intensity per ton of steel is 1.40tCO_2/t	/	/
Bengang Steel Plates Co., Ltd.	Achieve a breakthrough in the industrialization of cutting-edge low-carbon metallurgical technology by 2030, with large-scale promotion and application of deep carbon reduction processes, striving to reduce total carbon emissions by 30% from the peak by 2035; Continuously develop low-carbon metallurgical technology to become one of the first large steel companies in China to achieve carbon neutrality.	2025	/
Hang Zhou Iron & Steel Co.,Ltd.	In 2029, steel production emissions per ton of steel will not exceed 1.79tCO_2e/t, creating a new model and benchmark for factory-city integration.	2025	/
Sansteel Minguang Co.,Ltd.,Fujian	Company's 2024 business plan and strategy: strive for comprehensive energy consumption per ton of steel to be below 560kgce/t, self-generated electricity ratio above 96%, and average carbon emission intensity per ton of steel below 1.85tCO_2/t	/	/
Nanjing Iron & Steel Co.,Ltd.	Electrification phase (2031-2035), gradually achieving the transition from long process to short process, with the proportion of new energy reaching over 30%	2030	2050

Case 1: Baosteel Co., Ltd. promotes low-carbon emission steel products, achieving full coverage of carbon accounting for key industrial products.

The utilization of scrap steel is one of the core pathways for low carbon transition. By increasing the proportion of scrap steel recycling and reuse, and enhancing scrap steel processing capacity, the proportion of short-process steelmaking can be increased, thereby reducing energy consumption of fuel and raw materials in the front-end ironmaking stage, and consequently reducing carbon emissions. Baosteel Co., Ltd. proposes goals such as 'adding an additional 2.3 million tons/year of low-carbon emission high-grade steel produced by electric arc furnaces using 100% scrap steel before 2030,' gradually increasing the proportion of short-process electric arc furnace steelmaking and green energy[93]. In the 2023 sustainability report, Baosteel Co., Ltd. also disclosed that it signed a direct scrap supply agreement with automotive companies and silicon steel users, with the scrap recycling volume from users reaching 351,000 tons in 2023.

In addition, Baosteel Co., Ltd. released several low-carbon products (Table 4-2-2). For automotive sheet products, Baosteel Co., Ltd. conducted production trials with a high scrap ratio, achieving a scrap ratio of up to approximately 50%. Its all-scrap electric furnace process ultra-low carbon emission Gipha steel DH980 product can achieve a carbon emission reduction of more than 60%.

Table 4-2-2 Low Carbon Products Released by Baosteel

Product Name	Emission Reduction	Product Details
BeyondECO®	30%-80%	BeyondECO® is Baosteel's low carbon product launched in 2022, aiming to achieve a 30%-80% reduction in carbon footprint through a series of metallurgical process technologies, including high scrap steel ratio, electric arc furnace steelmaking, hydrogen-based reduction, and supplemented by the use of green electricity in the manufacturing process. BeyondECO®RC-BF strictly implements carbon reduction measures and production process paths. The carbon emission intensity of this low carbon steel is reduced by 30% compared to steel coils

[93] Baosteel Co., Ltd. 202 3 Sustainability Report [EB/OL]. [2024-07-31]. http://static.cninfo.com.cn/finalpage/2024-04-27/1219853679.PDF

		produced by traditional process paths, and through evaluation, the key material indicators meet the requirements of target parts.
Silicon Steel BeCOREs	Undisclosed	At the third Non-Oriented Silicon Steel Application Technology Conference, Baosteel Co., Ltd. released three first-of-its-kind non-oriented silicon steel products with thicknesses of 0.25mm, 0.27mm, and 0.30mm.
BCB EV Baosteel Ultra-light High-safety Pure Electric White Body	200 kg/ automotive body	The solution's GigaPascal Steel® X-GPa® ratio reaches 50%, achieving a 16% weight reduction rate and a 60% steel utilization rate. The steel required for manufacturing each white body can reduce 200 kilograms of carbon dioxide emissions.
BCB EV GPa Steel® X-GPa® Flexible Battery Pack	31.5 kilograms/ battery pack	The solution's GPa Steel® X-GPa® proportion reaches 100%, achieving a 12.5% lightweight rate and an 80% steel utilization rate. The steel required for manufacturing each battery pack can reduce 31.5 kilograms of carbon dioxide emissions.

In terms of supply chain management, Baosteel prioritizes the procurement of low-carbon products. In 2023, it identified 72 types of low-carbon raw materials and promoted their usage, achieving a cumulative annual carbon reduction of 92,000 tons. During the reporting period of 2023, Baosteel Co., Ltd. guided more than 1,000 suppliers to carry out carbon footprint accounting and certification work, covering 35% of the total number of Baosteel suppliers. A total of more than 3,000 industrial product carbon accounting reports were completed, achieving 100% coverage of carbon accounting for Baosteel's key industrial products.

Case 2: HBIS Group explores hydrogen metallurgy technology to produce low-carbon emission steel for automotive use.

In the long-process steel smelting process, coal is used as the main energy source and reducing agent, which generates a large amount of carbon dioxide. Hydrogen metallurgy technology can achieve deep decarbonization by using hydrogen to replace coal as a reducing agent in the ironmaking process.

HBIS Group Co., Ltd. (hereinafter referred to as 'HBIS Group') completed the world's first 1.2 million-ton coke oven gas zero-reforming hydrogen metallurgy demonstration project

(Figure 4-2-14) [94] at the end of 2022, optimizing the Direct Reduced Iron (DRI) process design. It adopted high-pressure shaft furnace zero-reforming hydrogen metallurgy technology using coke oven gas as the reducing gas, with a hydrogen-to-carbon ratio in the process gas reaching over 8:1. Compared to long process production, it can reduce carbon dioxide emissions by 800,000 tons annually, achieving an emission reduction rate of 70%.

Figure 4-2-14 Hebei Iron and Steel Group Hydrogen Metallurgy Demonstration Project

Based on this innovative process, HBIS Group assists the automotive industry in emission reduction by adopting the life cycle assessment method, facilitating the realization of the ecological value of hydrogen-based DRI. The life cycle study clarifies the emission reduction potential of steel raw materials under the support of DRI technology, namely: through the blast furnace-basic oxygen furnace process, using 10 to 20% direct reduced iron (reducing the amount of hydrogen-rich gas) to produce low-carbon automotive steel products can achieve a carbon reduction of 8-16%. Through the electric arc furnace process, using 30-50% green hydrogen direct reduced iron as raw material to produce low-carbon automotive steel products can reduce carbon by 40-50% compared to the current blast furnace-basic oxygen furnace process. In the scenario of full replacement by renewable energy power generation, the carbon reduction capacity will reach over 90%.

[94] HBIS Group. 2022 Annual Sustainability Report [EB/OL]. [2024-05-21]. https://www.hbisco.com/news/media/t105/857.

In the production process of high-strength steel, HBIS Group Tangshan Company adds auxiliary raw materials—DRI products, which can reduce carbon dioxide emissions by 10% - 30%. On June 20, 2023, the first batch of low-alloy high-strength steel for automobiles using DRI products as raw materials was successfully rolled off the production line at the Tangshan Company, with product composition control and surface quality meeting the expected targets.[95]

Relying on the hydrogen-based direct reduction iron-electric arc furnace process line, HBIS Group follows the principle of near-zero carbon in the smelting process, near-zero carbon in energy sources, and near-zero carbon in raw material production. It focuses on core technologies such as high-quality low-carbon preparation of hydrogen-based direct reduction iron, efficient green power supply for electric arc furnace steelmaking, and the addition of direct reduction iron in electric arc furnace smelting. The company conducts research and engineering application studies on key technologies for the 'hydrogen-based shaft furnace-near-zero carbon emission electric arc furnace' steelmaking process. HBIS Group Zhangxuan Company has officially launched the world's first 'hydrogen-based shaft furnace-near-zero carbon emission electric arc furnace' new short process project, aiming to ultimately achieve the goal of near-zero carbon emissions in crude steel, supporting the research and application of green high-quality steel materials.[96]

In contrast, the aluminum smelting industry's climate actions still lags behind, with a low level of climate information disclosure. Five companies disclosed carbon emissions or intensity data. Leading companies such as Shandong Nanshan Aluminium Co., Ltd., Aluminum Corporation of China Limited, Yunnan Aluminium Co,Ltd., China Hongqiao Group Limited, and Henan Zhongfu Industrial Co.,Ltd have set climate targets. Among them, Nanshan Aluminum has released cradle-to-grave product carbon footprint reduction targets (Table 4-2-3). In terms of climate action, 5 aluminum smelting companies disclosed using green electricity in

[95]HBIS Group. 2023 Environmental, Social, and Governance Report [EB/OL]. [2024-07-31]. http://static.cninfo.com.cn/finalpage/2024-04-27/1219869282.PDF.

[96]China Energy News. The world's first 'Hydrogen-Based Shaft Furnace—Near Zero Carbon Electric Arc Furnace' project launched (April 15, 2024, Issue 10) [EB/OL]. [2024-10-02]. http://paper.people.com.cn/zgnyb/html/2024-04/15/content_26056261.htm.

production; 6 companies disclosed conducting energy efficiency improvement projects, with 4 focusing on energy-saving technological modifications for electrolytic cell technology. Nanshan Aluminum, Aluminum Corporation of China, China Hongqiao disclosed the establishment of a recycled aluminum recovery demonstration line, Yunnan Aluminum announced initiating research on reducing the oxidation consumption of aluminum electrolysis anode carbon blocks.

Table 4-2-3 Summary of Climate Target Setting for Aluminum Smelting Companies

Enterprise Name	Carbon Reduction Targets	Carbon Peak Year	Carbon Neutrality Year
Shandong Nanshan Aluminium Co., Ltd.	From bauxite to electrolytic aluminum, the product carbon footprint target emission for 2025 is 17.01 (tCO_2e/product)	2030	2050
Aluminum Corporation of China Limited	40% carbon reduction target by 2035 Alumina sector - unit product (ton of alumina) carbon dioxide equivalent emission intensity decreased by 2% in 2023 compared to 2022 Electrolytic aluminum sector - carbon dioxide equivalent emission intensity per unit product (ton of electrolytic aluminum) in 2023, calculated based on comprehensive AC power consumption, with emission intensity below 8 tons	2025	/
Yunnan Aluminium Co,Ltd.	40% Carbon Reduction by 2035	2024	/
China Hongqiao Group Limited	/	2025	2055
Henan Zhongfu Industrial Co.,Ltd	50% reduction in carbon emissions for major subsidiaries in Scope 1 and Scope 2 by 2035	/	2050

Case 3: Yunnan Aluminum Co., Ltd. has 80% of its energy structure being clean energy, collaborating with Mercedes-Benz and Volvo on low-carbon aluminum

Greenhouse gas emissions from the electrolytic aluminum process account for 95% of the total emissions in the aluminum smelting process, with over 80% originating from electricity

consumption. Therefore, increasing the proportion of renewable energy power usage can significantly reduce the carbon emissions of aluminum smelting companies.

Yunnan Aluminum Co., Ltd.[97] commits to achieving carbon peak by 2024 and reduce carbon by 40% by 2035, continuously enhancing energy management levels, eliminating high-energy-consuming equipment, promoting distributed photovoltaic projects, and increasing the use of green electricity. In 2023, the proportion of clean energy usage by the company reached 80% (Figure 4-2-15), and it obtained the green electricity aluminum product evaluation certificate (Figure 4-2-16), with emissions per ton of electrolytic aluminum below 1.83 tCO_2e. Meanwhile, Yunnan Aluminum Co., Ltd. released environmental product declaration reports for products such as alumina and aluminum ingots produced by its subsidiaries through the China Nonferrous Industry EPD platform[98]. According to the calculation results, the 'cradle-to-grave' product carbon footprint of Yunnan Aluminum Wenshan Company's ton of alumina is 1203.3 kilograms of carbon dioxide equivalent; The 'cradle-to-grave' product carbon footprint of Wenshan's ton of hydropower aluminum ingot is 4829.81 kilograms of carbon dioxide equivalent, which is far below the limit proposed by the Aluminum Stewardship Initiative (ASI), reflecting the emission reduction effect brought by the use of green electricity.

In addition, Yunnan Aluminum Co., Ltd. and Mercedes-Benz signed a memorandum of cooperation for the 'China Low-Carbon Aluminum Lighthouse Project,' and signed a memorandum of cooperation for the 'Sustainable Aluminum Value Chain' with Volvo Cars, collaborating with automotive companies to jointly promote the application of low-carbon aluminum in the automotive industry and the low-carbon transition of the industrial chain.

[97]Yunnan Aluminium Co., Ltd. 2023 Environmental, Social, and Governance (ESG) Report [EB/OL]. [2024-07-31]. https://ylgf.chinalco.com.cn/kcxfz/gsesgbg/gsesg_bg/202405/P020240507702511224256.pdf.

[98] Non-ferrous Industry EPD Platform. Announced/Published EPD/CFP[EB/OL]. [2024-07-31]. https://www.cnia-epd.com/#/seach?flag=EPD.

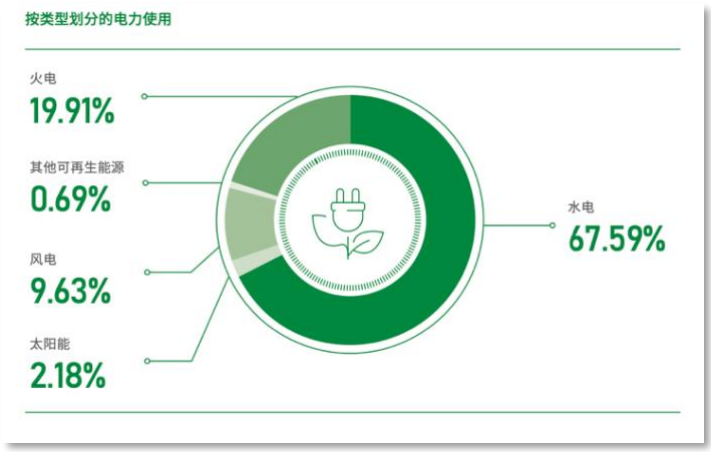


Figure 4-2-15 Yunnan Aluminum Co., Ltd. Energy Usage

Figure 4-2-16 Yunnan Aluminum Co., Ltd. Green Electricity Aluminum Product Evaluation Certificate

Case 4: Multiple aluminum companies establish recycled aluminum production lines to expand the scale of recycled aluminum production

As mentioned above, using recycled aluminum in the aluminum smelting process can reduce fossil energy and electricity consumption in the upstream metal smelting process, which is one of the core paths for aluminum material companies to achieve emission reduction.

Shandong Nanshan Aluminium Co., Ltd.[99] has established a waste aluminum recycling project with an annual capacity of 100,000 tons; accumulating a total of 55,000 tons of graded waste from downstream customers. Through the recycling of regenerated aluminum, the proportion of regenerated aluminum in the can packaging materials of the sheet and strip business unit has reached 18%, reducing carbon emissions from using scrap aluminum by more than 90% compared to electrolytic aluminum liquid. Meanwhile, the usage proportion of some products' scrap aluminum can exceed 20%.

[99] Nanshan Aluminum. 2023 Environmental, Social, and Governance Report [EB/OL]. [2024-05-21]. http://static.cninfo.com.cn/finalpage/2024-04-30/1219904816.PDF.

Aluminum Corporation of China Limited [100] Guizhou Company has built a 50,000 tons/year regenerated aluminum demonstration line. Through research on technologies such as graded processing, smelting, and alloying process control, the comprehensive loss of regenerated aluminum is reduced.

China Hongqiao Group Limited [101] and the German automobile dismantling and metal recycling company Scholz have collaborated to introduce scrap automobile dismantling and regenerated aluminum production technology, achieving upcycling of regenerated aluminum; Promote the automation of metal sorting technology to achieve sorting according to alloy grades, with a scrap car recycling rate of 97%. In addition, China Hongqiao also adopts the flotation process to comprehensively utilize the waste carbon slag generated during the aluminum smelting process. Part of the product obtained from flotation is reused as raw material in electrolytic aluminum production, and part is sold as a product.

[100] Aluminum Corporation of China. 2022 Social Responsibility and Environmental, Social, and Governance Report [EB/OL]. [2024-05-21]. http://static.cninfo.com.cn/finalpage/2023-03-22/1216181055.PDF.

[101] China Hongqiao. 2022 Environmental, Social, and Governance Report [EB/OL]. [2024-05-21]. http://www.hongqiaochina.com/responsibility/Regulatory.html.

Chapter V Conclusions and Recommendations

1. Conclusions

Chinese automotive companies are transitioning to NEVs on a larger scale, while overseas automotive companies are also making commitments to stop selling gasoline vehicles. With the advancement of the global energy transition, the carbon emissions of NEVs during the usage phase will continue to decrease. This means that Chinese automotive companies will play a greater role in assisting the decarbonization process of transportation in China and even globally.

Although NEV have a lower carbon footprint compared to gasoline vehicles as it emits no carbon during the use phase, the emissions from raw materials in the production process is relatively high regardless of gasoline or electric vehicle. Moreover, the higher the vehicle class[102], the higher the vehicle carbon footprint. This is mainly due to the higher carbon emissions associated with materials such as steel and aluminum. With the advancement of energy transition, the proportion of carbon emissions in the production process of automobiles and raw materials will continue to increase. This requires traditional and NEV companies to pay more attention to low-carbon manufacturing and focus on reducing carbon emissions in the production of raw materials such as steel and aluminum smelting.

However, most companies have not set target to reduce steel and aluminum emissions. Emission reduction actions are currently in the pilot stage, and there is a lack of quantitative data for stakeholders to track the contribution to steel and aluminum emission reductions. Although leading automotive companies have set emission reduction targets related to steel and aluminum and have begun to focus on Scope 3 emissions, they are far from incentivizing raw material suppliers to accelerate decarbonization. In general, NEV companies score lower

[102] The vehicle classes from low to high are: microcar, subcompact car, compact car, midsize car, upper midsize car, and full-size car

than traditional automotive companies in carbon emissions calculation and disclosure and target setting. Automakers headquartered in Europe, North America, Japan, and South Korea had an earlier start in setting Scope 3 carbon neutrality targets and emission reduction targets covering raw materials such as steel and aluminum. However, with the announcement of the 'Dual Carbon' goals, Chinese automakers such as Geely Auto have begun researching the product carbon footprint of raw materials. Geely Auto and Changan have also started setting emission reduction targets for the supply chain, while Li Auto, Xpeng, NIO, Seres, Chery, and BAIC Group have disclosed emission reduction pilot projects covering steel and aluminum production.

These are results of a number of difficulties and challenges, including: obtaining data from suppliers, the lack of representativeness of emissions factors, reaching consensus on the definitions of 'low-carbon emission steel/green steel' and 'low-carbon emission aluminum/green aluminum,' the absence of low-carbon procurement in mainstream ESG rating indicators, the ineffectiveness of recycling scheme for scrap steel and aluminum, and the high green premium of using low-carbon technologies and recycled resources in the production of steel and aluminum, along with the declining willingness of consumers to pay for low-carbon products.

Nevertheless, the global consensus on addressing climate change is strengthening, China's renewable energy is continuously expanding, and the carbon peaking and carbon neutrality '1+N' policy system is being implemented. Enterprise carbon disclosure standards and carbon footprint accounting methods and emissions factor data are under construction. Digital accounting tools and disclosure platforms can empower companies to enhance their carbon management capabilities. These have provided important opportunities for the automotive industry to promote collaborative carbon reduction.

2. Recommendations

Recommendations for automotive companies:

(1) Strengthen the calculation and disclosure of data. Automotive companies should pay attention to and participate in the drafting of corporate carbon disclosure guidelines, improve the accuracy of Scope 3 and product

carbon footprint data accounting. Apply supplier-specific data when calculating purchased goods and services in manufacturing stages such as steel, aluminum, and batteries.

(2) Set science-based supply chain emission reduction targets and disclose progress. Automotive companies should align with the global temperature control targets and the nationally determined contributions, set science-based greenhouse gas reduction and neutrality targets and break them down into raw material manufacturing stages such as steel and aluminum, publicly disclose progress, and encourage steel, aluminum, batteries, and components suppliers to set their own emission reduction targets.

(3) Incorporate supply chain emission reduction into corporate sustainability mechanism. Automotive companies should recognize the importance of supply chain carbon reduction and integrate it into corporate sustainability and supplier management mechanisms. NEV companies should shift from focusing solely on 'manufacturing green' to balancing 'manufacturing green' and 'green manufacturing' by setting quantifiable green procurement requirements for suppliers, including those of steel and aluminum, encouraging suppliers to engage in accounting, disclosure, target setting, and emission reduction actions.

(4) Develop mutually recognized low-carbon emission steel and aluminum standards. Automotive companies should collaborate with suppliers of steel and aluminum to advance decarbonization pathways and research decarbonization technologies, forming industry-recognized standards and certification for low-carbon emission steel and aluminum.

(5) Drive the development of low-carbon technologies and increase the scale of low-carbon materials supply. Automotive companies should encourage suppliers to accelerate the adoption of renewable energy, energy conservation, and the application of low-carbon metallurgical technology. Empower steel and aluminum suppliers who have not yet undertaken emission reduction to embark on climate action, expand the supply of

low-carbon products, and disclose the emission reduction effects of using low-carbon materials. Require large suppliers of components and other parts to carry out low-carbon procurement actions to accelerate low-carbon transition across the industrial chain.

(6) Pay attention to the carbon emissions at the end of the product life cycle. Automotive companies should collaborate with downstream companies in the industrial chain, such as recyclers, to promote and improve the dismantling, decomposition, and reuse of end-of-life vehicles, batteries, and other components, maximizing the utilization of resources such as steel, aluminum, and battery materials. Form a unified standard or classification requirement for waste materials to reduce the difficulty of material recycling and sorting, streamline the recycling-classification-regeneration chain, and enhance the efficiency of resource recycling and utilization.

(7) Engage in multi-stakeholder collaborations. Automotive companies should deepen communication with stakeholders such as environmental organizations and think tanks, pay attention to external evaluations, and understand their position in driving the low-carbon transition of the industry chain, benchmarking against best practices. Conduct information disclosure to assist investors in assessing the progress and potential of the low-carbon transition in the automotive industry chain, guide consumers in making choices, and promote multi-party participation in the low-carbon transition of the automotive industry chain.

Recommendations for banks and other financial institutions:

1. Support low-carbon investment and financing mechanisms. Banks and other financial institutions should formulate climate investment and financing plans, develop diversified financing mechanisms, and support the automotive industry chain, particularly the development and application of key technologies in the low-carbon transition of steel and

aluminum. Special attention should be given to providing support for the funding needs of large-scale, long-term loan projects in the zero-carbon transition of the supply chain.

2. Guide financing companies to enhance the level of carbon information disclosure. Banks and other financial institutions should require financing companies to conserve energy, reduce emission and disclose information, and guide them to focus on the emission reduction of emission hotspots in the supply chain, and enhance transparency.
3. Conduct research on sustainable finance innovation. Banks and other financial institutions should explore innovative financial products, combine traditional financial tools such as loans and bonds with new concepts like product carbon footprint, guiding financing companies to focus on greenhouse gas emissions from product design, raw material extraction, production, distribution, storage, usage to disposal or recycling.

Suggestions for the Regulatory Authorities:

1. Accelerate the integration of emissions hotspots in the automotive industry chain, such as steel and electrolytic aluminum, into the carbon market. Improve the carbon accounting standards for key industries such as steel and aluminum, and promptly include key companies in the steel and electrolytic aluminum sectors into China’ s carbon emissions trading market regulation mechanism. Enhance the identification of compliance entities, allocation of allowances, and the Monitoring, Reporting, and Verification (MRV) mechanisms, as well as other processes for quantifying carbon emissions and ensuring data quality, to incentivize steel and electrolytic aluminum companies to expedite the implementation of energy conservation and emission reduction measures.
2. Establish internationally recognized rules for sustainable development information disclosure in the automotive industry chain. Benchmark

against international mainstream carbon disclosure mechanisms, formulate greenhouse gas information disclosure standards for automotive companies, guide automotive companies to focus on supply chain emission reduction actions, and promote the disclosure of carbon emissions and product carbon footprints. Continuously improve the sustainable development information disclosure requirements for listed companies and bond issuers, guide listed companies and bond issuers in the automotive, steel and aluminum industries to increase the transparency and quality of information disclosure, and strengthen investors' confidence in investing in low-carbon technologies, products, and companies.

3. Establish and improve the automotive industry chain product carbon footprint management system. Promote the development of a collaborative product carbon footprint accounting methodology for the automotive industry chain, especially the accounting rules for recycled materials in the stages of automobile dismantling and steel and aluminum recycling. Accelerate the construction of a product life cycle emission factor database in China, and promote international alignment and mutual recognition. Guide the industry to accelerate product carbon footprint accounting work, formulate a product label certification system for low-carbon footprint automobiles, low-carbon emission steel, and low-carbon emission aluminum, improve the quality of product carbon footprint data, and establish a product carbon footprint grading management system.
4. Promote automotive companies to focus on the embedded carbon in raw materials and implement green supply chain management mechanisms. Encourage the automotive industry to pay attention to the embedded carbon emissions in raw materials, leverage the leading role of chain companies, and collaborate with upstream industries such as steel, aluminum smelting, and batteries to accelerate the decarbonization process. Establish unified standards for low-carbon emission steel and aluminum, guide automotive companies to develop green procurement

systems for low-carbon emission steel, aluminum, and other raw materials, and drive upstream raw material companies to accelerate energy conservation and emission reduction from the demand side, continuously reducing the carbon footprint of automotive products. Guide the public to pay attention to the climate impact of the life cycle of automobiles, choose low-carbon emission automotive products, practice a green lifestyle, and encourage automotive companies to accelerate green low-carbon transitions, enhancing the scale of usage of low-carbon emission steel and aluminum materials.

Appendix I: Policies Related to Carbon Reduction and Pollution Control in the Automotive Industry Issued by the Chinese Government Since 2021

Policies	Issuing Authorities	Date of Issue	Related Work
The 14th Five-Year Plan for Circular Economy Development[103]	National Development and Reform Commission	July 2021	1. Promote Full Life Cycle Management of Automobile Usage. Research and formulate a full life cycle management plan for automobile usage, build an information interaction system covering automobile manufacturers, dealers, repair companies, recycling and dismantling companies, etc., to strengthen the interconnection and interactive sharing of information on automobile production, import, sales, registration, maintenance, used car transactions, scrapping, and the flow of key components. 2. Implement standardized management in the recycling and utilization industries of renewable resources such as scrap steel, scrap non-ferrous metals, waste tires, and used power batteries to enhance the standardization level of the industry and promote the aggregation of resources towards advantageous companies.
14th Five-Year Plan for Industrial Green Development[104]	Ministry of Industry and Information Technology	December 2021	1. Promote the coordinated development of green industrial chains and green supply chains, encourage manufacturing companies in the automotive, home appliance, and machinery sectors to build a green supply chain management system supported by data, network sharing, and intelligent collaboration, to improve resource utilization efficiency and the greening level of the supply chain.
Implementation Plan for Carbon	Ministry of Industry and Information	July 2022	1. Support leading companies in the automotive industry to play a leading role in key areas such as supply chain integration and innovative low-carbon management, embedding the

[103] National Development and Reform Commission. The "14th Five-Year" Circular Economy Development Plan [EB/OL]. 2021-07-01[2024-04-29]. https://www.gov.cn/zhengce/zhengceku/2021-07/07/content_5623077.htm.

[104] Ministry of Industry and Information Technology. "14th Five-Year Plan for Green Industrial Development" [EB/OL]. [2024-05-10]. https://wap.miit.gov.cn/zwgk/zcwj/wjfb/tz/art/2021/art_4ac49eddca6f43d68ed17465109b6001.html.

Policies	Issuing Authorities	Date of Issue	Related Work
Peaking in the Industrial Sector[105]	Technology National Development and Reform Commission, Ministry of Ecology and Environment		green and low-carbon concept throughout the entire process of product design, raw material procurement, production, transportation, storage, usage, and recycling, accelerate the establishment of a unified green product certification and labeling system, and promote the green and low-carbon development of the entire supply chain. 2. Encourage the formulation of low-carbon development plans with a 'one chain, one policy' approach, and release reports on the carbon reduction achievements of core suppliers. 3. Promote the extended producer responsibility system for products such as automobiles. Facilitate the construction of a recycling system for power batteries of new energy vehicles. 4. Build a digital collaborative green supply chain in industries such as automobiles.
Guidelines for the Construction of Carbon Peak and Carbon Neutrality Standard Systems[106]	National Standardization Committee and Others	April 2023	1. Accelerate the formulation and revision of carbon emission accounting and reporting standards for industries such as transportation, metallurgy, and non-ferrous metals, as well as standards and specifications related to data quality. 2. Formulate and revise carbon reduction standards for industrial production processes in industries such as automobiles, steel, and non-ferrous metals. 3. Formulate and revise standards for the recycling and utilization of renewable resources such as scrap metal, waste textiles, waste plastics, and waste power batteries. Formulate and revise remanufacturing standards for automotive parts and internal combustion engines.
Work Plan for Stable Growth in the Automotive	Ministry of Industry and Information Technology and Others	September 2023	1. Strengthen cooperation in low-carbon development across the entire industry chain with key countries and regions, and promote the formation of mutually recognized carbon emissions and carbon footprint accounting systems, creating a better environment for the overseas development of automotive companies.

[105] Ministry of Industry and Information Technology, National Development and Reform Commission, Ministry of Ecology and Environment. "Implementation Plan for Carbon Peaking in the Industrial Sector" [EB/OL]. 2022-07-07[2024-04-29]. https://www.gov.cn/zhengce/zhengceku/2022-08/01/content_5703910.htm.

[106] National Standardization Administration and ten other departments. "Guidelines for the Construction of Carbon Peaking and Carbon Neutrality Standard System" [EB/OL]. [2024-05-10]. https://www.mee.gov.cn/xxgk2018/xxgk/xxgk10/202304/t20230424_1028080.html.

Policies	Issuing Authorities	Date of Issue	Related Work
Industry (2023–2024)[107]			
Guidelines for Improving the Supply Chain Management of Manufacturing Companies (Trial)[108]	General Office of the Ministry of Industry and Information Technology, General Office of the Ministry of Transport, General Office of the Ministry of Commerce	May 2024	1. Vigorously promote green supply chain design. Companies should integrate low-carbon and circular concepts into the entire supply chain design process. Give priority to selecting renewable, degradable, and other green materials, and gradually reduce the types and usage of non-green materials. Actively apply green design technologies, accelerate the development of more green products with high reliability, easy packaging and transportation, easy disassembly and recycling, and low resource and energy consumption throughout the lifecycle, as well as low pollutant emissions, and gradually increase the supply of green products. 2. Conduct product carbon footprint accounting. Leading companies in the supply chain should actively explore and carry out product carbon footprint accounting, and take the lead or participate in the formulation and revision of industry carbon footprint accounting standards. Encourage upstream and downstream companies in the supply chain to open and share carbon emissions data. 3. Encourage industries with the necessary conditions to establish a Product Environmental Declaration (EPD) platform to disclose carbon footprint and other environmental impact information externally, promoting mutual recognition and trust among upstream and downstream industries.
2024-2025 Energy Conservation and	State Council	May 2024	1. Promote the low-carbon transition of transportation equipment. Accelerate the elimination of old vehicles, raise the energy consumption limit standards for operational vehicles,

[107] Ministry of Industry and Information Technology and six other departments. "Work Plan for Stable Growth in the Automotive Industry (2023–2024)" [EB/OL]. [2024-05-10]. https://www.miit.gov.cn/zwgk/zcwj/wjfb/tz/art/2023/art_345e17e8729443eb8be3ecac76765874.html.

[108] General Office of the Ministry of Industry and Information Technology, General Office of the Ministry of Transport, General Office of the Ministry of Commerce. Guidelines for Improving the Supply Chain Management Level of Manufacturing Companies (Trial) [EB/OL]. [2024-05-21]. https://www.miit.gov.cn/jgsj/yxj/wjfb/art/2024/art_38fde85ccefa4b29bcb1a41e8b8edf15.html.

Policies	Issuing Authorities	Date of Issue	Related Work
Carbon Reduction Action Plan[109]			gradually remove restrictions on the purchase of new energy vehicles in various regions, and implement supportive policies such as facilitating the passage of new energy vehicles. Promote the electrification of public sector vehicles, orderly promote new energy medium and heavy-duty trucks, and develop zero-emission freight fleets. Advance the scrapping and renewal of old transport vessels, and promote pilot projects for the electrification transformation of coastal and inland river vessels. By the end of 2025, the carbon dioxide emission intensity in the transportation sector will be reduced by 5% compared to 2020.
Action Plan for Further Strengthening the Construction of the Carbon Peak and Carbon Neutrality Standard Measurement System (2024–2025)[110]	National Development and Reform Commission, State Administration for Market Regulation, Ministry of Ecology and Environment	August 2024	1. Strengthen the construction of standards for carbon footprint labeling of products. Issue the national standard for general requirements for quantifying product carbon footprints, unifying the principles of carbon footprint accounting, accounting methods, data quality, and other requirements for specific products. Accelerate the development of national standards for the carbon footprint of products such as new energy vehicles, photovoltaics, and lithium batteries to serve new advantages in foreign trade exports. Develop carbon footprint standards for key products such as electronics, plastics, and building materials. Research and formulate management measures for product carbon labeling certification, and develop relevant national standards for carbon labeling. 2. Accelerate the update and upgrade of product energy efficiency standards. Benchmark against international advanced levels, revise and upgrade energy efficiency standards for industrial general equipment, refrigeration and heating equipment, office equipment, kitchen appliances, and lighting products, expand the coverage of energy-efficient products, accelerate the development of energy efficiency standards for new infrastructure such as

[109] State Council. Notice of the State Council on Issuing the Energy Conservation and Carbon Reduction Action Plan for 2024-2025 [EB/OL]. [2024-07-31]. https://www.gov.cn/zhengce/zhengceku/202405/content_6954323.htm.

[110] National Development and Reform Commission and other three ministries. Notice of the National Development and Reform Commission, State Administration for Market Regulation, and Ministry of Ecology and Environment on Further Strengthening the Construction of the Carbon Peak and Carbon Neutrality Standard Measurement System Action Plan (2024-2025) [EB/OL]. [2024-08-09]. https://www.ndrc.gov.cn/xxgk/zcfb/tz/202408/t20240808_1392291.html.

Policies	Issuing Authorities	Date of Issue	Related Work
			electric vehicle charging piles and fifth-generation mobile communication (5G) base station equipment, include products such as high-voltage motors and servers in energy efficiency labeling management, and research and introduce implementation rules for data center energy efficiency labeling. 3. Strengthen the development of recycling standards for key products and equipment. Formulate recycling and dismantling standards for automobiles, electronic products, household appliances, etc., and research and develop relevant standards for the recycling and utilization of agricultural machinery parts. Develop recycling standards for retired photovoltaic equipment, wind power equipment, and power batteries, increase the supply of green design standards for new energy products and equipment, and accelerate the development of standards for recycled plastics and recycled metals. In accordance with the requirements of the 'General Principles for the Evaluation Index System of Cleaner Production,' develop a series of national standards for cleaner production evaluation in key industries such as steel, chemical, and building materials. 4. Deepen international cooperation. Continue to promote international cooperation in the fields of climate change measurement and standards, fully leveraging the key role of Chinese experts in international metrology and standardization organizations, and continuously enhancing China's participation and contribution in the field of climate change response. Continue to conduct international standard applicability analysis, propose a series of international standard proposals in fields such as electric vehicles, new power systems, and ecological carbon sinks, and strengthen international cooperation in new fields and new technologies.

Appendix II: Policies Related to Carbon Reduction and Pollution Control in the Steel and Aluminum Industries Issued by the Chinese Government Since 2021

Policies	Issuing Authorities	Date of Issue	Related Work
Guiding Opinions on Promoting High-Quality Development of the Steel Industry[111]	Ministry of Industry and Information Technology, National Development and Reform Commission, Ministry of Ecology and Environment	February 2022	1. Promote the high-quality and efficient utilization of scrap steel resources and orderly guide the development of electric furnace steelmaking 2. Promote the integrated development of scrap steel recycling, dismantling, processing, classification, and distribution, and further improve the construction of the scrap steel processing and distribution system 3. Implement the carbon peaking action plan for the steel industry and coordinate the collaborative governance of pollution reduction and carbon reduction 4. Support the establishment of a low-carbon metallurgy innovation alliance, formulate a hydrogen metallurgy action plan, and accelerate the research, development, and application of low-carbon smelting technology 5. Support the construction of a comprehensive carbon emissions data management system for the entire steel production process and participate in the national carbon emissions trading scheme. 6. Conduct industrial energy conservation diagnostic services to support companies in increasing the proportion of green energy usage. 7. Comprehensively promote ultra-low emissions transformation in the steel industry, accelerate the advancement of clean transportation in steel companies, and improve differentiated electricity pricing policies conducive to green and low-carbon development.

[111] Ministry of Industry and Information Technology National Development and Reform Commission Ministry of Ecology and Environment. Guiding Opinions on Promoting High-Quality Development of the Steel Industry [EB/OL]. [2024-05-21]. https://www.gov.cn/zhengce/zhengceku/2022-02/08/content_5672513.htm.

Policies	Issuing Authorities	Date of Issue	Related Work
			8. Actively promote the coupled development of the steel industry with building materials, electricity, chemicals, non-ferrous metals, and other industries to improve the comprehensive utilization efficiency of solid waste resources such as steel slag. (1) Vigorously promote the utilization of unconventional water sources such as comprehensive industrial wastewater and urban domestic sewage. (2) Promote green consumption, conduct pilot projects for steel structure housing and rural housing construction, and optimize the standard system for steel structure buildings. Establish and improve the evaluation system for green design products in the steel industry to guide the upgrading of steel use in downstream industries.
Guidelines for Energy Conservation and Carbon Reduction Transformation and Upgrading in the Steel Industry[112]	National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Ecology and Environment, National Energy Administration	February 2022	1. Green technology processes. Promote technological transformations such as sintering flue gas internal circulation, blast furnace top pressure equalization gas recovery, and dry dust removal of primary converter flue gas. Promote technologies such as hot metal one ladle to the end, thin strip casting and rolling, hot charging and hot delivery of cast billets, and online heat treatment. Break through the technical interfaces of the steel production process and advance the compactness and continuity of metallurgical processes. Increase the application and promotion of fluxed pellet production and high-proportion pellet ore smelting in blast furnaces. Conduct demonstrations of green, intelligent, and efficient electric arc furnace short-process steelmaking, and promote technologies such as efficient scrap recovery and processing, waste heat recovery from scrap, energy-saving electric furnaces, and intelligent steelmaking. Promote the gradual transformation and upgrading of equipment with low energy efficiency, low clean production levels, and high pollutant emission intensity, such as step-by-step sintering machines and pellet shaft furnaces, to advanced process equipment. Research and promote the gradual phase-out of independent sintering (pellet) and independent hot rolling.

[112]National Development and Reform Commission. Notice on Issuing the 'Implementation Guide for Energy Conservation and Carbon Reduction Upgrading in Key Areas of High Energy-Consuming Industries (2022 Edition)' [EB/OL]. [2024-05-21]. https://www.ndrc.gov.cn/xwdt/tzgg/202202/t20220211_1315447.html.

Policies	Issuing Authorities	Date of Issue	Related Work
			2. Cascade comprehensive utilization of residual heat and energy. Further increase the recovery and utilization of residual heat and energy, focusing on promoting the recovery of low-grade residual heat from various low-temperature flue gases, slag flushing water, and circulating cooling water. Promote advanced technologies such as electric furnace flue gas waste heat, high-parameter generator unit enhancement, low-temperature waste heat Organic Rankine Cycle (ORC) power generation, and low-temperature waste heat multi-generation. Achieve maximum recovery and utilization of residual heat and energy resources through cascade comprehensive utilization. Increase technological innovation, encourage and support the research, development, and application of process technology and equipment for the efficient recovery and comprehensive utilization of medium and high-temperature flue gas waste heat and metallurgical slag waste heat under complex conditions such as electric furnaces and converters. 3. Energy system optimization. Research and apply digital and intelligent control measures for heating furnaces, baking ladles, and internal transportation of molten steel and billets to promote the collaborative optimization of large material flows and large energy flows in the steel production process. Comprehensively promote the application of energy management centers, strengthen the management of energy equipment, enhance the allocation and use of energy measuring instruments, and promote the digital and intelligent transformation of enterprise energy management. Promote the research and application of technologies such as optimization of various energy medium systems, multi-flow coupled micro-distributed energy systems, and regional energy utilization self-balancing. 4. Intelligent energy efficiency management. Further promote the innovative application of new-generation information technologies such as 5G, big data, artificial intelligence, cloud computing, and the Internet in energy management. Encourage research and development of energy efficiency mechanisms and data-driven models, establish a three-tier energy efficiency diagnostic system for equipment, systems, and factories. Achieve intelligent control of core energy-consuming equipment through dynamic visual fine control, intelligent coupling of production processes for energy conservation and carbon reduction,

Policies	Issuing Authorities	Date of Issue	Related Work
			global-level intelligent scheduling optimization and control, and collaborative management of energy and environmental protection. Promote the digitalization, networking, and intelligent development of energy management to enhance overall energy efficiency levels. 5. Renovation of General Auxiliary Facilities. Promote the application of high-efficiency energy-saving motors, pumps, and fan products, and increase their usage proportion. Configure motor power reasonably to achieve system energy savings. Enhance the level of mechanization and automation in companies. Conduct research and application of advanced technologies such as centralized group control smart energy saving for compressed air, servo control energy saving for hydraulic systems, and potential energy recovery. Encourage companies to fully utilize large areas of high-quality rooftop resources to invest in the construction of distributed photovoltaic power generation projects through self-construction or leasing, thereby increasing the proportion of green electricity usage in companies. 6. Circular Economy Low Carbon Transformation. Focus on promoting the production and application of steel slag micro-powder and the comprehensive utilization of iron- and zinc-containing dust and mud to enhance the level of resource utilization. Encourage the research and application of steel slag micro-powder and composite powder technology to increase the substitution rate of cement clinker. Intensify the research and application of permeable high-strength asphalt pavement technology using steel slag particles and carbon sequestration technology for steel slag to enhance the circular economy value of steel slag. Promote the co-production of steel and chemicals by utilizing the abundant hydrogen and carbon monoxide resources in the by-product gas of steel companies to produce high-value-added chemical products. Conduct demonstrative applications of industrial furnace flue gas recovery and carbon dioxide utilization technology to promote industrial application.

Policies	Issuing Authorities	Date of Issue	Related Work
Guidelines for Energy Conservation and Carbon Reduction Transformation and Upgrading in Key Areas of High Energy-Consuming Industries (2022 Edition)[113]	National Development and Reform Commission	February 2022	1. Focus on promoting large-scale technology for aluminum electrolysis cells and alumina production lines, key technologies for aluminum electrolysis energy management, and new energy-saving technologies for stable current and insulated aluminum electrolysis cells. Prioritize the research and development of technologies such as calcium-free alumina dissolution, carbon sequestration and alkali removal from red mud, medium and low-grade waste heat recovery in aluminum smelting, and low-carbon primary aluminum smelting. 2. Continuously improve the green finance standard system, accelerate the research and formulation of transition finance standards, and enhance the evaluation system and incentive mechanisms for financial institutions' green finance. Leverage the role of the national industry-finance cooperation platform, strengthen the integration of information such as carbon emissions, and support the transformation and upgrading of high energy-consuming and high-emission projects in the non-ferrous metal industry. ...Strengthen corporate social responsibility awareness, improve the corporate carbon emission reporting and information disclosure system, encourage key companies to prepare low-carbon development reports, and enhance the carbon emission credit supervision mechanism. 3. Guide non-ferrous metal production companies to select green raw and auxiliary materials, technologies, equipment, and logistics, and establish a green low-carbon supply chain management system. Benchmark against international leading levels, comprehensively carry out clean production audit evaluation and certification, implement clean production transformation, and promote coordinated pollution reduction and carbon reduction management.
Implementation Plan for Accelerating the	Ministry of Industry and Information Technology,	February 2022	1. Promote technological upgrades to reduce the intensity of solid waste generation: Promote non-blast furnace ironmaking

[113] National Development and Reform Commission. 'Implementation Guide for Energy Conservation and Carbon Reduction Upgrading in Key Areas of High Energy-Consuming Industries (2022 Edition)' [EB/OL]. [2024-05-21]. https://www.ndrc.gov.cn/xwdt/tzgg/202202/t20220211_1315447.html.

Policies	Issuing Authorities	Date of Issue	Related Work
Promotion of Comprehensive Utilization of Industrial Resources[114]	National Development and Reform Commission, Ministry of Science and Technology, Ministry of Finance, Ministry of Natural Resources, Ministry of Ecology and Environment, Ministry of Commerce, State Administration of Taxation		2. Accelerate the large-scale and efficient utilization of industrial solid waste: Promote the comprehensive development and utilization of industrial solid waste based on elemental value, and accelerate the large-scale utilization of industrial solid waste such as smelting slag in fields such as valuable component extraction, building material production, municipal facility construction, underground filling, ecological restoration, and soil remediation 3. Enhance the comprehensive utilization capacity of complex and difficult-to-use solid waste: Actively carry out the graded and quality-based utilization of steel slag, expand the application of steel slag in low-carbon cement and other green building materials and roadbed materials, and enhance the scale of comprehensive utilization of steel slag 4. Optimizing industrial structure to promote solid waste source reduction: The steel industry is scientifically and orderly advancing the advanced electric furnace short process technology for scrap steel.
Industrial Water Efficiency Improvement Action Plan[115]	Ministry of Industry and Information Technology, Ministry of Water Resources, National	June 2022	1. Key core technology research directions in the steel industry: recycling of cold rolling acidic wastewater, near-zero discharge integration of coking wastewater, efficient cooling of circulating water, zero discharge of wastewater throughout the plant, etc. 2. Key directions for upgrading and transforming water efficiency in the steel industry: graded and cascading utilization of water quality, vapor cooling of heating furnaces, closed-loop cooling water for large blast furnaces, integrated regeneration and reuse of comprehensive

[114] Ministry of Industry and Information Technology and Six Other Departments. Notice on Issuing the Implementation Plan for Accelerating the Comprehensive Utilization of Industrial Resources by Eight Departments [EB/OL]. [2024-05-21]. https://www.gov.cn/zhengce/zhengceku/2022-02/11/content_5673067.htm.

[115] Six departments including the Ministry of Industry and Information Technology. Action Plan for Improving Industrial Water Efficiency. [EB/OL]. [2024-05-21]. https://www.gov.cn/zhengce/zhengceku/2022-06/22/content_5697083.htm.

Policies	Issuing Authorities	Date of Issue	Related Work
	Development and Reform Commission, Ministry of Finance, Ministry of Housing and Urban-Rural Development, State Administration for Market Regulation		wastewater, deep treatment of coking wastewater with electromagnetic strong oxidation, salt separation and zero discharge of concentrated brine, five-in-one low-temperature multi-effect seawater desalination of fuel-heat-electricity-water-salt, joint regeneration and reuse of steel wastewater and municipal sewage, smart water management, etc. 3. Expand the industrial use of seawater, mine water, and rainwater: Encourage coastal steel companies and parks to increase the direct use of seawater and the application of seawater desalination technologies such as low-temperature multi-effect, reverse osmosis, and solar thermal. Support the construction of seawater cooling and desalination facilities, either self-built or third-party investments, to expand the scale of seawater utilization.
Action Plan for Industrial Energy Efficiency Improvement[116]	Ministry of Industry and Information Technology, National Development and Reform Commission, Ministry of Finance, Ministry of Ecology and Environment, State-owned Assets Supervision and Administration Commission of the	June 2022	1. Key directions for energy-saving and efficiency-enhancing transformation and upgrading in the steel industry: Develop short-process electric furnace steelmaking in an orderly manner through capacity replacement, increase the use of scrap steel, and accelerate the promotion of technologies such as sintering flue gas internal circulation, blast furnace top pressure equalization gas recovery, hot metal one-tank-to-end, thin strip casting and rolling, hot charging and hot delivery of cast billets, high-parameter power generation units using by-product gas, comprehensive utilization of waste heat and pressure in a cascading manner, and intelligent energy management and control. 2. Accelerate the promotion of electrification and low-carbonization of end-use energy: In the steel industry, promote alternative process technologies and equipment such as electric arc furnaces, electric boilers, electric kilns, electric heating, high-temperature heat pumps, and high-power electric thermal storage boilers in heating, drying, steam supply, and other processes to expand the proportion of electrified end-use energy equipment.

[116] Six departments including the Ministry of Industry and Information Technology. Action Plan for Improving Industrial Energy Efficiency [EB/OL]. [2024-05-21]. https://www.gov.cn/zhengce/zhengceku/2022-06/29/content_5698410.htm.

Policies	Issuing Authorities	Date of Issue	Related Work
	State Council, State Administration for Market Regulation		
Implementation Plan for Synergistic Pollution and Carbon Reduction[117]	Ministry of Ecology and Environment, National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Housing and Urban-Rural Development, Ministry of Transport, Ministry of Agriculture and Rural Affairs, National Energy Administration	June 2022	1. In key areas for air pollution prevention, it is strictly prohibited to add new capacities for steel, coking, refining, electrolytic aluminum, cement, and flat glass (excluding photovoltaic glass). 2. Promote synergy and efficiency in the industrial sector. Implement green manufacturing projects, promote green design, and explore the greening of the entire industrial chain, including product design, production processes, product distribution, and recycling and disposal. Accelerate source emission reduction, process control, end treatment, and comprehensive utilization for green development throughout the industrial sector. Promote industrial energy conservation and improve energy efficiency levels. Legally implement mandatory clean production audits for 'double high energy consumption' companies, carry out clean production transformations in key industries, and promote a number of key companies to reach international leading levels. Research and establish a long-term mechanism for capacity reduction in industries such as steel and coking under the constraints of atmospheric environmental capacity, gradually reducing the number of independent sintering and hot rolling companies. Vigorously support the development of electric furnace short-process technology... By the year 2025 and 2030, the national proportion of short-process steelmaking will increase to 15% and above 20%, respectively... Encourage key industry companies to explore the adoption of multi-pollutant and greenhouse gas synergistic control technologies and processes, and carry out collaborative

[117]Seven departments including the Ministry of Ecology and Environment. Implementation Plan for Synergistic Pollution and Carbon Reduction [EB/OL]. [2024-05-21]. https://www.gov.cn/zhengce/zhengceku/2022-06/17/content_5696364.htm.

Policies	Issuing Authorities	Date of Issue	Related Work
			innovation. Promote the application of carbon capture, utilization, and storage technology in the industrial field. 3. Promote the collaborative efficiency of transportation. Accelerate the shift from road to rail and road to water, increasing the proportion of rail and water transport in comprehensive transportation. Develop urban green delivery systems and strengthen the construction of urban slow traffic systems. Accelerate the development of new energy vehicles, gradually promote the electrification of public sector vehicles, orderly replace old vehicles with new energy vehicles, and use new energy clean energy power for non-road mobile machinery. Explore the demonstration application and commercial operation of medium and heavy-duty electric and fuel cell trucks. By 2030, in key regions for air pollution prevention, the sales volume of new energy vehicles will reach about 50% of the total new car sales. Accelerate the elimination of old ships, promote the application of new energy and clean energy-powered ships, speed up the construction of port power supply facilities, and promote the use of shore power for ships at berth. 4. Promote the coordinated control of air pollution prevention. Optimize governance technology routes and intensify the collaborative reduction of nitrogen oxides, volatile organic compounds (VOCs), and greenhouse gases. Integrate the deep governance of air pollution in key industries with energy conservation and carbon reduction actions, promote ultra-low emission transformations in the steel, cement, coking industries, and boilers, and explore pilot projects for the collaborative control and transformation of air pollutants and greenhouse gas emissions. For the treatment of atmospheric pollutants such as VOCs, prioritize source substitution measures. Promote energy conservation and consumption reduction in atmospheric pollution control equipment, and improve the level of automation and intelligent operation of the equipment. Strengthen the management of ozone-depleting substances and hydrofluorocarbons, accelerate the transformation of production lines using hydrochlorofluorocarbons, and gradually phase out the use of hydrochlorofluorocarbons. Promote the coordinated control of atmospheric pollutant emissions and carbon emissions from mobile sources.

Policies	Issuing Authorities	Date of Issue	Related Work
			5. Strengthen the research and application of collaborative technologies... Enhance the research and development of key technologies such as hydrogen metallurgy, carbon dioxide synthesis of chemicals, and new power systems, and promote pilot applications of technologies such as energy optimization in refining systems, low greenhouse effect refrigerant replacement, and carbon capture and utilization. Promote the integration of photovoltaic storage and direct current, renewable energy and building integration, smart transportation, and transportation energy integration technologies. Carry out collaborative technological innovation for ultra-low emission and carbon reduction in flue gas, and develop technologies and equipment for multi-pollutant system management, VOCs source substitution, and low-temperature denitrification.
Implementation Plan for Carbon Peaking in the Industrial Sector[118]	Ministry of Industry and Information Technology, National Development and Reform Commission, Ministry of Ecology and Environment	July 2022	1. Strictly implement relevant regulations on capacity replacement, project filing, environmental impact assessment, and energy conservation evaluation review to effectively control steel production capacity. 2. Strengthen industrial collaboration to build a clean energy and steel industry community. Encourage the moderate and steady development of advanced electric arc furnace short processes in steelmaking. Promote the demonstration and promotion of low-carbon ironmaking technologies. 3. Optimize product structure to increase the application proportion of low-carbon products such as high-strength and high-toughness, corrosion-resistant and weather-resistant, and material-saving and energy-saving products. 4. Strengthen the recycling of renewable resources. Implement standardized management of the recycling and utilization industries for renewable resources such as scrap steel, scrap non-ferrous metals, waste paper, waste plastics, and used tires, and encourage companies that meet the standards to disclose their carbon footprint. Extend the deep processing

[118] Ministry of Industry and Information Technology, National Development and Reform Commission, Ministry of Ecology and Environment. "Implementation Plan for Carbon Peaking in the Industrial Sector" [EB/OL]. 2022-07-07[2024-04-29]. https://www.gov.cn/zhengce/zhengceku/2022-08/01/content_5703910.htm.

Policies	Issuing Authorities	Date of Issue	Related Work
			industrial chain of renewable resources to promote the efficient recycling of steel, copper, aluminum, and other materials.
Carbon Peak Implementation Plan for the Non-Ferrous Metal Industry[119]	Ministry of Industry and Information Technology, National Development and Reform Commission, Ministry of Ecology and Environment	November 2022	1. During the '14th Five-Year Plan' period, the structure of the non-ferrous metal industry and energy use was significantly optimized, important progress was made in the research and application of low-carbon processes, the energy consumption and carbon emission intensity per unit product of key varieties were further reduced, and the proportion of recycled metal supply reached over 24%. 2. During the '15th Five-Year Plan' period, the energy use structure of the non-ferrous metal industry will be greatly improved, with the proportion of renewable energy used in electrolytic aluminum reaching over 30%, and a green, low-carbon, and circular development industrial system will be basically established. Ensure that the non-ferrous metal industry achieves peak carbon emissions before 2030.
The Steel Industry Stabilization and Growth Work Plan[120]	Ministry of Industry and Information Technology, National Development and Reform Commission, Ministry of Finance Ministry of Natural Resources,	August 2023	1. Accelerate the promotion of green and low-carbon transformation. Accelerate the process of ultra-low emission transformation in steel companies, support steel companies in striving for environmental performance A level, and encourage companies to implement technological transformations such as mechanization of raw material yards, internal circulation of sintering flue gas, and low-nitrogen combustion in kilns. Support companies that have completed ultra-low emission transformations to collaborate with related industries such as ferroalloy, coking, chemical, building materials, and power to build a collaborative pollution reduction and carbon reduction 'consortium.'Support the implementation of 'extreme energy efficiency' transformation projects, explore the creation of super energy-efficient factories, and accelerate the promotion and application of energy-

[119] Ministry of Industry and Information Technology, National Development and Reform Commission, Ministry of Ecology and Environment. Carbon Peak Implementation Plan for the Non-ferrous Metal Industry [EB/OL]. [2024-05-21]. https://www.miit.gov.cn/zwgk/zcwj/wjfb/tz/art/2022/art_aef8faf38c7846c694fa88893b071b10.html.

[120] Seven departments including the Ministry of Industry and Information Technology. Work Plan for Stable Growth in the Steel Industry [EB/OL]. [2024-05-21]. https://www.miit.gov.cn/zwgk/zcwj/wjfb/tz/art/2023/art_2a4233d696984ab59610e7498e333920.html.

Policies	Issuing Authorities	Date of Issue	Related Work
	Ministry of Ecology and Environment, Ministry of Commerce, General Administration of Customs		saving and efficiency-enhancing technological equipment. Promote green transportation, prioritize the use of rail or water transport for medium and long-distance transportation, encourage the use of corridors or new energy vehicles for short and medium-distance transportation, and encourage companies to use new energy locomotives. Increase support for pilot testing and industrialization of low-carbon common technologies such as hydrogen metallurgy and low-carbon metallurgy, and provide capacity replacement policy support for the research of eligible low-carbon frontier technology industrialization demonstration projects. Coordinate the development of the coking industry with industries such as steel, and promote the coking industry to intensify green and environmental protection transformations. 2. Support and guide the orderly development of electric furnace steel. Accelerate the implementation of high-quality development leading projects for electric arc furnace short process steelmaking, enforce differentiated capacity replacement and environmental management policies for all-scrap electric arc furnace steelmaking projects, and create a world-leading electric arc furnace steel industry cluster. Support steel companies in building integrated bases for scrap steel storage, processing, and distribution based on the demand for scrap raw materials, enhance the level of scrap processing and classification management, achieve customized processing and distribution of scrap raw materials, and promote the high-quality and efficient utilization of scrap resources. Establish evaluation standards for electric arc furnace short process companies and scrap processing and distribution companies, and select approximately 5 leading benchmark companies to form a replicable industry model.
The Work Plan for Stabilizing Growth	The Ministry of Industry and Information Technology and Others	August 2023	1. Support industry associations in conducting evaluations of green products, carbon footprints, etc., and expedite the formulation of systematic management and technical standards for carbon emissions.

Policies	Issuing Authorities	Date of Issue	Related Work
in the Non-Ferrous Metals Industry[121]			
Guidelines for Accounting and Reporting Greenhouse Gas Emissions for Companies in the Aluminum Smelting Industry[122]	Ministry of Ecology and Environment	March 2024	1. Clearly define the accounting boundaries and types of greenhouse gases covered: At the facility level, only the aluminum electrolysis process is included, covering direct carbon dioxide emissions from anode consumption, indirect carbon dioxide emissions from electricity consumption in the aluminum electrolysis process, and greenhouse gas emissions of tetrafluoromethane (CF4) and hexafluoroethane (C2F6) due to anode effects during electrolysis. 2. Clarification of the conditions for determining indirect emissions from non-fossil energy power: This guideline clarifies that the power generated from non-fossil energy within the same company and directly delivered to key emission facilities via dedicated lines, as well as non-fossil energy power used by power users who have signed market-based trading contracts with non-fossil energy power generation companies and delivered through the grid to key emission facilities, will have their indirect emissions calculated as zero. For the consumption of non-fossil energy power purchased through market-based transactions, it is required to provide the market-based trading contract signed by both the power generation and consumption parties (if the contract cannot be provided, a transaction commitment letter, transaction announcement, and transaction results should be provided), as well as the green power certificate trading voucher executed according to the contract and the transaction settlement voucher issued by provincial or higher-level power trading institutions. Existing conventional hydropower and nuclear power are not required to provide green power certificate trading vouchers.

[121] Ministry of Industry and Information Technology and six other departments. 'Work Plan for Stable Growth in the Non-Ferrous Metal Industry' [EB/OL]. [2024-05-21]. https://wap.miit.gov.cn/zwgk/zcwj/wjfb/tz/art/2023/art_ac08a23d562440bdbe51e7a00b1ba36c.html.

[122] Ministry of Ecology and Environment. 'Guidelines for Accounting and Reporting of Enterprise Greenhouse Gas Emissions: Aluminum Smelting Industry' [EB/OL]. [2024-05-21]. https://www.mee.gov.cn/xxgk2018/xxgk/xxgk06/202403/t20240315_1068508.html.

Policies	Issuing Authorities	Date of Issue	Related Work
2024-2025 Energy Conservation and Carbon Reduction Action Plan[123]	State Council	May 2024	1. Deeply adjust the structure of steel products. Vigorously develop high-performance special steel and other high-end steel products, and strictly control the export of low value-added basic raw material products. Implement an integrated layout of steel, coking, and sintering, significantly reducing independent coking, sintering, and hot rolling companies and processes. Vigorously promote the recycling of scrap steel and support the development of electric furnace short-process steelmaking. By the end of 2025, strive to increase the proportion of electric furnace steel output to 15% of the total crude steel output, and achieve a scrap steel utilization of 300 million tons. 2. Accelerate energy-saving and carbon-reduction transformation in the steel industry. Promote the comprehensive utilization of blast furnace top gas, coke oven gas waste heat, and low-grade waste heat, and promote the integration of processes such as hot metal direct-to-casting and hot charging and hot delivery of cast billets. Strengthen the demonstration and application of low-carbon smelting technologies such as hydrogen metallurgy. By the end of 2025, the proportion of steel industry capacity above the energy efficiency benchmark level will reach 30%, and capacity below the energy efficiency baseline level will complete technological transformation or be phased out; more than 80% of the national steel capacity will complete ultra-low emission transformation. Compared to 2023, the comprehensive energy consumption per ton of steel will be reduced by about 2%, and the self-generation rate of residual heat, residual pressure, and residual energy will increase by more than 3 percentage points. In the years 2024-2025, energy-saving and carbon-reduction transformations in the steel industry are expected to achieve energy savings of approximately 20 million tons of standard coal and reduce carbon dioxide emissions by about 53 million tons.

[123] State Council. Notice of the State Council on Issuing the Energy Conservation and Carbon Reduction Action Plan for 2024-2025 [EB/OL]. [2024-07-31]. https://www.gov.cn/zhengce/zhengceku/202405/content_6954323.htm.

Policies	Issuing Authorities	Date of Issue	Related Work
			3. Strictly implement capacity replacement in the electrolytic aluminum industry, strictly control the addition of new capacity in copper, alumina, and other smelting industries, and reasonably plan the addition of new capacity in the silicon, lithium, and magnesium industries. Vigorously develop the recycled metal industry. By the end of 2025, the proportion of recycled metal supply will reach over 24%, and the proportion of direct alloying of molten aluminum will increase to over 90%. 4. Promote energy-saving and carbon-reduction transformations in the non-ferrous metal industry. Promote advanced technologies such as efficient and stable aluminum electrolysis, continuous copper matte blowing, vertical reduction magnesium smelting, and large-scale submerged arc furnace silicon production, and accelerate energy-saving and carbon-reduction transformations in the non-ferrous metal industry. By the end of 2025, the proportion of production capacity above the energy efficiency benchmark level in the electrolytic aluminum industry will reach 30%, and the proportion of renewable energy usage will exceed 25%; The proportion of production capacity above the energy efficiency benchmark level in copper, lead, and zinc smelting will reach 50%; Production capacity below the energy efficiency benchmark level in the non-ferrous metal industry will undergo technological transformation or be phased out. In 2024-2025, the energy-saving and carbon-reduction transformation in the non-ferrous metal industry will result in energy savings equivalent to about 5 million tons of standard coal and a reduction of approximately 13 million tons of carbon dioxide.
Implementation Plan for Establishing a Carbon Footprint	Ministry of Ecology and Environment and Others	June 2024	1. Publish standards for the calculation of key product carbon footprints. Prioritize the focus on key products such as electricity, coal, natural gas, fuel oil, steel, electrolytic aluminum, cement, fertilizers, hydrogen, lime, glass, ethylene, synthetic ammonia, calcium carbide, methanol, lithium batteries, new energy vehicles, photovoltaics, and electronic appliances, and formulate and publish calculation standards. 2. Encourage the inclusion of product carbon footprints in green low-carbon supply chains and product evaluation indicators, fully leveraging the positive role of product carbon footprints in promoting the application of low-carbon technologies, implementing low-carbon

Policies	Issuing Authorities	Date of Issue	Related Work
Management System[124]			transformations, optimizing energy resource allocation, and fulfilling social responsibilities among upstream and downstream companies in the industrial chain.
Accelerating the Construction of Work Plan for the Dual Control System of Carbon Emissions[125]	General Office of the State Council	July 2024	1. During the '15th Five-Year Plan' period, implement a dual control system for carbon emissions that focuses primarily on intensity control and is supplemented by total volume control. Establish a comprehensive evaluation and assessment system for carbon peaking and carbon neutrality. Strengthen the carbon emission accounting capabilities in key sectors and industries. Improve the management system for key energy-consuming and carbon-emitting units. Conduct carbon emission evaluations for fixed asset investment projects. Develop a product carbon footprint management system and product carbon labeling certification system that aligns with China's national conditions to ensure the timely achievement of the carbon peaking target. 2. After reaching peak carbon emissions, implement a dual control system focusing primarily on total volume control and supplemented by intensity control. Establish a carbon neutrality target evaluation and assessment system, further strengthen carbon emission management requirements for various regions, key sectors, industries, and companies, improve the product carbon footprint management system, promote the product carbon labeling certification system, and facilitate a stable reduction in total carbon emissions. 3. Improve the carbon emission accounting mechanism for key industry sectors. Leverage the role of industry regulatory authorities and associations, focusing on industrial sectors such as electricity, steel, non-ferrous metals, building materials, petrochemicals, and chemicals, as well as areas like urban and rural construction and transportation. Reasonably delineate the carbon emission accounting scope for industry sectors, relying on data from energy and

[124] Ministry of Ecology and Environment and fourteen other departments. Notice on Issuing the 'Implementation Plan for Establishing a Carbon Footprint Management System' [EB/OL]. [2024-07-31]. https://lgc0208.github.io/reference_format_generation/.

[125] General Office of the State Council. Notice from the General Office of the State Council on Issuing the 'Work Plan for Accelerating the Establishment of a Dual Control System for Carbon Emissions' [EB/OL]. [2024-07-31]. https://www.gov.cn/zhengce/content/202408/content_6966079.htm.

Policies	Issuing Authorities	Date of Issue	Related Work
			industrial statistics, carbon emission accounting from energy activities and industrial production processes, and the national carbon emission trading market to conduct carbon emission accounting for key industries. 4. Establish a sound management system for key energy-consuming and carbon-emitting units. Formulate and revise carbon emission accounting rules and standards for key industries such as power, steel, non-ferrous metals, building materials, petrochemicals, and chemicals. Develop and implement energy conservation and carbon reduction management measures for key energy-consuming and carbon-emitting units, incorporate carbon emission control requirements into the current management system for key energy-consuming units, promote the implementation of energy conservation and carbon reduction management requirements by key energy-consuming and carbon-emitting units, and strengthen the allocation and calibration of energy and carbon emission measurement instruments.
Special Action Plan for Energy Conservation and Carbon Reduction in the Electrolytic Aluminum Industry[126]	National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Ecology and Environment,	July 2024	1. By the end of 2025, the proportion of production capacity in the electrolytic aluminum industry above the energy efficiency benchmark level will reach 30%, production capacity below the energy efficiency baseline level will undergo technological transformation or be phased out, the industry's renewable energy utilization ratio will reach over 25%, and the production of recycled aluminum will reach 11.5 million tons. By implementing energy-saving and carbon-reduction transformations, the electrolytic aluminum industry is expected to achieve an energy saving of approximately 2.5 million tons of standard coal and a reduction of about 6.5 million tons of carbon dioxide emissions from 2024 to 2025. 2. By the end of 2030, the energy consumption and carbon emissions per unit product in the electrolytic aluminum industry will have significantly decreased, the use of renewable energy

[126] National Development and Reform Commission and four other departments. Notice from the National Development and Reform Commission and other departments on the issuance of the 'Special Action Plan for Energy Conservation and Carbon Reduction in the Electrolytic Aluminum Industry'[EB/OL]. [2024-07-31]. https://www.ndrc.gov.cn/xxgk/zcfb/tz/202407/t20240723_1391887_ext.html.

Policies	Issuing Authorities	Date of Issue	Related Work
	State Administration for Market Regulation, National Energy Administration		will have further increased, and significant breakthroughs will have been made in energy-saving and carbon-reduction technologies such as low-temperature aluminum electrolysis, new continuous anode electrolytic cells, inert anode aluminum electrolysis, and the graded utilization of recycled aluminum. The supply capacity of high-end aluminum products will have been greatly enhanced, and the industry's green and low-carbon development will have achieved remarkable results.
On the 2024 Renewable Energy Power Consumption Responsibility Weight and Related Matters[127]	General Office of the National Development and Reform Commission, National Energy Administration	July 2024	1. To promote the decomposition of renewable energy power consumption responsibility weights to key energy-consuming units, a new target for the proportion of green power consumption in the electrolytic aluminum industry has been set this year. 2. The completion status of green power consumption proportions by companies in the electrolytic aluminum industry will be accounted for using green certificates, with monitoring only in 2024 and no assessment. Determine the list of companies in the electrolytic aluminum industry, calculate the required green power consumption based on their annual electricity consumption and the national green power consumption proportion assigned, and assess completion using held green certificates. By the end of February 2025, provincial energy regulatory authorities will report to the National Development and Reform Commission and the National Energy Administration on the completion status of the 2024 renewable energy power consumption responsibility weights and the green power consumption ratio in the electrolytic aluminum industry. 3. The expected values for green electricity consumption in the electrolytic aluminum industry across provinces and cities for 2024-2025 range from 21% to 70%.
Action Plan for Further	National Development and	August 2024	1. Accelerate the development of corporate carbon emissions accounting standards. Accelerate the research and revision of carbon emissions accounting standards and technical

[127] General Office of the National Development and Reform Commission, Comprehensive Department of the National Energy Administration. Notice on the 2024 Renewable Energy Power Consumption Responsibility Weight and Related Matters (Development and Reform Office Energy [2024] No. 598) [EB/OL]. [2024-07-31]. https://www.ndrc.gov.cn/xxgk/zcfb/tz/202408/t20240802_1392176.html.

Policies	Issuing Authorities	Date of Issue	Related Work
Strengthening the Construction of the Carbon Peak and Carbon Neutrality Standard Measurement System (2024–2025)[128]	Reform Commission, State Administration for Market Regulation Ministry of Ecology and Environment		specifications for key industries such as electricity, coal, steel, non-ferrous metals, textiles, transportation, building materials, petrochemicals, chemicals, and construction. Develop supporting technical specifications for greenhouse gas verification, low-carbon evaluation, and other related areas to support corporate carbon emissions accounting work and effectively serve the construction of the national carbon emissions trading market. Formulate carbon emissions accounting and evaluation standards for industrial parks. 2. Raise the energy consumption standards in the industrial sector. Revise and enhance the energy consumption limit standards for unit products in key industries such as steel, refining, coal-fired power generation, pulp and paper, industrial caustic soda, and rare earth smelting. This aims to comprehensively improve energy efficiency levels to basically reach international advanced standards. Revise and improve energy measurement, monitoring, and auditing energy-saving supporting standards. 3. Strengthen the development of recycling standards for key products and equipment. Formulate recycling and dismantling standards for automobiles, electronic products, household appliances, etc., and research and develop relevant standards for the recycling and utilization of agricultural machinery parts. Develop recycling standards for retired photovoltaic equipment, wind power equipment, and power batteries, increase the supply of green design standards for new energy products and equipment, and accelerate the development of standards for recycled plastics and recycled metals. In accordance with the requirements of the 'General Principles for the Evaluation Index System of Cleaner Production,' develop a series of national standards for cleaner production evaluation in key industries such as steel, chemical, and building materials.

[128] National Development and Reform Commission and three other ministries. Notice from the National Development and Reform Commission, State Administration for Market Regulation, and Ministry of Ecology and Environment on the Action Plan for Further Strengthening the Carbon Peak and Carbon Neutrality Standard Measurement System (2024–2025)[EB/OL]. [2024-08-09]. https://www.ndrc.gov.cn/xxgk/zcfb/tz/202408/t20240808_1392291.html.

Policies	Issuing Authorities	Date of Issue	Related Work
			4. Strengthen research on measurement technology in key areas. Promote and strengthen research on carbon measurement technology in key industries and fields such as thermal power, steel, cement, petrochemical, chemical, and non-ferrous metals. Conduct comparative studies on direct measurement methods and calculation methods for carbon emissions, as well as empirical research on natural gas emission factors. In the field of thermal power, develop calibration devices for continuous monitoring systems of flue gas emissions to continuously improve the accuracy and consistency of carbon emissions and carbon monitoring data. 5. Strengthen the supervision and management of energy measurement. Organize various regions to conduct energy measurement reviews in traditional industries such as construction materials, petrochemicals, energy, and steel, as well as key areas like data centers and public institutions. This will help energy-using units solve the challenges of energy conservation, emission reduction, and carbon measurement, continuously improving their energy measurement management level and capability.

Appendix III: Benchmarking the Automotive Industry CATI with Corporate Climate Action CATI Evaluation

Dimension	Sub-dimension	Automotive Industry CATI		Corporate Climate Action CATI	
		Evaluation Indicator	Score	Evaluation Indicator	Score
1. Governance (10%)	1.1 Policy Construction	1.1.1 Commitment to Climate Action and Issuance of Climate Declaration	**1**	1.1.1 Company has committed to climate action and made climate declaration(s)	2
		1.1.2 Commitment to Transition Away from Fuel Vehicles	**1**	/	/
		1.1.3 Development of Corporate Carbon Neutrality Supporting Management Systems	2	1.1.2 Company has developed a corporate carbon neutrality plan and management system	2
		1.1.4 Incorporate Requirements for Suppliers on Energy Conservation and Emission Reduction, Greenhouse Gas Accounting and Reporting into Supplier Codes of Conduct and Other Written Documents	1	1.1.3 Company has incorporated policies regarding supplier energy conservation, emissions reduction, and carbon accounting and reporting into written documents such as the supplier code of conduct	1
	1.2 Mechanism Construction	1.2.1 Incorporate climate change into business decisions and have risk management procedures for climate-related risks	2	1.2.1 Company has integrated climate-related issues into its business strategy and has specific climate-related risk management procedures in place	2
		1.2.2 Include climate-related issues in the supervisory responsibilities of the board of directors (highest decision-making level)	1	1.2.2 Company has integrated climate-related issues into board-level oversight	1
		1.2.3 Guide suppliers in emission reduction through mechanisms such as empowerment, innovative projects, and financial incentives	2	1.2.3 Company provides capacity building and financial incentives, and/or initiates innovative projects for suppliers to reduce emissions	2

2. Measurement & Disclosure (22 %)	2.1 Scope 1&2	2.1.1 Calculate and disclose Scope 1&2 emissions	5	2.1.1 Company has publicly disclosed Scope 1 & 2 emissions data	5
		2.1.2 Calculate and disclose comprehensive energy consumption and energy usage	2	2.1.2 Company has publicly disclosed total energy use and energy use by source of energy	2
		2.1.3 Calculate and disclose carbon intensity or calculate and disclose energy intensity	2	2.1.3 Company has publicly disclosed carbon intensity or energy intensity	2
		2.1.4 Disclose carbon emissions trading information (e.g., carbon quotas, renewable energy certificates, and other voluntary emission reduction verifications, etc.)	1	2.1.4 Company has publicly disclosed information on carbon emission trading (e.g. carbon allowances, renewable energy certificates and other certified emission reductions)	1
	2.2 Scope 3	2.2.1 Calculate and disclose Scope 3 emissions	**5**	2.2.1 Company has publicly disclosed Scope 3 emissions	4
		2.2.2 Regularly collect actual emissions data from suppliers	1	2.2.2 Company collects supplier carbon emissions data on a regular basis	1
	2.3 Product Carbon Footprint	2.3.1 Calculate and disclose product carbon footprint data	6	2.3.1 Company has publicly disclosed product carbon footprint	6
3. Carbon Target Setting (16%)	3.1 Scope 1&2 Targets	3.1.1 Set and disclose ongoing Scope 1&2 emission reduction targets or energy conservation targets	3	3.1.1 Company has set and publicly disclosed its ongoing Scope 1 & 2 emissions reduction targets or energy consumption targets	3
		3.1.2 Set and disclose Scope 1 & 2 carbon neutrality targets	2	3.1.2 Company has set and publicly disclosed its Scope 1 & 2 carbon neutrality target	2
		3.1.3 Set and disclose renewable energy targets	1	3.1.3 Company has set and publicly disclosed its renewable energy target	1
		3.1.4 Scope 1 & 2 climate targets certified or approved by professional organizations (e.g., approved by the Science Based Targets initiative or other initiatives)	1	3.1.4 Scope 1 & 2 climate targets are certified or approved by a third party, such as the Science Based Targets initiative (SBTi) or other initiatives	1

	3.2 Scope 3 Targets	3.2.1 Set and disclose ongoing Scope 3 emission reduction targets	**5**	3.2.1 Company has set and publicly disclosed its ongoing Scope 3 emissions reduction targets	3
		3.2.2 Set and disclose Scope 3 carbon neutrality targets	2	3.2.2 Company has set and publicly disclosed its Scope 3 carbon neutrality target	2
		3.2.3 Set and disclose targets covering: encouraging suppliers to set emission reduction targets	1	3.2.3 Company has set specific targets to motivate suppliers to set their own emission reduction targets	1
		3.2.4 Scope 3 climate targets certified or approved by professional organizations (e.g., approved by the Science Based Targets initiative or other initiatives)	1	3.2.4 Scope 3 climate targets are certified or approved by a third party, such as Science Based Targets initiative (SBTi) or other initiatives	1
4. Performance Towards Carbon Targets (12%)	4.1 Progress on Scope 1 & 2 Climate Targets	4.1.1 Disclosure of Progress on Scope 1&2 Emission Reduction Targets or Energy Conservation Targets	3	4.1.1 Company has publicly disclosed progress made towards its Scope 1 & 2 emissions reduction targets or energy consumption targets	3
		4.1.2 Disclosure of Progress on Scope 1&2 Carbon Neutrality Targets	1	4.1.2 Company has publicly disclosed progress towards its Scope 1 & 2 carbon neutrality target	1
		4.1.3 Disclosure of Progress on Renewable Energy Targets	2	4.1.3 Company has publicly disclosed progress towards its renewable energy target	2
	4.2 Progress on Scope 3 Climate Targets	4.2.1 Disclosure of Progress on Scope 3 Emission Reduction Targets	3	4.2.1 Company has publicly disclosed progress towards its Scope 3 emissions reduction targets	3
		4.2.2 Disclosure of Progress on Scope 3 Carbon Neutrality Targets	1	4.2.2 Company has publicly disclosed progress towards its Scope 3 carbon neutrality target	1
		4.2.3 Track and Disclose Progress on Supplier Target Setting	2	4.2.3 Company tracks its suppliers' target setting progress	2
5. Climate Action (40%)	5.1 Decarbonization in Company Operations	5.1.1 Implement non-fossil energy utilization projects (e.g., hydro, nuclear, wind, solar, geothermal, tidal, biomass energy) or green electricity procurement projects, and disclose the emission reduction of the projects	4	5.1.1 Company has implemented non-fossil energy use projects (e.g. hydro, nuclear, wind, solar, tidal, biomass) and/or green electricity procurement and disclosed associated emission reductions	4

		5.1.2 Implement energy monitoring and management projects (e.g., energy management system certification, etc.)	1	5.1.2 Company has implemented energy monitoring and management programs (e.g. energy management system certification)	1
		5.1.3 Implement energy efficiency improvement technology application projects (e.g., LED, waste heat utilization, introduction of energy-saving production technologies, etc.), and disclose the emission reduction of the projects	3	5.1.3 Company has implemented energy efficiency improvement projects (e.g. switching to LED lighting, waste heat utilization, technique adjustment) and disclosed associated emission reductions	3
		5.1.4 Develop low-carbon product design, and disclose the potential emission reduction of low-carbon products	1	5.1.4 Company has incorporated emission reduction approaches into the product design process	1
		5.1.5 Undertake other types of emission reduction projects (e.g., reducing emissions from industrial production processes, fugitive emissions, developing negative carbon technologies, etc.), and disclose the emission reductions of the projects.	2	5.1.5 Company has implemented other types of emission reduction projects and disclosed associated emission reductions (e.g. direct emission reduction from manufacturing process, logistics optimisation, carbon negative technology development, etc.)	2
		5.1.6 Offset through voluntary carbon market mechanisms and disclose the offset amounts (e.g., Carbon Capture, Utilization, and Storage (CCUS), Nature-based Solutions (NbS), carbon market offset mechanisms, etc.)	2	5.1.6 Company has reduced emissions through carbon offsets, and disclosed associated emission reductions (e.g. Carbon Capture, Utilization and Storage (CCUS), Nature-based Solutions (NbS), market-based carbon offset mechanisms)	2
	5.2 Affiliated Company Engagement	5.2.1 **Automobile manufacturers, joint ventures** and other associated companies independently calculate and publicly disclose annual emissions data	3	5.2.1 Affiliates have measured and publicly disclosed their carbon emissions at the facility level	3
		5.2.2 **Automobile manufacturers, joint ventures,** and other related companies independently set and	3	5.2.2 Affiliates have set carbon targets, tracked and publicly disclosed reduction progress at the facility level	3

		publicly disclose targets and progress, **or obtain zero-carbon factory certification**			
	5.3 Decarbonization in the Value Chain	5.3.1 Encourage suppliers to implement corporate carbon management or energy management projects (e.g., promote third-party greenhouse gas verification, product carbon footprint certification, energy management system certification, etc.)	**0.5**	5.3.1 Company has promoted suppliers to conduct corporate greenhouse gas and energy management (e.g. third-party verification of greenhouse gas accounting, product carbon footprint certification, energy management system certification)	1
		5.3.2 Encourage suppliers of steel and aluminum to undertake emission reduction actions and disclose emission reduction performance	**3**	5.3.3 Company has launched energy saving initiatives and/or low carbon technology innovation initiatives with material suppliers, and disclosed associated emission reductions	1
		5.3.3 Promote emission reduction actions among battery suppliers and disclose emission reduction performance	**2**	/	/
		5.3.4 Promote emission reduction actions among suppliers of other materials or components and disclose emission reduction performance	**1**	5.3.2 Company has promoted suppliers to replace primary production raw materials with recycled materials or lower carbon substitutes, and disclosed associated emission reductions	1
		5.3.5 Collaborate with logistics suppliers to carry out emission reduction projects and disclose the emission reductions of the project	1	5.3.4 Company has launched emission reduction initiatives with logistics suppliers, and disclosed associated emission reductions	1
		5.3.6 Establish (or jointly establish with downstream customers) an end-of-life recycling mechanism to carry out the recycling and utilization of scrapped automobiles, used batteries, or other components	**0.5**	5.3.6 Company has established (or coordinated with downstream customers to establish) end-of-life recycling mechanisms to recycle used products	0.5

		5.3.7 Implement emission reduction actions targeting other emission sources in the value chain (e.g., **investment in low-carbon emission steel and aluminum technology,** business travel, and other categories within the value chain)	**1**	5.3.7 Company has conducted emission reduction projects targeting other emission sources along the value chain and disclosed associated emission reductions (e.g. reducing emissions from business travel)	0.5
		5.3.8 Annually publish the best supplier emission reduction cases	**1**	5.3.5 Company has published best practice on supply chain carbon management annually (e.g. IPE Brand Story)	2
	5.4 Upstream Supplier Engagement	**5.4.1 Steel and Aluminum Suppliers Independently Calculate and Publicly Disclose Annual Emissions Data**	**2**	5.4.1 Direct suppliers have measured and publicly disclosed their carbon emissions at the facility level	2
		5.4.2 Steel and Aluminum Suppliers Independently Set and Publicly Disclose Targets and Progress	**1**	5.4.2 Direct suppliers have set carbon targets, tracked and publicly disclosed reduction progress at the facility level	3
		5.4.3 Battery and Battery Material Suppliers Independently Calculate and Publicly Disclose Annual Emissions Data	**2**	5.4.3 Indirect suppliers have measured and publicly disclosed their carbon emissions at the facility level	4
		5.4.4 Battery and Battery Material Suppliers Independently Set and Publicly Disclose Targets and Progress	**1**	5.4.4 Indirect suppliers have set carbon targets, tracked and publicly disclosed reduction progress at the facility level	3
		5.4.5 Other material or component suppliers independently calculate and publicly disclose annual emissions data	**2**	/	/
		5.4.6 Other material or component suppliers independently set and publicly disclose targets and progress	**1**	/	/

		5.4.7 Companies empower upstream suppliers to conduct supply chain carbon management through the Blue Eco-Chain or equivalent automated systems	**2**	5.4.5 Company employs the Blue EcoChain or other automated methods to empower upstream suppliers to manage supply chain carbon emissions	5
		5.4.7 Parallel Indicator: Companies guide large suppliers to publicly disclose product carbon footprint data		5.4.5 Parallel indicator: Promote large suppliers to publicly disclose product carbon footprint data	

(Note: In the Automotive Industry Corporate Climate Action CATI Evaluation, indicators marked in red are industry specific indicators, aimed at guiding automotive companies to accelerate emission reduction in upstream emission hotspots, particularly in the production of steel, aluminum, and batteries.)