

# Methods for Carbon Reduction through Green Supply Chain Management in the Automotive Industry

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**Abstract:** The automotive industry chain is long and involves a wide range of fields. Implementing green supply chain management is of great significance for reducing pollution and carbon emissions. In this paper, three enterprises in the automotive industry are taken as examples, and the practice of green supply chain carbon reduction in the automotive field is summarized. It is concluded that automotive enterprises can carry out carbon emission reduction in the supply chain from multiple dimensions, such as setting goals, capacity building, technology application and economic incentives, including establishing carbon neutrality goals and working groups, providing carbon management training for suppliers, developing digital carbon management platforms, implementing supply chain localization and internal carbon pricing mechanisms, etc., so as to promote the green transformation of the entire industrial chain.

**Keywords:** Green supply chain, Automotive industry.

## 1. Introduction

The automobile industry constitutes one of the key carbon emission domains in China. Its carbon emissions amount to approximately 83% of the total carbon emissions in China's transportation sector, representing 7.5% of the overall carbon emissions in society [1]. Concurrently, with the accelerating popularization and development of new energy vehicles, the source of carbon emissions within the vehicle life cycle has shifted from the traditional fuel vehicle usage stage to the pure electric vehicle production stage.

Owing to the characteristics of a long chain and a wide range of fields in the automobile industry chain, it has driven the development of hundreds of thousands of enterprises in industries such as steel, machinery, electronics, rubber, and glass while undergoing rapid growth. At present, the carbon emissions of the whole life cycle of automobiles account for 20% of the carbon emissions in the manufacturing process, while the consumption process (that is, the use stage) accounts for 80%, of which the vehicle manufacturing only accounts for 1.5% [2]. Supplier carbon reduction and the increase in the proportion of new energy vehicles are crucial for carbon reduction in the automotive industry. However, currently, the Chinese automotive industry lags relatively behind in aspects such as supplier environmental management and comprehensive utilization of resources. Implementing green supply chain management in a targeted and area-based manner can drive the entire automotive industry chain and other industries to reduce pollution and carbon emissions, which is of great significance for China to achieve the "Carbon Peaking and Carbon Neutrality" goal and enhance the international competitiveness of products.

In the carbon neutrality plans announced by several major multinational automotive companies, specific targets for reducing emissions and carbon footprints of suppliers and supply chains have been clearly stated. Some automotive companies have stated that they will not place orders with suppliers who have not taken sufficient action to reduce their impact on the environment, nor will they choose suppliers who have not transitioned their entire business to a low-

carbon model in accordance with the requirements of the Paris Agreement.

## 2. Green Supply Chain Carbon Reduction Practice in Automotive Field

### 2.1. Carbon Reduction in The Green Supply Chain of Vehicle Enterprises

#### 2.1.1. Carbon reduction of Geely's green supply chain

Geely has identified the overall goal of achieving carbon neutrality throughout the Group's entire link by 2045 and has coordinated and promoted the formulation of carbon reduction target indicators for its subordinate business units to support the realization of the Group's overall goals [3]. In order to better implement supply chain carbon emission reduction management, Geely established a carbon neutrality working group to focus on the field of climate change, study carbon neutrality-related policy trends and industry dynamics, and formulate the Group's overall carbon neutrality strategy and objectives; establish the relevant operating mechanism and process of carbon neutral business, plan carbon neutral management as a whole, and promote the carbon neutral work collaboration across business units; coordinate the development and trading of carbon assets of all units of the Group to achieve the overall goal of carbon asset management of the Group; be responsible for group carbon neutral management methods and concepts training. The Carbon Neutral Working Group will report regularly to the Collaborative Steering Group on the progress of its work.

Geely regards supply chain carbon reduction as a crucial link for achieving carbon neutrality. While reducing its own carbon emissions, Geely actively encourages upstream and downstream enterprises in the industrial chain to embrace the concept of sustainable development by conducting supplier carbon management capacity training and establishing an information-based carbon management platform.

To foster suppliers' carbon management capabilities, Geely's dual carbon management team initiated with original

courses and created a comprehensive methodology through hundreds of pages of training materials to address the "what", "why", and "how" of carbon management in the automotive industry. Currently, Geely has offered more than 10 training sessions for over 1,000 suppliers, and more than 5,000 individuals have participated in the training.

At the same time, to manage climate change-related indicators more effectively, Geely has independently developed a digital intelligent carbon management platform - Geely Carbon Cloud, based on a diversified industrial ecology. Geely chain suppliers can calculate the product carbon footprint of supplied parts in Geely Carbon Cloud for free and obtain emission reduction analysis. By the end of 2022, Geely Carbon Cloud has been applied to all subordinate business units and production bases of Geely Holding Group, assisting 76 Geely entities in calculating organizational carbon emissions, calculating carbon footprints for more than 100 models and thousands of parts of the Geely system, and implementing applications in over 1,500 suppliers upstream of the industrial chain, with annual carbon emissions under management exceeding 100 million tons.

### **2.1.2. NIO Green Supply Chain Carbon Reduction Situation**

Nio has established a working mechanism for vehicle carbon reduction and gradually extended the requirements of sustainable development to the access and daily management processes of partners, and actively promoted the supply chain and industry partners to carry out energy conservation and carbon reduction work [4]. The vehicle carbon reduction working mechanism of NIO takes the low-carbon goal of the vehicle as the starting point and decomposes the carbon reduction goal into various links such as design, manufacturing, and logistics by conducting internal carbon pricing, partner carbon reduction training, and the "near-earth supply chain" layout, etc., and incorporates partners to continuously strengthen the synergistic effect with partners. Jointly build a high-level carbon management capacity of value chain linkage and continuously improve and practice the carbon management of the whole life cycle of products.

Nio is one of the first car companies in China to develop an internal carbon pricing mechanism. Based on the changing external environment of the enterprise, the internal carbon pricing mechanism monetizes the carbon emission risk and supports the total carbon emission or carbon emission intensity control of the enterprise in the best way to reduce carbon efficiency and cost control. Nio introduces an internal carbon pricing mechanism in project design scheme selection, financial target issuance, partner designation, and other links. After establishing an independent carbon reduction budget pool for key models, the carbon reduction budget and target are assigned to specific parts packages. At the same time, NIO will continue to iterate the internal carbon pricing price according to the model mix, dynamically adjust the target and continue to optimize.

Nio actively empowers its industry chain partners to help them explore ways to reduce the carbon footprint of their products and enhance their awareness of green manufacturing through education and training. Nio has conducted dozens of multi-dimensional and multi-theme carbon reduction trainings for partners with different business characteristics to assist in implementing the green manufacturing action plan. For example, for vehicle partners, NIO organized hydropower aluminum traceability research to encourage them to purchase green aluminum with lower carbon emissions; for electric

drive battery partners, NIO Automobile has specially set up training on topics such as carbon footprint inventory guidance and overseas relevant regulations.

In terms of logistics carbon reduction, NIO first proposed the concept of "supply chain localization" in 2021 and became the initial enterprise of Hefei Xinqiao Intelligent Electric Vehicle Industrial Park in the same year, driving the first batch of upstream core partners to settle in and gradually forming a complete industrial cluster layout. In recent years, NIO has firmly realized supply chain intensification and localization by promoting supply chain partners to build factories around NIO's Hefei production base and in Anhui Province. The high proportion of near-earth procurement not only helps reduce logistics carbon emissions but also strengthens the synergy between NIO and partners, enabling NIO to work with multiple parties to jointly build an efficient and sustainable operation system.

## **2.2. Carbon Reduction in the Green Supply Chain of Auto Parts Enterprises**

Bosch Group, as an auto parts enterprise, provides advanced technologies and solutions in the fields of automotive and intelligent transportation, industry, consumer goods, as well as energy and building technology for the Chinese market and users. It aims to create a sustainable, safe and convenient future mobility vision. Bosch Group has set a carbon emission target of achieving a 15% carbon reduction in the upstream and downstream on the basis of 2018 by 2030, which is equivalent to reducing 67 million tons of carbon dioxide emissions [5].

To achieve the goal of reducing carbon emissions by 15% across the entire value chain by 2030, Bosch Group is promoting key suppliers to sign corresponding carbon reduction agreements and is committed to working with local ecosystem partners towards carbon neutrality. Currently, the carbon emissions and climate activities of Bosch Group's business partners have become an important criterion for signing business contracts with Bosch Group. Meanwhile, Bosch Group has also released sustainable development guidelines for suppliers in China, promoting specific carbon neutrality actions in the supply chain from six dimensions, including carbon reduction awareness training, carbon data disclosure, carbon target setting, carbon database establishment, supplier carbon awareness maturity assessment, and the awarding of the Best Sustainable Development Supplier in the Asia-Pacific Region.

In 2020, Bosch Group identified the suppliers that provided the most procurement services and generated the most carbon emissions for it. Since 2021, Bosch has carried out cooperation with other organizations, including the Carbon Disclosure Project (CDP), jointly supporting the carbon disclosure and carbon reduction actions of Bosch's global business partners. In 2021, about 200 suppliers in China participated in the CDP's carbon emission data reporting platform, which helped Bosch Group clearly understand the carbon calculations and corresponding activities of suppliers. In 2023, Bosch invited more than 2,200 suppliers worldwide to join the CDP Carbon Disclosure Project, among which about 400 were Chinese suppliers.

## **3. Conclusions**

By synthesizing the management practices of leading enterprises, companies in the automotive sector can undertake

supply chain carbon reduction initiatives across various dimensions, including target setting, capacity building, technological application, and economic incentives. These efforts aim to decrease carbon emissions throughout the supply chain and foster the green transformation of the entire industrial chain.

### **3.1. Establishing Carbon Neutrality Targets and Work Groups**

Both Geely and NIO have established explicit carbon neutrality objectives. Geely is targeting full-chain carbon neutrality by 2045 and has formed a dedicated carbon neutrality task force to oversee and facilitate the development and achievement of carbon reduction goals. This strategy ensures a methodical and coordinated approach to carbon reduction through high-level planning and the establishment of an organizational framework.

### **3.2. Providing Supplier Carbon Management Training**

Geely offers training materials and courses to enhance suppliers' carbon management capabilities, addressing questions related to carbon management in the automotive industry and improving suppliers' understanding and practical skills in carbon emission reduction. Similarly, NIO supports its partners in implementing green manufacturing action plans through comprehensive and thematic carbon reduction training programs. This training system aids in elevating carbon management standards across the supply chain.

### **3.3. Developing a Digital Carbon Management Platform**

Geely has independently developed a digital intelligent carbon management platform called Carbon Cloud, which is

utilized for calculating product carbon footprints and conducting emission reduction analyses. This digital tool enhances the efficiency and precision of carbon management, making carbon emissions data in the supply chain more transparent and easier to monitor and manage.

### **3.4. Implementing Supply Chain Localization and Internal Carbon Pricing Mechanisms**

NIO has introduced the concept of "supply chain localization" to minimize logistics-related carbon emissions and enhance collaboration with partners by situating them near NIO's production facilities. Additionally, NIO has implemented an internal carbon pricing mechanism to quantify carbon emission risks and support corporate carbon emission control in the most effective manner, thereby reducing carbon efficiency and controlling costs. These strategies not only reduce carbon emissions through optimized physical layouts but also incentivize carbon reduction behaviors through economic measures.

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