

# HSBC GBA ESG Index Report

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# Executive Summary



# Executive Summary



This report is the quarterly update of the HSBC GBA ESG Index (the Index), which analyses the ESG and sustainable development performance of the Guangdong-Hong Kong-Macao Bay Area (GBA) in 2025 Q1.

The GBA ESG Regional Index recorded a year-on-year increase of

1% in Q1 2025, reaching a value of 125.75



**1** The Guangdong Province outlined strategies with specific targeted measures to promote the development of the silver economy in 2025 Q1. At the same time, GBA cities initiated a series of measures to bolster the silver economy and establish a leading position.

Due in part to a changing demographic profile, in Q4 2024 the central government identified the silver economy as a key area of focus. In line with the national call, GBA cities have set out comprehensive policy initiatives to enhance the well-being of the elderly and take advantage of the opportunities afforded by the silver economy. For example, “pension finance” is integrated with “cross-border finance” to enhance the financial services of elderly care across borders in the GBA. Several silver economy industrial parks are under construction in different GBA cities, tapping into local industrial and technology advantages.

**2**

The GSSS bond market in the GBA experienced robust growth in Q1 2025 even without the active participation of government bodies.

The issuance volume of GSSS bonds<sup>i</sup> issued by the GBA increased significantly compared both to the previous quarter and the same period last year, reaching approximately RMB30 billion in Q1 2025. Guangzhou was the most active issuer, accounting for 45% of the GBA’s total volume, followed by Shenzhen and Hong Kong, with 20% each. Although governments were not directly involved in green and sustainable finance in this quarter, their positions on promoting the growth of green and sustainable finance remain firm. Meanwhile, the sustainable investment market also experienced growth, with a year-on-year increase in the launch of mutual ESG funds of 270%.

**3**

Over the past few years, international environment policies have experienced significant changes. However, climate policies within the GBA have remained remarkably consistent and demonstrated steady progress, ensuring the low-carbon transition in the region does not compromise economic and social development.

Governments in the GBA have developed a unique model of low-carbon transition, characterised by gradual energy transition, pilot programs in carbon market expansion, and the cultivation of a technology-driven low-carbon economy. GBA cities have responded positively to international environmental requirements in different industries such as shipping and aviation, converting regulatory challenges into opportunities for high-quality development.

i. GSSS bonds include green bonds, social bonds, sustainability bonds and sustainability-linked bonds. GSSS bonds issued by issuers in the GBA or any specific GBA city in this report refer to both onshore and onshore GSSS bonds issued by entities registered or primarily operating in the GBA or any specific GBA city.

GBA’s companies<sup>ii</sup> have shown remarkable progress and leadership, particularly in the areas of disclosure and carbon reduction target setting. According to our data, GBA companies have been increasingly active in responding to the CDP<sup>iii</sup> climate change questionnaire, with disclosure rates consistently higher than the national average in China, which increased from 18% in 2019 to 32% in 2024. Furthermore, the proportion of GBA companies achieving the highest scores (A and A-) on the CDP climate change questionnaire, rose from 4% in 2019 to 17% in 2024.

The number of companies in the GBA setting their first carbon emission reduction targets or making commitments through the Science Based Targets initiative (SBTi) has grown substantially from 2 in 2019 to 112 in 2024.

The average value of the GBA ESG Industry Sub-indices reached a value of 227.19 in Q1 2025, representing a year-on-year increase of 22%



**4** This report examines the ESG performance of the consumer discretionary sector and looks at trends within the automobile industry in 2025. The main points of focus are trade barriers and autonomous driving. The report analyses the responses of the GBA automobile industry to the complex international trade environment. It also discusses the prospects of autonomous driving and associated social and regulatory concerns.

Over the past few months, rising geopolitical tensions have significantly impacted international trade policies, with the United States (U.S.) and Europe revising their policies to protect domestic industries. This has led to the introduction of a series of new trade barriers. Some industries, for example, Electric vehicles (EVs), are particularly affected and facing a challenging business environment. GBA EV brands have actively responded to these challenges, mainly via technology licensing, market diversification and regulatory engagement.

By leveraging its advantages in advanced industrial chains, technologies and comprehensive application scenarios, the GBA is well positioned to offer a “GBA solution” in autonomous driving. The industrial chain covers multiple stakeholders from leading automobile makers and sensor suppliers to testing platforms. The GBA has continuously refined its autonomous driving technologies through testing and pilot programs, accelerating multi-scenario deployments to expedite commercialisation. However, when it comes to autonomous driving there are valid concerns about technical safety, accountability, and the impact on employment. The GBA is exploring solutions to these socio-economic issues.



ii. Unless otherwise specified, “companies in the GBA” or “GBA companies” refer to listed companies registered or primarily operating in the GBA.  
 iii. The CDP is an international non-profit organisation that helps companies and cities disclose their environmental impact.  
 iv. The SBTi is a partnership between CDP, the United Nations Global Compact, World Resources Institute (WRI), and the World Wide Fund for Nature (WWF). The SBTi defines and promotes best practices in science-based target setting. Offering a range of target-setting resources and guidance, the SBTi independently assesses and approves companies’ targets in line with its strict criteria.

# GBA ESG Regional Index

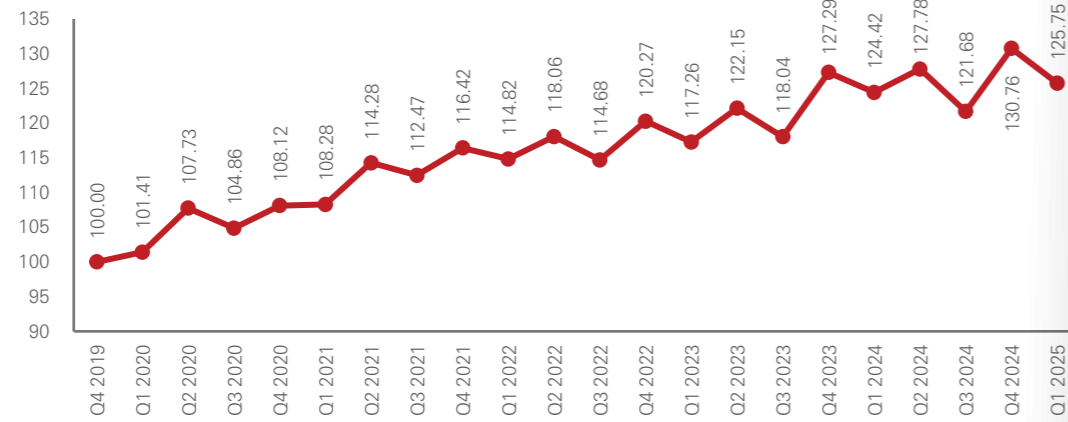


# GBA ESG Regional Index



**Figure 1. The GBA ESG Regional Index**

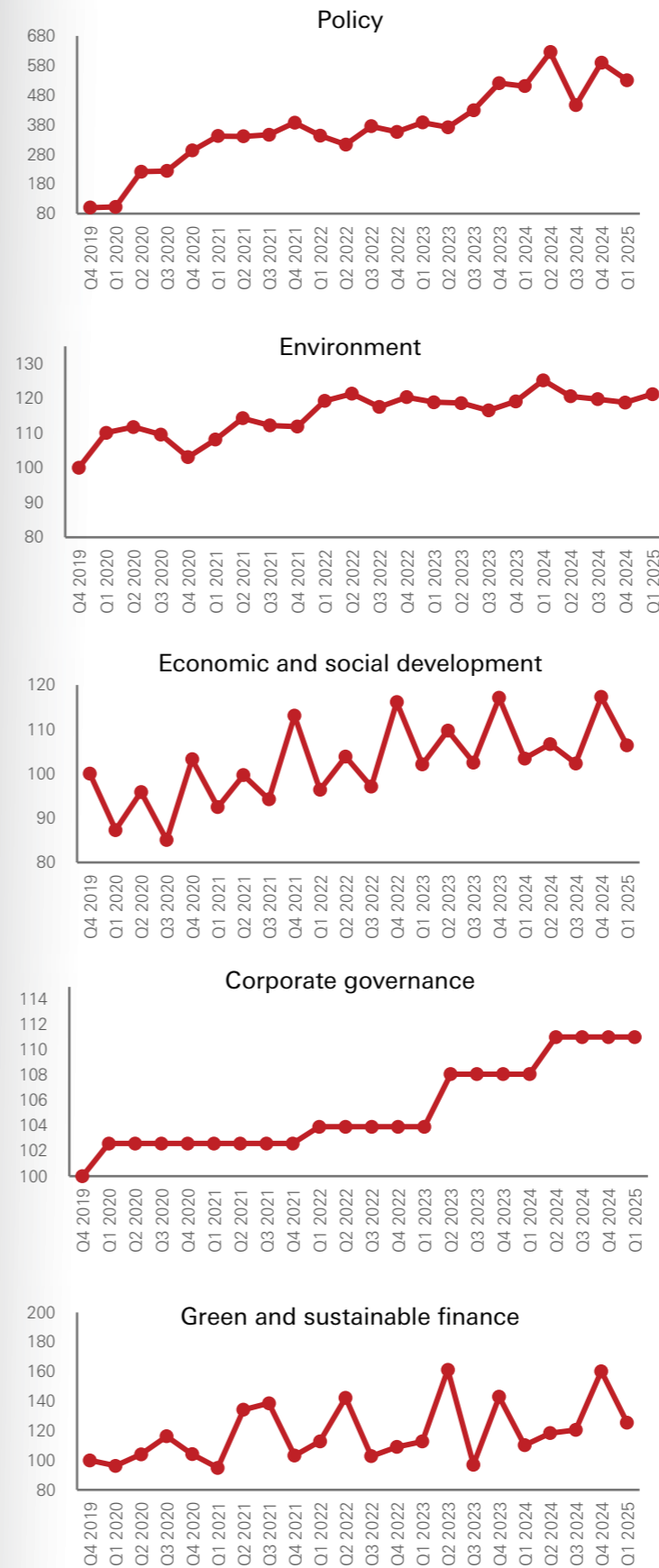
The GBA ESG Regional Index recorded a slight year-on-year increase of **1%** in Q1 2025, reaching a value of **125.75**



Source: China's official statistical database, public disclosure of listed companies, public information from relevant third-party databases, other public sources, CECEPEC



**Figure 2. Breakdown of the GBA's performance in the five areas**



Note: The values are normalised. The base values were 100.00 for Q4 2019 (base period). Source: China's official statistical database, public disclosures of listed companies, other public sources, CECEPEC





Our study found that the GBA scored highly in the policy area, albeit with a slight decrease in Q1 2025 compared with Q4 2024. In the area of environment, the GBA's performance improved compared to Q4 2024. It is worth noting that the GBA saw notable improvements in CDP climate change questionnaire scores in Q1. However, in the economic and social areas there was a cyclical decrease, similar to that experienced in previous years. Corporate governance was stable.

With regards to the performance in green and sustainable finance, the decrease in Q1 2025 was mainly due to the lack of new Principles for Responsible Investment (PRI) signatories and fewer new ESG mutual fund launches compared with Q4 2024.

## Policy

**In Q1 2025, governments within the GBA unveiled plans to promote the development of a silver economy in line with national strategy. Shenzhen also issued a working plan on the construction of an ESG system, setting ambitious goals to position itself as a leader in sustainable development.**

As highlighted in the Q4 2024 report, the Chinese central government has identified the silver economy as a key area of focus for 2025. To this end, in Q1 2025, Guangdong Province unveiled a comprehensive plan to promote the high-quality development of the silver economy and enhance the well-being of the elderly. The plan outlines systematic strategies with 20 measures to develop the silver economy through enhanced public services, market expansion, and industrial innovation<sup>1</sup>. Hong Kong also outlined its strategy to bolster the silver economy in its 2024 Policy Address and 2025-26 Budget.

There is a more detailed analysis of the steps taken by the GBA to develop the silver economy in the section on Economic and Social Development.



Hong Kong's 2025-26 Budget, which was unveiled in Q1 2025, also addresses other sustainability issues with several key initiatives such as increasing investment in electric buses and taxis and enhancing residential food waste recycling.

Shenzhen's working plan to establish an ESG system is noteworthy, aiming as it does to position the city as a leader in sustainable development. The working plan has set ambitious targets for 2027 as follows<sup>2</sup>:

- ◆ Full ESG disclosure for municipal state-owned enterprises and state-controlled listed companies.
- ◆ ESG disclosure rate of at least 60% among Shenzhen's A-share listed companies in key sectors such as green and low-carbon and high-end equipment sectors.
- ◆ At least 10 ESG-related standards and guidelines; or cultivating or introducing at least 10 renowned ESG disclosure, verification, and rating service institutions.
- ◆ At least 30 internationally influential ESG pioneer enterprises.



## Economic and Social Development

**The GBA has positioned itself as a national leader in the development of the silver economy. In line with policy guidance, the GBA has over recent quarters initiated a series of measures that combine financial innovation, industrial integration and pilot demonstrations to achieve the high-quality development of the silver economy.**

The Guangdong Provincial Branch of the People's Bank of China (PBOC) has been encouraging financial institutions in the GBA to explore a new model that integrates "cross-border finance" with "pension finance". These efforts aim to build a "cross-border financial bridge" for elderly care.

### Examples of integrating "cross-border finance" with "pension finance" within the GBA

Financial institutions in the GBA are encouraged to provide financial support for projects offering cross-border elderly care services. For example, two eligible elderly care projects in Foshan and one project in Zhuhai were granted RMB8.5 million in low-interest loans and a credit line of RMB30 million respectively<sup>3</sup>.

The GBA has also facilitated cross-border medical services and welfare. As of 2024, the pilot programs Hong Kong and Macao Medical Device Access<sup>v</sup> and Hong Kong's Elderly Medical Vouchers<sup>vi</sup> have included 45 hospitals and eight medical institutions in PRD municipalities within the GBA<sup>4</sup>, demonstrating the region's commitment to enhancing healthcare accessibility.

Leveraging its robust manufacturing clusters and significant technological advantages, the GBA is committed to developing the silver economy through industrial integration and pilot demonstrations. In Q1 2025, Guangdong Province set a goal of developing at least two national-level high-quality silver economy industrial parks within the GBA. These parks will focus on smart elderly care, anti-ageing products, and rehabilitation equipment,<sup>1</sup> with Guangzhou and Foshan being the first cities to establish their silver economy industrial parks.

### Guangzhou

In Q1 2024, Guangzhou launched its first silver economic industrial park in the Huangpu District. The park offers a range of supports to attract and nurture high-quality enterprises in the silver economy. These include a rent subsidy of up to RMB50 per square meter according to 50% of the actual rent, under which each enterprise can receive up to RMB1 million a year<sup>5</sup>. The first batch of enterprises and institutions to settle in the park cover the entire industrial chain of the silver economy, demonstrating a comprehensive approach to fostering innovation and growth in this sector.

### Foshan

In Q4 2024, a conference focused on the silver economy was held in Shunde District, Foshan. During the launch ceremony, the GBA Silver Economy Industrial Park was officially inaugurated. The park is dedicated to five core areas of the silver economy and aims to become a one-stop hub offering the most comprehensive range of elderly care products and the highest quality services in the GBA and beyond. In Q1 2025, the industrial park witnessed significant milestones with 19 project agreements signed, and 43 new silver economy products launched<sup>6</sup>. These achievements highlight the park's innovative capabilities and commitment to promoting the silver economy.

v. The "Hong Kong and Macao Medical Device Access" policy enables designated medical institutions in PRD municipalities within the GBA to use clinically urgent drugs and medical devices that are already approved in Hong Kong and Macau, with approval from Guangdong Province. This provides elderly individuals with broader medical options and convenience ([Source](#)).

vi. The Elderly Health Care Voucher GBA Pilot Scheme enable eligible Hong Kong elderly persons to use health care vouchers to pay for outpatient healthcare services provided by designated departments/services of the GBA pilot medical institutions ([Source](#)).



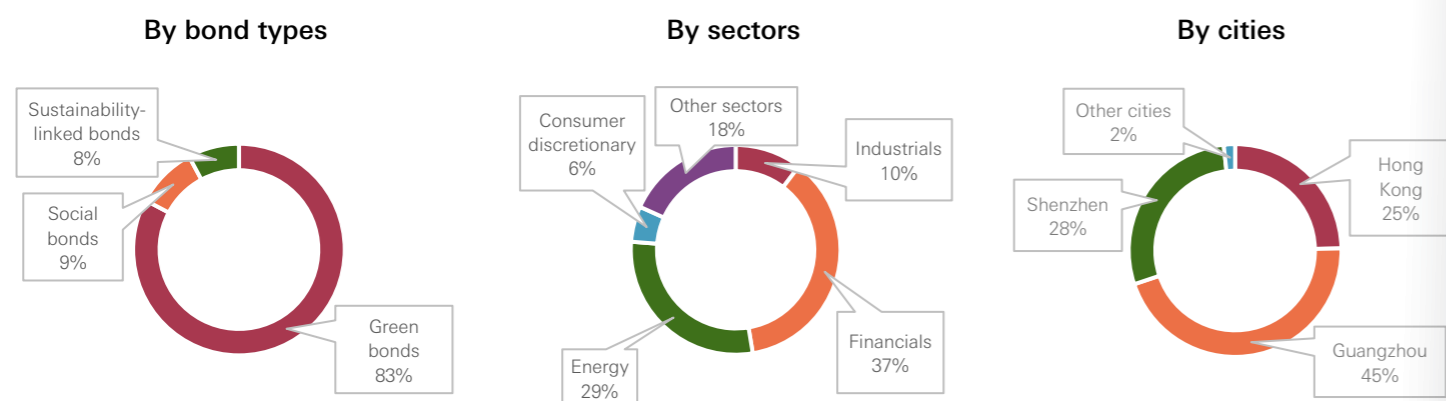
# Green and Sustainable Finance

**In Q1 2025, the GBA's GSSS bond market demonstrated robust growth and ongoing commitment to sustainable finance, despite an absence of governmental participation in GSSS bond issuance.**

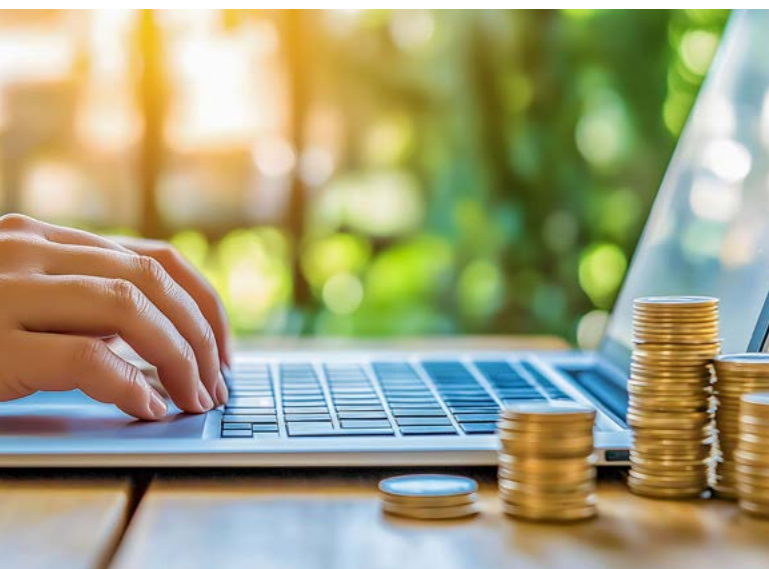
The volume of GSSS bonds issued by the GBA was approximately RMB30 billion in Q1 2025, constituting a year-on-year increase of 30% and an increase of 34% from Q4 2024. Figure 3 illustrates the issuance volume of GSSS bonds within the GBA, categorised by bond types, sectors and cities. As always, the green bond market remained the most active segment within the GSSS bond market; the financials and energy sectors continued to be significant contributors to GSSS bond issuance, and the market was primarily driven by Hong Kong, Guangzhou and Shenzhen.

Although the governments within the GBA did not participate in GSSS bond issuance in Q1 2025, their commitment to promoting the development of the GBA's GSSS finance market remains strong. For example, the Hong Kong government announced plans to expand the scale of bond issuance to meet the increase in capital works expenditure. It is expected that during the five-year period from 2025-26 to 2029-30, a total of about HKD150 billion to HKD195 billion worth of bonds will be issued annually under the Government Sustainable Bond Programme and the Infrastructure Bond Programme.<sup>7</sup>

**Figure 3. Issuance volume of GSSS bonds within the GBA in Q1 2025**



Note 1: By bond type: The proportion refers to the issuance volume of the specific type of bond / the GBA's total issuance volume. By sectors: The proportion refers to the issuance volume by the specific type of issuer / the GBA's total issuance volume. By cities: The proportion refers to the issuance volume by the specific city / the GBA's total issuance volume.  
Note 2: GSSS bonds issued by a specific city refer to both onshore and offshore GSSS bonds issued by entities registered or primarily operating within the city.  
Source: Wind, CECEPEC



With regard to the sustainable investment market, our study found that fund management companies within the GBA have been more active in launching new ESG mutual funds compared to the same period last year. In Q1 2025, 26 new ESG mutual funds were launched by the GBA, a year-on-year increase of 270%. Shenzhen was the most active city in this regard. Of the 26 new launches in Q1, approximately 80% were pure ESG funds<sup>vii</sup>, while 12% and 8% were environmental themed and social themed funds<sup>viii</sup>, respectively.

As noted in our report dated February 2025, the rate of new signatories to the Principles for Responsible Investment (PRI) has slowed due to market saturation. According to our data, within the GBA, there were no new signatories to the UN PRI this quarter.

vii. Pure ESG mutual fund: Incorporate all three dimensions, i.e., environmental, social and governance, into their investment strategies (Source).  
viii. Environmental themed fund: Incorporate the environmental dimension into the investment strategies. Social themed fund: Incorporate the social dimension into the investment strategies. (Source).



# Environment

In early 2025, in the environmental area the GBA continued to strengthen policy guidance and mechanism alignment within the region. For example, Guangzhou stated that its working focus in 2025 is ecological environmental protection. Additionally, the region has actively promoted the mechanism alignment, which involves initiatives such as the recognition of carbon labels between Guangdong Province and Hong Kong. A clear example of alignment within the GBA in Q1 was the standard mutual recognition of modular prefabricated construction products between Huizhou and Hong Kong.

In the following wrap-up section, we review the GBA's progress in the environmental area over the past few years. This period has seen significant developments and achievements that have positioned the GBA as a leader in China's ESG landscape, aligning with international standards and providing a domestic model for sustainable development.

## Wrap-up of Environment

In recent years, international environmental regulations have become increasingly complex and subject to change, most notably the policy adjustments effected by the U.S. and the EU. Climate policy within the U.S. has fluctuated significantly depending on the election cycle, with different administrations adopting differing stances and measures. Meanwhile, the EU has continuously modified the requirements, scope and implementation details of its Carbon Border Adjustment Mechanism (CBAM). These dynamics pose challenges to enterprises within and outside these regions and to global environmental collaboration.

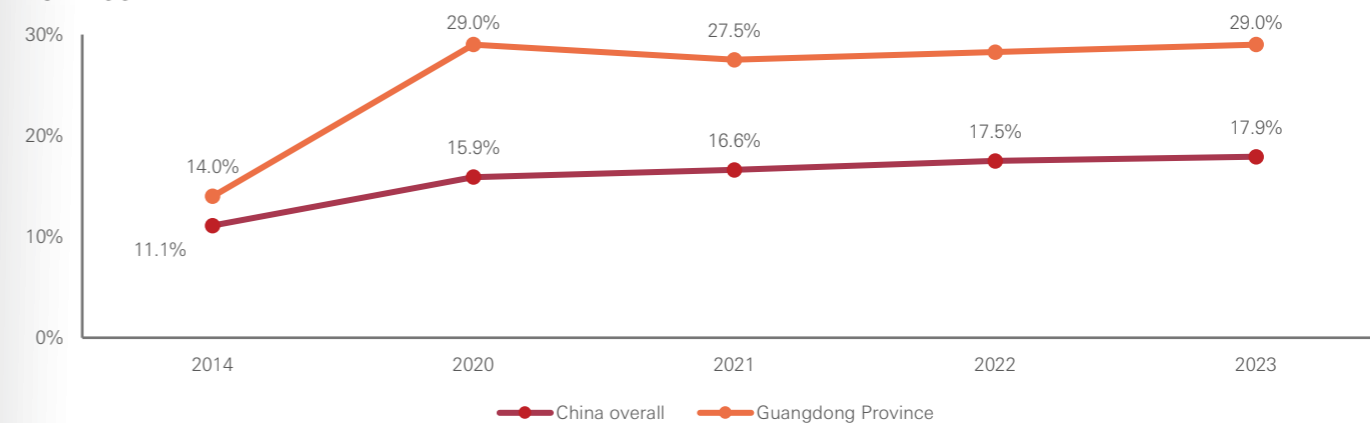
Within this context, China has adopted a strategy of steady progress that contrasts with the fluctuations in U.S. and EU policy. The GBA, a leader in ESG within China, has made significant progress in the environmental field, aligning with international rules and offering a domestic model. This section examines the GBA's progress across several dimensions, including the energy transition, carbon market expansion, and the development of enterprises and industries in the environmental arena.

## Energy Transition

**The GBA has made significant strides in transitioning from a high-carbon to a low-carbon energy system.**

This energy transition, which is crucial for achieving the dual carbon goals, has been a key focus for both the central government and governments within the GBA. The national goal is to increase non-fossil energy consumption to 20% by 2025 and 25% by 2030. Guangdong Province has set a more ambitious target, aiming for a non-fossil energy consumption proportion exceeding 32% by 2025. As can be seen in Figure 4, the GBA is leading the way in energy transition, with a higher proportion of non-fossil energy consumption compared to the national average.

**Figure 4. Proportion of non-fossil energy consumption in China overall and in Guangdong Province**



Source: Public sources  
Note: Proportion of non-fossil energy consumption = (non-fossil energy consumption/total energy consumption)\*100%. Public data for the Guangdong Province's figure of 2022 is not available.

Several key industries, such as ceramics and transportation, have made significant contributions to the energy transition in the GBA.

### Ceramics

Guangdong Province accounts for a quarter of national ceramic tile production<sup>8</sup>. GBA cities, such as Foshan and Zhaoqing, are significant hubs for a number of ceramics enterprises. Since the start of the coal-to-gas initiative, over 85% of the province's building ceramics enterprises have completed the transition,<sup>8</sup> leading to a substantial reduction in energy consumption and carbon emissions.

### Transportation

The GBA's transportation sector has seen remarkable progress in its energy transition as evidenced by the following data:

- ♦ **New energy vehicles (NEVs) production:** In 2020, Guangdong Province's NEV output was approximately 200,000 units, representing 15% of the national total<sup>9</sup>. In 2024, the figure was expected to reach over 3 million units, accounting for a quarter of the national production<sup>10</sup>.
- ♦ **NEV penetration:** To date, the penetration rate of NEVs in the GBA has reached 38%, 12 percentage points higher than the national average<sup>11</sup>. By the end of 2024, Shenzhen's NEV penetration rate was projected to reach 73%, with buses, taxis, and ride-hailing vehicles achieving a 100% electrification rate, leading the nation in public transportation electrification<sup>12</sup>.

Hydrogen vehicles are increasingly recognised as an ideal alternative to fossil fuel vehicles. The GBA has actively explored the application scenarios for hydrogen fuel cell vehicles. As highlighted in our previous report dated Q3 2024, cities such as Foshan, Guangzhou, Shenzhen, and Hong Kong are at the forefront of hydrogen vehicle applications, pioneering their integration into urban transportation networks.

## Carbon Market Expansion and Corporate ESG Awakening

**The GBA has transitioned from passive compliance to proactive leadership in climate action, driven by carbon market mechanisms and corporate strategic transformations.**

The compliance carbon market has established a market-based mechanism to reduce carbon emissions. This mechanism effectively requires high-emitting and energy-intensive enterprises to optimise their technologies and reduce energy consumption. Since 2011, China has launched pilot programs for carbon emissions trading in seven provinces and cities, including the carbon markets in Guangdong Province<sup>ix</sup> and Shenzhen. These two markets each have unique characteristics, focusing on key industries and diversification.

### Guangdong Carbon Emissions Trading Market

The Guangdong Carbon Emissions Trading Market has focused on key industries and demonstrated the advantages of large-scale leadership. At its launch in 2013, it concentrated on four major industries: steel, cement, power, and petrochemicals. In December 2016, it expanded to include the papermaking and civil aviation industries. These six industries account for over 70% of Guangdong Province's total emissions<sup>13</sup>. Under the carbon trading mechanism, these industries achieved remarkable progress in emission reduction. By 2019, the carbon emission intensity of the companies included decreased by more than 11%.<sup>13</sup> The power, steel, petrochemical, and papermaking industries saw emission reductions of 14.6%, 2.5%, 9.7%, and 11%, respectively.<sup>13</sup>

In 2024, Guangdong Province further expanded the scope of its emission control to include the ceramics, transportation (ports), and data centre industries. In 2025, the steel and cement industries will be transferred to the national carbon emissions trading market, while a pilot will be carried out in the textile industry to explore low-carbon transformation paths for light industry and provide experience for the expansion of the national carbon market.

ix. The scope of the enterprises of the Guangdong Carbon Emissions Trading Market excludes enterprises within Shenzhen.

### Shenzhen Carbon Emissions Trading Market

Guangdong Province accounts for a quarter of national ceramic tile production<sup>8</sup>. GBA cities, such as Foshan and Zhaoqing, are significant hubs for a number of ceramics enterprises. Since the start of the coal-to-gas initiative, over 85% of the province's building ceramics enterprises have completed the transition,<sup>8</sup> leading to a substantial reduction in energy consumption and carbon emissions.

Beyond the mandatory carbon emission trading mechanism, the GBA has been active in developing and engaging with voluntary carbon trading mechanisms. It has not only engaged in the National Voluntary Greenhouse Gas Emission Reduction Trading Market but also explored innovations in carbon inclusion.

Since 2016, Guangdong Province has led pilots of the carbon-inclusive system, in cities such as Guangzhou, Dongguan, and Zhongshan. The GBA now embraces diverse carbon-inclusive transaction scenarios, including green transportation, waste sorting, and so on.

*The carbon-inclusive mechanism is regarded as a complement to and extension of the carbon market. Unlike the corporate-centric National Voluntary Greenhouse Gas Emission Reduction Trading Market, carbon inclusion incentivises low-carbon behaviour and green consumption among individuals and small and micro-enterprises.*

### Case study: Regional Collaborative Innovation of Carbon Inclusive Platforms

The development of carbon-inclusive platforms through collaboration between Macao and Zhuhai is a key highlight within the GBA. In 2023, the Guangdong Carbon Inclusion Innovation and Development Centre partnered with the Macao Low-Carbon Development Association to co-develop a GBA platform. In 2024, the Guangdong-Macao In-Depth Cooperation Zone in Hengqin launched the "Qin Tan Xing Ren" ("琴碳星人") mini-program, integrating 14 low-carbon practice scenarios. Citizens can earn points for engaging in low-carbon activities that can be redeemed for rewards in the platform's mall. This initiative has significantly advanced the integration of low-carbon lifestyles across the region.

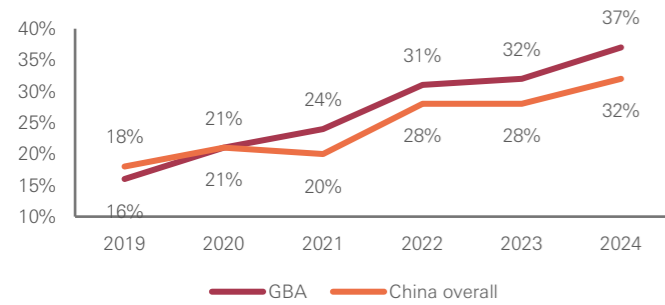
**The GBA companies have shown remarkable progress and leadership in environmental performance, particularly in the areas of disclosure and carbon reduction target setting.** Our study reveals that GBA companies have been increasingly active in responding to the CDP climate change questionnaire, with disclosure rates consistently higher than the national average in China, which increased from 18% in 2019 to 32% in 2024, as shown in Figure 5. This upward trend underscores the growing emphasis on environmental responsibility and transparency among GBA enterprises.

Furthermore, the CDP climate change questionnaire scores of GBA companies have improved notably. As shown in Figure 6, the proportion of GBA companies achieving the highest grades (A and A-), rose from 4% in 2019 to 17% in 2024, while those receiving B or B- grades increased from 26% to 44% over the same period. These clearly indicate the significant strides made in climate change response and environmental management practices within the GBA.

With regard to the establishment of SBT for carbon emissions, GBA companies have demonstrated a leading position. Figure 7 indicates that the number of companies in the GBA setting their first carbon emission reduction targets or making commitments via the SBTi has grown substantially from 2 in 2019 to 112 in 2024. Furthermore, the number of GBA companies doing so accounted for a significant proportion of the national total, specifically 27%.

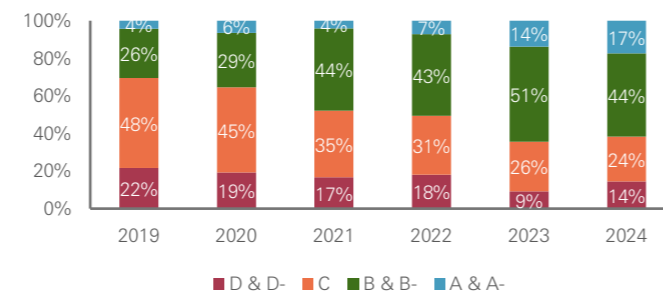


**Figure 5. Disclosure rate of the CDP climate change questionnaire, GBA vs. China overall**



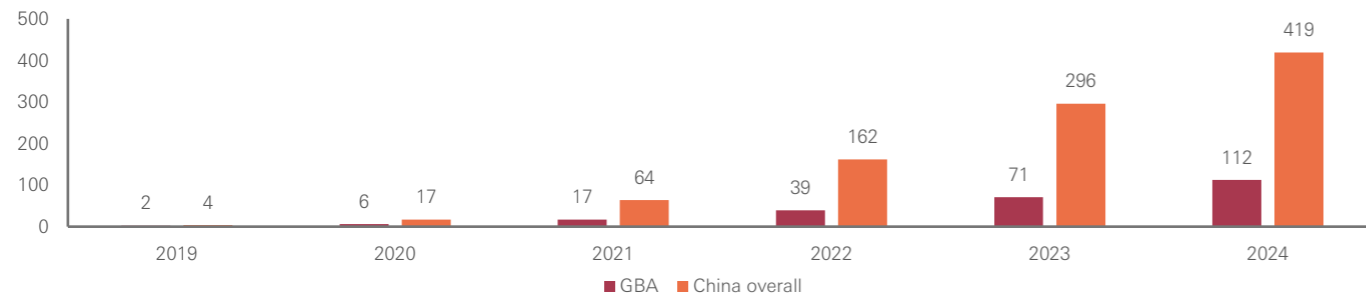
Note1: The data for China overall covers companies in mainland China, Hong Kong and Taiwan.  
 Note 2: Disclosure rate of the CDP climate change questionnaires = no. of companies that submitted the CDP climate change questionnaire / no. of companies invited to disclose via the CDP climate change questionnaire.  
 Source: CDP, CECEPHK, CECEPEC

**Figure 6. Scoring distribution of the CDP Climate Change Questionnaire within the GBA Companies**



Note: The 2024 score distribution was consolidated based on the scoring results published by CDP in February 2025.  
 Source: CDP, CECEPHK, CECEPEC

**Figure 7. Number of companies that set their first carbon emission reduction targets or made commitments via SBTi**



Note: The data for China overall covers companies in mainland China, Hong Kong, Macao and Taiwan.  
 Source: SBTi, CECEPEC

### Industrial Clustering and Tech-driven Innovation

The GBA has accelerated the development of a world-class green and low-carbon industrial cluster through regional collaboration and technology innovation, emerging as a new engine of high-quality growth within the country.

A well-structured policy framework provides strategic guidance for establishing green and low-carbon industrial clusters within the region. In 2024, the central government proposed that the GBA become a “world-class green and low-carbon industrial cluster”, synergising with a series of plans and guidance issued by governments within the GBA to create a collaborative “national strategy + local implementation” model. This integrated approach has positioned the region at the forefront of green transformation. The GBA has achieved remarkable progress in building green and low-carbon industrial clusters.

The GBA has enhanced regional collaboration in the fields of mechanism alignment and infrastructure sharing to facilitate resource flow and promote the development of green and low-carbon industries.

#### Examples of the GBA’s leading positions in the green and low-carbon industrial clusters

- ◆ **New energy industries and green petrochemicals** are two of Guangdong’s nine trillion yuan-level sectors.
- ◆ As of the end of 2024, Guangdong Province’s offshore **wind power** capacity ranked first nationally.
- ◆ The region leads in the **hydrogen energy** field. Our previous report dated Q3 2024 explained the hydrogen energy industry within the GBA in detail.



#### Mechanism alignment:

- ◆ At the end of 2023, the central government proposed the establishment of a product carbon label certification system by 2025. Guangdong Province took the lead in piloting this initiative, becoming the first province to publish a carbon label mechanism and actively promote the alignment of the mechanism within the GBA. This led to the successful mutual recognition of the first batch of product carbon labels between Guangdong Province and Hong Kong.
- ◆ Another example is Huizhou’s innovative approach to achieving standard mutual recognition for Modular Integrated Construction (MiC) products with Hong Kong, breaking down cross-border collaboration barriers in the MiC field. This initiative has helped drive the development of green building and construction.

#### Infrastructure sharing:

- ◆ A prime example of infrastructure sharing is the construction of the GBA Hydrogen Corridor. This project which was launched in early 2025 will connect cities within the GBA to further facilitate the reliable hydrogen supply and transportation network.

The GBA has integrated intelligent technologies and climate technologies to promote the development of green and low-carbon industries. In our previous report dated Q1 2024, we analysed the role of the communication service sector in enabling the decarbonisation of other sectors by providing intelligent solutions. Additionally, climate technologies are reshaping high-emission sectors. For example, the GBA’s petrochemical industry has adopted climate technologies such as CCUS and electrification to drive decarbonisation.

#### Response to Global Challenges

The GBA has actively addressed the global ESG requirements with its “GBA’s solutions”, establishing itself as an international green hub.

International environmental regulations are increasingly impacting specific sectors. For instance, the shipping industry was included in the EU Emissions Trading System (EU ETS) in 2024. Additionally, the EU’s new Batteries Regulation imposes stringent requirements. To address these differentiated international mandates, industries within the GBA have developed tailored responses to advance their sustainable development.

## Shipping

- ◆ **Offering cash incentives:** Hong Kong launched the Green Incentive Scheme in 2024 to promote the green transformation of registered ships.
- ◆ **Setting ambitious targets:** In alignment with the International Maritime Organisation's (IMO's) requirements, Hong Kong has set a series of targets for its shipping industry, including the carbon reduction target, targets of increasing the use of green maritime fuels, and so on.



## Aviation

- ◆ **Using sustainable aviation fuel (SAF):** An aviation company headquartered in Guangzhou participated in the national SAF pilot program in 2024. Additionally, Hong Kong has set usage targets for SAF for 2025.



## Automobile and Key Inputs to its Supply Chain

- ◆ **Vigorously developing NEVs:** The GBA has taken strategic moves to expand its NEVs market, including optimising industrial layout, diversifying markets, and engaging in regulatory games. In the section on Consumer Discretionary Sector Close-up - Automobile Industry, we give detailed information on the GBA's responses to pressure from the international market.
- ◆ **Enhancing the carbon footprint assessment:** Leading GBA-based automotive manufacturers now disclose the carbon footprint of their products via the national platform, China Automobile Industry Chain Carbon Publicity Platform (CPP)<sup>x</sup>
- ◆ **Promoting battery recycling:** Leading GBA companies have set out strategic plans to enhance battery recycling.



In summary, the GBA has made remarkable progress in the environmental area, leading China's ESG landscape through energy transition, carbon market expansion, industrial clustering and innovation, and active response to global challenges. With continuous efforts and collaboration, the GBA is well-positioned to further drive sustainable development and serve as a model for other regions both domestically and internationally.

x. CPP is the official abbr of China Automobile industry chain carbon publicity platform ([Source](#)).



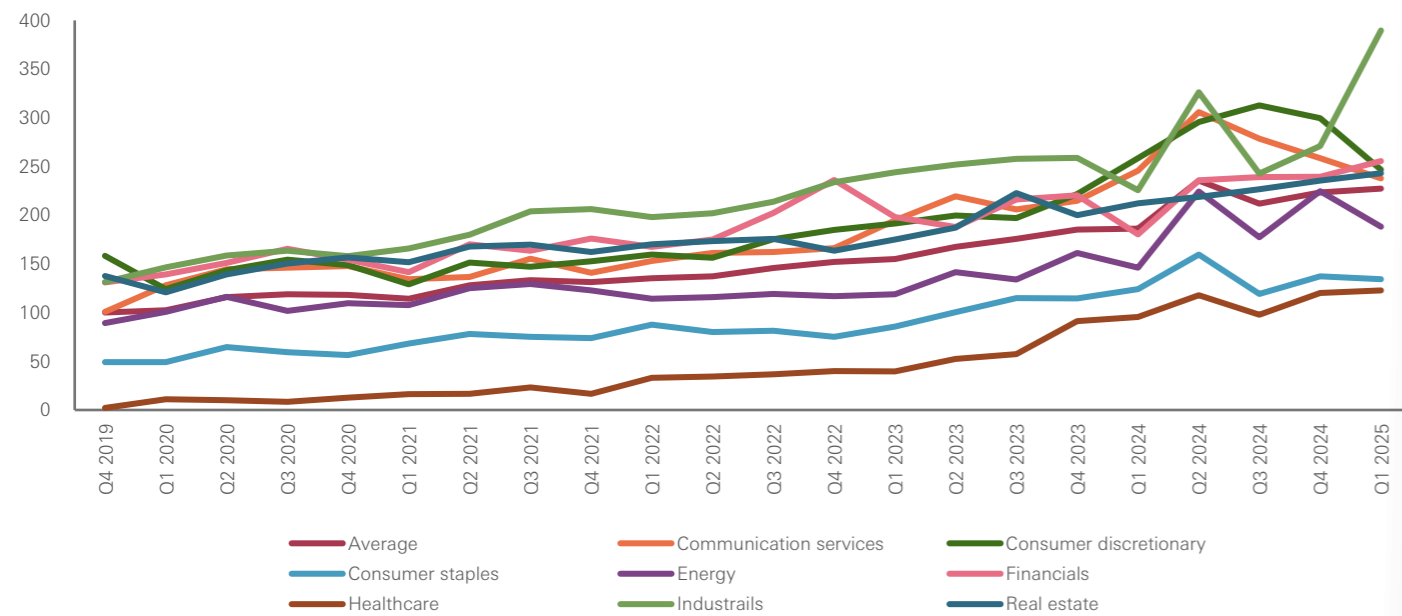
# GBA ESG Industry Sub-indices



# GBA ESG Industry Sub-indices



**Figure 8. Relative ESG performance evolution of the eight sectors**



Note: Note: The average value of the GBA ESG Industry Sub-indices was set at 100.00 for Q4 2019 (base period), as a benchmark with which to compare each key sector's individual ESG performances as well as their average performance.

Source: China's official statistical database, public sources, CECEPEC

Our study observed that in Q1 2025, the average value of the GBA ESG Industry Sub-indices was up 2% compared with Q4 2024 representing a year-on-year increase of 22%. The industrials sector saw a notable increase in Q1 and was first among the eight key sectors. This increase was primarily due to substantial improvements in the disclosure quality of the CDP climate change questionnaire.

The energy and consumer discretionary sectors experienced significant decreases over the same period. The reduction in the number of sustainability-related policies introduced in Q1, compared to the previous quarter, was a key factor in the downturn in both sectors. Another key driver of the decline in the consumer discretionary sector was the decrease in the number SBTs or related commitments set in Q1, compared with Q4 2024.

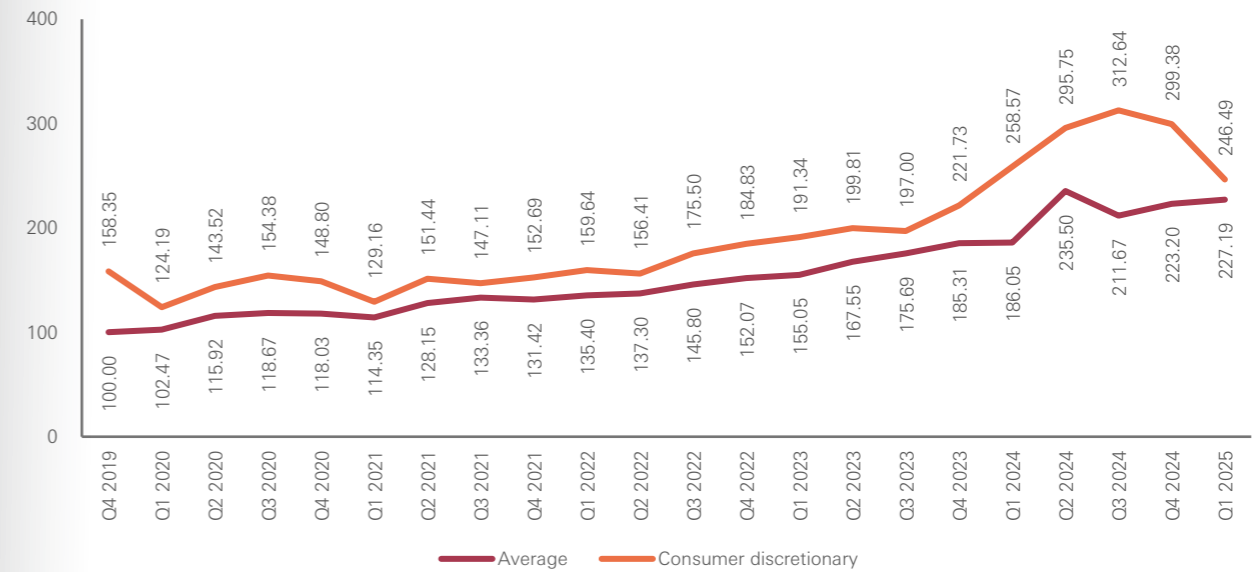


## Case Study:

# Consumer Discretionary

The consumer discretionary sector has witnessed significant improvement in ESG since 2023, as observed in our study (see Figure 9). The two primary drivers of this improvement are stronger policy support for the sector and its enhanced performance in climate-related areas.

**Figure 9. GBA ESG Sub-index – Consumer Discretionary**

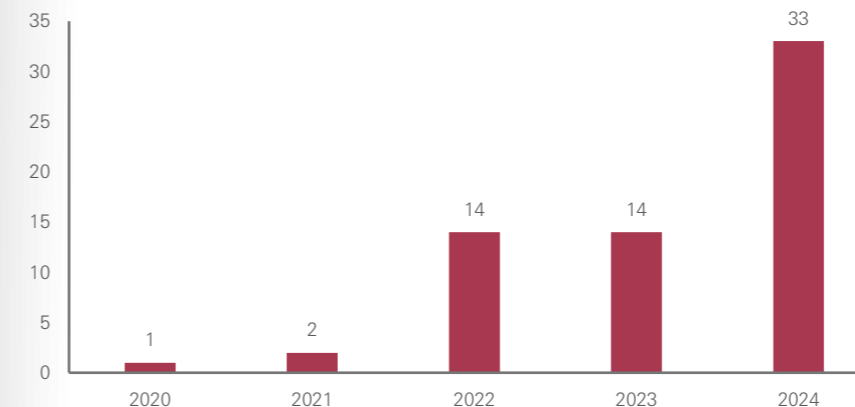


Note: The line chart shows the ESG performance evolution of the consumer discretionary sector. The average value of the GBA ESG Industry Sub-indices was set at 100.00 for Q4 2019 (base period).

Source: China's official statistical database, Wind, public sources, public disclosures of listed companies, CECEPEC

With regard to the performance in climate-related areas, our study found that the number of consumer discretionary companies achieving high scores (i.e., B- or higher) in CDP climate change questionnaires increased at year-on-year rates of 38% in 2024 and 100% in 2023. Additionally, in 2024, the consumer discretionary sector in the GBA was increasingly ambitious in setting climate-related targets. According to our data, in 2024, the number of companies from the consumer discretionary sector setting their first carbon emission reduction targets or making commitments via the SBTi was the highest among the eight key sectors. However, the sector was less active in Q1 2025.

**Figure 10. Number of consumer discretionary companies that set their first carbon emission reduction targets or made commitments via SBTi**



Source: SBTi, CECEPEC

In the subsequent analysis, we will take a closer look at the automobile industry. A vital part of the consumer discretionary sector, **the automobile industry is currently navigating a complex landscape of trade barriers while also embracing the transformative potential of autonomous driving technologies.** In the following sections, we will explore these two topics in depth: firstly by looking at how the GBA's automobile industry is addressing and overcoming trade barriers, and secondly by discussing the development of autonomous driving within the GBA and its intersection with ESG practices.

# Consumer Discretionary Sector Close-up - Automobile Industry

## Topic 1: Navigating a Complex Landscape of Trade Barriers

### Rising geopolitical tensions have led to abrupt changes in international trade policies over the past few months.

Amid the growing trend of trade protectionism, the U.S. and Europe have revised their trade policies to protect domestic industries and safeguard their economic interests.

#### U.S. Tariff Barriers on Chinese Goods

May 2024	The U.S. government announced the application of Section 301 tariffs on an estimated USD18 billion worth of goods, covering EVs and key inputs to the EV supply chain. Tariffs include but are not limited to, <b>an increase in tariff on EVs from 25% to 100%</b> and an increase in tariff on EV lithium-ion batteries from 7.5% to 25%. These increased tariffs on EVs and EV lithium-ion batteries took effect on August 1, 2024.
February 2025	The U.S. government announced additional tariffs on imports of goods from China, effective from February 4, 2025. The additional tariff rate for China is a 10% ad valorem duty on “all articles that are products of China” <sup>xi</sup> .
March 2025	The U.S. government announced an additional 10% tariff on goods from China, effective from March 4, 2025. This means 20% additional tariffs have been imposed since 2025. On March 26, the government announced <b>an additional 25% tariff on all automobiles shipped to the U.S.</b> , which will take effect on April 3, 2025.
April 2025	The U.S. government imposed an additional 34% tariff on Chinese imports on top of the existing 20% tariff introduced in early 2025. After a series of announcements, by April 11, the total tariff on Chinese imports has accumulated to <b>145%</b> . <sup>xii</sup>

#### EU Tariff Barriers on Chinese EVs

July 2024	The EU imposed provisional countervailing duties for EVs imported from China, with rates varying from 17.4 to 37.6%.
October 2024	The EU concluded its anti-subsidy investigation into Chinese EVs in October 2024. As a result, leading Chinese exported EVs were subject to countervailing duties ranging from 17% to 35.3%. These duties are set to remain in place for five years. <b>When combined with the existing basic tariff of 10%, the overall maximum rate exceeds 48%.</b>
April 2025	The EU and China have agreed to look into setting minimum prices on Chinese-made EVs instead of tariffs imposed by the EU last year.

**In the context of complex trade barriers, the business environment for China’s EV industry is increasingly challenging.**

The direct impact of the tariff policies on China’s EV exports to the U.S. market is limited, given that the export of EVs to the U.S. was relatively small, with only 12,400 units, accounting for less than 1% of the overall national EV exports<sup>15</sup>. However, these measures have restricted the entry of China’s EVs into the U.S. market.

While the impact of the U.S. trade barriers on EV exports themselves may be limited, the broader trade tensions have had a significant spillover effect on the lithium-ion battery industry, which is a crucial component of the EV supply chain. The U.S. remains the largest market for China’s lithium-ion battery exports, with Guangdong Province being the second-largest exporting province<sup>16</sup>. From January to September 2024, Guangdong’s lithium-ion battery exports amounted to USD10.39 billion, a decrease of 11% year-on-year, accounting for 23.8% of China’s total lithium-ion battery exports; the export volume reached 1.01 billion units, a year-on-year increase of 10%<sup>17</sup>. The phenomenon of “increasing volume but decreasing price” to some extent reflects the increasing pressure on lithium-ion battery production costs.

As regards the EU, under the influence of the anti-subsidy investigation, China’s EV export market to Europe has experienced fluctuations. From January to October 2024, China’s pure EVs exports to Europe dropped to 506,800 units, with a year-on-year decrease of 10%.<sup>18</sup>

The minimum prices mechanism, which has been under discussion, could be a bullish factor for Chinese EV industry. Although it has characteristics of a trade barrier by preventing Chinese EVs from entering the EU market at low prices, it offers certain advantages compared to the anti-subsidy tariffs. Specifically, it helps Chinese EVs avoid the impact of high tariffs and simultaneously forces Chinese automakers to accelerate technological innovation and industrial upgrading to reduce costs and cope with price restrictions.

Beyond the tariff barriers discussed above, the EU’s New Battery Regulation introduced last year has made it more difficult and costly for foreign NEV firms to access the EU market. This can also be viewed as a form of green trade barrier. Another important mechanism is CBAM. While CBAM is not intended as a trade protection measure, its implementation can have effects similar to a trade barrier. Currently, CBAM does not cover the automobile industry, but there is a possibility that its scope could be expanded in the future. If the automobile industry is included, companies will face higher costs for managing carbon emissions. In our previous report dated July 2024, we detailed how GBA companies are responding to the New Battery Regulation and enhancing their carbon management. These measures are also summarised in the Wrap-up of Environment section.

#### Case Study: Technology Licensing - Blade Battery

A battery manufacturer, a subsidiary of a leading EV brand in Shenzhen, has signed an eight-year strategic co-operation agreement with a top-tier U.S. automotive supplier, licensing the intellectual property rights related to the manufacturing and design of blade batteries. This initiative marks a significant step in optimising the industrial layout for both companies. By enabling the U.S. supplier to produce blade batteries locally, the Shenzhen-based company is able to leverage the supplier’s local production capabilities and resources, thereby enhancing the efficiency of the supply chain and reducing the impact of trade barriers.

In response to the challenges brought by the trade barriers, **GBA’s EV brands have taken strategic moves to prepare for existing and anticipated challenges with multi-pronged approaches, namely optimising industrial layout, diversifying markets and engaging in regulatory games.**

#### Adopting Technology Licensing to Optimise the Industrial Layout

Technology licensing is recognised as an effective strategy for navigating trade barriers. By licensing core technologies and production processes to overseas partners, companies can produce locally, effectively circumventing trade barriers while enhancing the efficiency and resilience of their global supply chains. A leading GBA automotive brand has taken this approach to enhance its global market presence.

xi. All articles that are products of China generally refers to goods that are wholly obtained or produced in China, produced exclusively from Chinese materials or substantially transformed in China (Source).  
xii. The value of US tariff on Chinese products is updated until April 11, 2025.



## Market Diversification Strategy

To navigate the complex geopolitical landscape, leading EV brands in the GBA have diversified their production bases and sales markets to reduce over-reliance on specific markets and mitigate associated risks in their global ventures. Faced with obstacles in market expansion in the EU and the U.S., these brands have sought opportunities in emerging economies, leveraging favourable foreign policies in their overseas expansion and operations.

In recent years, Southeast Asian countries such as Thailand, Malaysia, and Indonesia, have introduced plans and roadmaps for electrification transformation, along with a series of incentives to promote the development of the local NEV industry. These measures include improving supporting facilities and increasing tax exemptions or financial subsidies to attract foreign enterprises, particularly Chinese NEV-related companies, to invest locally.

### Case Study: GBA EV Brand Expansion in Indonesia

To promote the development of the local EV industry and attract foreign investment, the Indonesian government has offered substantial tax incentives for overseas EV manufacturers, that meet the investment criteria, including the establishment of an EV manufacturing facility in Indonesia. In December 2024, the Indonesian government announced that three global EV manufacturers, including two from the GBA, are to establish manufacturing plants in the country. These manufacturers will benefit from an exemption on import taxes and a 15% reduction in the value-added tax on luxury goods, effective from January 1, 2025.

## Engaging in Regulatory Games

In addition to technology licensing and market diversification, GBA EV brands are also actively engaging in regulatory games, which can help offset cost increases due to trade barriers.

### Case Study: GBA EV Brand Expansion in Indonesia

Starting in 2025, the EU mandates that new passenger vehicles achieve an average CO<sub>2</sub> emission of 93.6 grams per kilometre, with fines of EUR95 for every gram exceeded.<sup>19</sup> A leading Shenzhen-based automobile brand, known for its EVs and advanced battery technology, has accumulated a surplus of carbon credits. This brand is now in talks with European automakers to establish a carbon credit pool to help them meet EU standards and avoid hefty fines. This co-operation will not only enable European automakers to avoid fines but also bring new revenue streams for the Shenzhen brand and expand its market share.



## Topic 2: Autonomous Driving & ESG

**The emergence of autonomous driving marks a significant leap in the field of transportation, which has evolved from laboratory experiments into real-world applications. As well as improving traffic efficiency and reshaping human travel habits, this transformative technology promises to be of significant benefit to the environment. At the same time, it presents multidimensional challenges in social and governance arenas.**

### Definition of autonomous driving vehicles, intelligent vehicles, and intelligent connected vehicles (ICVs)

According to the Chinese government's definition, intelligent vehicles are commonly known as ICVs and autonomous driving vehicles. An intelligent vehicle refers to a new generation of automobiles equipped with advanced sensors and other devices, leveraging cutting-edge technologies such as artificial intelligence (AI) to achieve autonomous driving capabilities.<sup>20</sup>

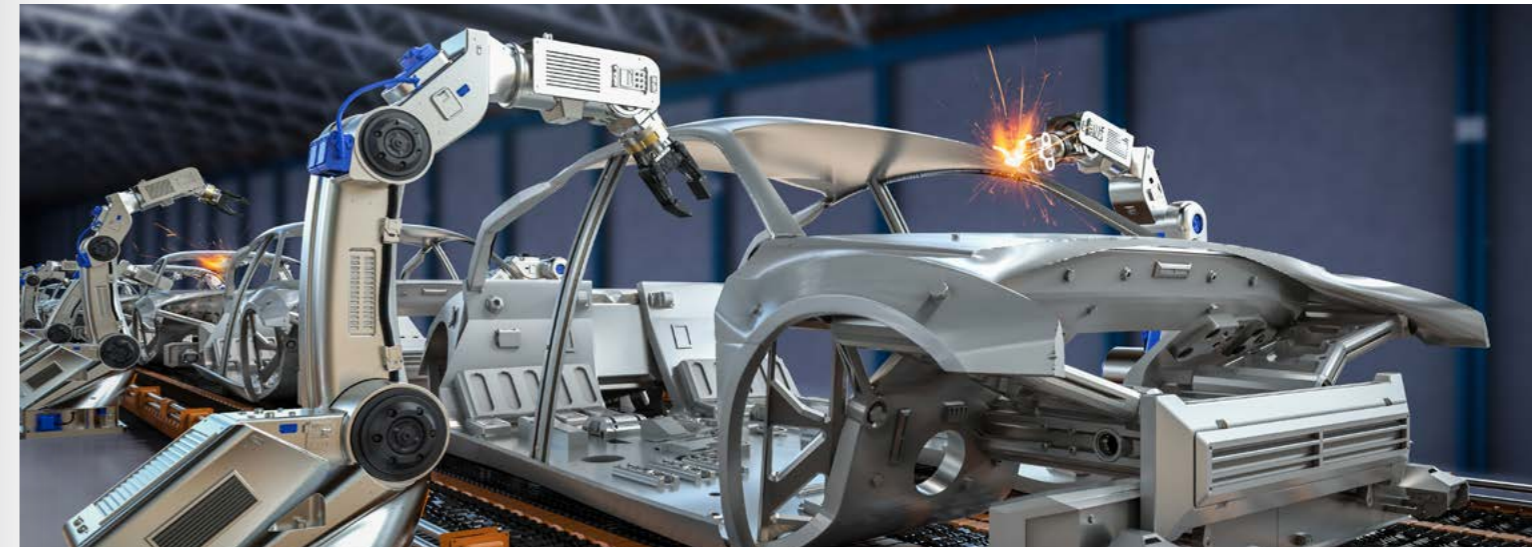
### Autonomous Driving Levels

The national classification of driving automation for vehicles is divided into six levels: the higher the level, the greater the degree of automation. For detailed definitions of Levels 0 to 5, refer to the Appendices. The national classification is largely aligned with the global standards developed by SAE International.

Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
Emergency Assistance	Partial Driver Assistance	Combined Driver Automation	Conditionally Automated Driving	Highly Automated Driving	Fully Automated Driving

China first proposed the concept of ICV ten years ago. Since then, China has gradually enhanced its policy system for autonomous driving. In 2020, China issued the *Intelligent Vehicle Innovation and Development Strategy*, with the goal of achieving large-scale application of Level 3 autonomous driving by 2025 and building a strong nation in intelligent vehicles by 2035. According to the Government Work Report in 2024 and 2025, the government has increasingly emphasised the development of autonomous driving, making it a key focus for the coming years.

The GBA, as a major player in the global automobile industry, has been at the forefront of autonomous driving. In line with national strategies, the GBA has established a policy framework to advance in this area. The table below outlines the latest policies issued by the governments within the GBA to support the development of autonomous driving.



**Figure 11. Policies related to autonomous driving issued by the governments within the GBA**

Issuers	Issuance Date	Name of the Policies	Key Information Related to Autonomous Driving
Guangdong Province	February 2025	<i>2025 Action Plan for Building a Modern Industrial System in Guangdong</i>	One of the primary tasks in building a modern industrial system is to cultivate emerging industries (including the NEV industry). The policy specifically highlights enhancing the industrial level of ICVs and continuing and advancing with the pilot programs in Guangzhou and Shenzhen.
Guangzhou	August 2024	<i>Opinions on Accelerating the Development of the Automobile Industry (Draft for Public Comment)</i>	The document sets out a series of goals for building a world-class automobile industry cluster. The goals for the autonomous driving field are that by 2027, over 80% of new ICVs will be Level 2 or higher-level autonomous driving vehicles, and over 20% will be L3 or higher levels. It also proposes providing subsidies for testing programs and large-scale production of L3 or higher-level autonomous driving vehicles.
Shenzhen	March 2025	<i>Shenzhen Action Plan for Accelerating the Building of an Artificial Intelligence Pioneer City (2025-2026)</i>	In the field of autonomous driving, the city aims to advance the large-scale application of Level 3 autonomous driving, master Level 4 technology, and take the lead in the development of Level 5 autonomous driving.
Hong Kong	October 2020	<i>Hong Kong Smart City Blueprint 2.0</i>	The document highlights the importance of the development of autonomous driving, which is a key element for establishing Smart Mobility.

Source: Public sources

**The GBA has positioned itself as a global leader in the field of autonomous driving, offering a “Chinese solution” for smart cities by leveraging its unique strength, such as complete industrial chains, cutting-edge technologies, and a wealth of application scenarios.** Currently, the GBA has established a comprehensive industrial chain in autonomous driving, encompassing leading automakers, autonomous driving solution providers, sensor suppliers and testing platforms. This complete industrial chain not only facilitates the exchange of technologies within industries but also reduces the cost of developing autonomous driving.



In addition to Guangzhou and Shenzhen, other GBA cities, such as Hong Kong, Zhuhai, and Foshan, have initiated autonomous driving testing and pilot programs in recent years. In December 2024, four areas within the GBA jointly signed a co-operation agreement for the mutual recognition of the pilot demonstration applications for autonomous driving. Following the signing of the agreement, autonomous driving demonstration vehicles will freely travel across multiple pilot locations within the GBA, providing cross-city autonomous driving services in major scenarios such as airports and high-speed rail stations.<sup>21</sup>

Leveraging the technological breakthroughs and experiences gained from testing and pilot programs, the GBA has continuously refined autonomous driving technologies and accelerated multi-scenario deployments to expedite the commercialisation of these technologies. To date, the GBA has developed a wide range of autonomous driving application scenarios, including urban transportation, logistics, and public transportation. It is worth noting that, the pace of commercialisation has been considerably accelerated in specific areas, such as autonomous taxis, logistic vehicles, buses, sanitation trucks, and so on.

Figure 12 provides a summary of the GBA’s achievement and current progress with regard to different levels of autonomous driving.

**Figure 12. GBA’s progress in autonomous driving Levels 2-5**

Levels	GBA’s achievements and progress
<b>Level 2 (Combined Driver Automation)</b>	The region has achieved a wide range of applications for Level 2 autonomous driving, with large automakers leading the way in large-scale production.
<b>Level 3 (Conditionally Automated Driving)</b>	The region is currently carrying out pilot programs and gradually promoting the commercialisation of Level 3 autonomous driving vehicles. Leading automakers aim to achieve large-scale production in 2025 or 2026.
<b>Level 4 (Highly Automated Driving)</b>	The region is at the research and testing phase and conducting tests in specific areas, such as the Pingshan District, Shenzhen. Leading automakers plan to promote large-scale production and deployment of L4 autonomous driving vehicles in the coming years.
<b>Level 5 (Fully Automated Driving)</b>	Level 5 autonomous driving technology is at an exploratory stage.

**While autonomous driving technology is still developing, numerous studies and projections suggest that the widespread adoption of autonomous driving could lead to significant environmental benefits.**<sup>22</sup> Two promising outcomes, in particular, are enhanced energy efficiency and synergies between NEVs and autonomous driving. These benefits are especially evident in innovation hubs like the GBA, where pilot programs indicate positive impacts.

#### Enhanced Energy Efficiency

By optimising driving patterns and alleviating traffic congestion, autonomous driving facilitates a transition from “passive saving” to “active optimisation”. A study carried out by a US university suggests that autonomous driving vehicles can achieve energy savings of 8% to 23%, varying according to the driving environment.<sup>23</sup>

Autonomous driving vehicles are programmed to drive smoothly and efficiently, dynamically optimising routes by anticipating traffic flows and avoiding sudden braking. This mode of smooth and efficient driving helps reduce the consumption of fossil fuels, electricity or alternative energy sources, as well as reducing the energy waste caused by frequent acceleration and braking in congested traffic.

#### Case Study: “Vehicle-road-cloud integration”

In early 2024, China launched the “Vehicle-road-cloud integration” pilot program. More complex than single-vehicle intelligence, vehicle-road-cloud integration leverages AI and technologies such as Cellular Vehicle-to-Everything (C-V2X)<sup>xiii</sup> to enable seamless collaboration between humans, vehicles, roads and cloud systems.<sup>24</sup> By linking autonomous driving vehicles with roadside perception and cloud control, vehicles gain enhanced situational awareness, allowing them to receive real-time traffic updates, avoid congestion and optimise routes for efficiency and safety. This integration also supports better energy management by enabling vehicles to adjust their speed and driving patterns based on overall traffic flow.

Guangzhou and Shenzhen have been designated as two of the 20 pilot cities in China to spearhead the “vehicle-road-cloud integration” pilot program. It is worth noting that, Pingshan District in Shenzhen, with its advanced vehicle-road-cloud collaborative ecosystem and extensive experience in autonomous driving testing and commercialisation, is set to become a pioneering demonstration area. Looking ahead, Pingshan District will accelerate the construction of a comprehensive vehicle-road-cloud integration system, achieving full 5G coverage, complete networking of traffic signals and the deployment of intelligent devices at all intersections.

xiii. Cellular Vehicle to Everything (C-V2X) is an advanced wireless communication technology that enables vehicles to communicate with one another (V2V), with infrastructure (V2I), with pedestrians (V2P), and with the broader network (V2N) (Source).

## Synergies between NEVs and Autonomous Driving

Compared with traditional fuel vehicles, EVs have inherent advantages in their electrification systems, rendering the integration of autonomous driving technology more “seamless”. Additionally, autonomous driving technology can simplify the charging process of users. The GBA has provided an exemplary charging solution for autonomous driving EVs in Guangzhou.

### Case Study: A Pioneering Achievement in Autonomous Driving Energy Supply

The Nansha Huanshi West Road Supercharging Station in Guangzhou, which is the country’s first “unmanned charging station”, began operation in December 2024. This station enables autonomous NEVs to perform the entire process of vehicle docking, charging, and departure in a fully unmanned operation, leveraging automated robotic arm charging and intelligent dispatch systems.

Upon arrival at the station, the autonomous NEV is met by a robotic arm that automatically identifies the vehicle and precisely inserts the charging gun, a process that takes a mere 80 seconds to complete. Once the charging is finished, the vehicle proceeds to automatic settlement, showcasing a seamless and efficient charging experience.

As mentioned in our previous report, dated October 2024, hydrogen energy is increasingly being used in the transportation sector. The integration of hydrogen energy with autonomous driving technology can further enhance the efficiency and sustainability of transportation. The GBA has notably pioneered the application of “hydrogen fuel cell vehicles (HFC vehicles) + autonomous driving” in the sanitation industry, underscoring the potential of autonomous hydrogen-powered vehicles.

### Case Study: A Demonstration Project of Autonomous HFC Sanitation Vehicles in Guangzhou

In Q1 2025, a pioneering commercial project featuring autonomous HFC sanitation vehicles was launched in Guangzhou’s Nansha District. This collaborative effort involves a Guangzhou-based electricity and heating utility, a local provider of autonomous driving technology solutions, and a renowned Korean automotive brand. The partners aim to introduce 50 HFC sanitation vehicles equipped with autonomous driving technology in 2025.

#### Technical Features:

- ♦ Enhanced efficiency: These sanitation vehicles are powered by highly efficient hydrogen fuel cell systems, achieving an impressive energy conversion rate of 63%, surpassing the industry average of 55%. They boast a driving range of 300 kilometres and can be refuelled in a mere three minutes. Furthermore, the operational hours are 40% greater when compared to the conventional sanitation vehicles.
- ♦ Intelligent coordination: Equipped with advanced autonomous driving technology, these vehicles can navigate around obstacles, recognise different types of waste, and strategise efficient cleaning routes.

**While autonomous driving has the potential to revolutionise transportation, its widespread adoption still faces multidimensional challenges, primarily centred around technical safety, accountability, and impact on the employment of drivers.** The following paragraphs discuss these three challenges and explore how governments and enterprises within the GBA are responding to these issues to ensure the safe and sustainable development of autonomous vehicles.

## Technical Safety

Despite significant advancements in autonomous driving technology, there are still substantial challenges regarding technical safety. Autonomous driving vehicles struggle to handle complex scenarios effectively. For example, adverse weather conditions, such as heavy rain, can impair sensor performance, leading to inaccurate assessment of road conditions. Additionally, irregular road construction and unexpected incidents may expose autonomous driving vehicles to precarious situations. The reliability of autonomous driving systems is also a major concern. Given that these systems are intricate integrations of software and hardware, they are susceptible to software vulnerabilities and hardware failures. Any system malfunction could lead to loss of vehicle control, potentially causing severe accidents. Thus, enhancing system reliability remains a critical priority.

Multi-modal sensor fusion and redundant design are two key strategies to enhance the technical safety of autonomous driving that have been widely adopted by the leading autonomous driving companies.

## Multi-modal sensor fusion

Multi-modal sensor fusion enhances environmental perception by integrating data from various sensors, such as cameras and LiDAR. This approach compensates for individual sensor limitations, thereby improving the system’s ability to handle complex scenarios.

The GBA has made significant progress in multi-modal sensor fusion. For example, in 2024, a leading autonomous driving solution provider in Shenzhen launched a driving system that employs a multi-modal sensor fusion approach. The System integrates various sensors, including LiDAR, millimetre-wave radar, and cameras for comprehensive environmental perception. This advanced driving system has been used by several EV brands.

## Redundant design

Redundant design ensures that if one system fails, a backup system with the same functionality can seamlessly take over, maximising system reliability.

GBA companies have ramped up R&D investment in redundant design. For example, a Guangzhou-based automobile brand has collaborated with a tech firm to jointly develop a new type of autonomous driving vehicle with innovations in the redundant design of vehicles, aiming to complete the first batch of vehicles by 2025 and expand to more regions and countries.

Vehicle-road-cloud integration is another measure that further enhances safety. As mentioned above, Guangzhou and Shenzhen have been designated as two of 20 pilot cities in China to spearhead the “vehicle-road-cloud integration” pilot program. By leveraging real-time data from roadside sensors and cloud-based analytics, vehicle-road-cloud integration can anticipate and respond to potential hazards more effectively, thereby improving overall driving safety.

## Accountability

Accountability is a crucial issue for the large-scale adoption of autonomous driving. Currently, no national laws and regulations clearly define the liability of autonomous driving vehicles. Lack of clarity with regard to accountability leaves consumers concerned about potential accident liabilities when using autonomous driving mode. Additionally, there is ongoing debate about the handling of accidents and insurance claims related to autonomous vehicles.

Despite the absence of national laws and regulations clearly setting out the liability of autonomous driving, governments within the GBA have enhanced accountability mechanisms within the region by enacting local regulations.

- ♦ In August 2022, the first regulation for the management of intelligent connected vehicles in China, *Regulations on the Management of Intelligent Connected Vehicles in Shenzhen Special Economic Zone* officially came into effect. This regulation provides specific provisions on matters such as traffic violations, accident handling, and legal liability related to autonomous driving.
- ♦ In January 2025, Guangzhou published the *Regulations on the Innovative Development of Intelligent Connected Vehicles in Guangzhou*. While promoting the innovative development of the autonomous driving industry, the regulation also includes specific provisions on matters such as safety assurance and legal liability.

## Impact on the Employment of Drivers

The impact of autonomous driving on employment has been a subject of intense debate. Autonomous driving vehicles can operate around the clock without the need for driver salaries, thereby significantly reducing operational costs. As a result, the widespread adoption of autonomous driving could lead to job displacement of drivers, particularly in industries such as taxis, ride-hailing, freight, and logistics, which rely heavily on human drivers. Furthermore, drivers who are replaced may face reduced incomes or unemployment, potentially exacerbating social income inequality.

To mitigate the adverse impacts of autonomous driving on traditional drivers, career transition support is regarded as a significant solution. This includes the provision of retraining programs to help drivers transition to other professions. In Q1 2025, Guangdong Province issued the *Guangdong Province Vocational Skills Training Subsidy (Guidance) Standard Catalogue (2025 Edition)*. The catalogue provides subsidies for a range of vocational training programs. Some occupations that are related to the traditional driving or autonomous driving industries and which traditional drivers might consider include logistics services specialists, automobile mechanics, and information and communication network operations administrators.

# Appendices

## Glossary

Term/Acronym/Abbreviation	Interpretation
AI	Artificial intelligence
AI	Artificial intelligence
CBAM	Carbon Border Adjustment Mechanism
CCUS	Carbon capture and utilisation and storage
CPP	China Automobile Industry Chain Carbon Publicity Platform
C-V2X	Cellular Vehicle-to-Everything
EU ETS	EU Emissions Trading System
GBA	Guangdong-Hong Kong-Macao Greater Bay Area
GHG	Greenhouse gas
GSSS bonds	Green, social, sustainability and sustainability-linked bonds
HFC vehicles	Hydrogen fuel cell vehicles
ICV	Intelligent connected vehicle
IMO	Maritime Organisation
LiDAR	Light Detection and Ranging
MiC	Modular Integrated Construction
NEVs	New energy vehicles
PBOC	People's Bank of China
PRD	Pearl River Delta
PRI	Principles for Responsible Investment
R&D	Research and development
SAF	Sustainable aviation fuel
SBT	Science-based targets
SBTi	Science-Based Targets initiative
The Index	HSBC Greater Bay Area ESG Index
Autonomous Driving Levels 0 to 5	<ul style="list-style-type: none"> <li>◆ Level 0 (Emergency Assistance): The emergency assistance system cannot sustain continuous vehicle control.</li> <li>◆ Level 1 (Partial Driver Assistance): The partial driver assistance system sustains vehicle control laterally or longitudinally under its designed operating conditions.</li> <li>◆ Level 2 (Combined Driver Assistance): The combined driver assistance system sustains vehicle control both laterally and longitudinally under its designed operating conditions.</li> <li>◆ Level 3 (Conditionally Automated Driving): The conditionally automated driving system sustains all dynamic driving tasks under its designed operating conditions.</li> <li>◆ Level 4 (Highly Automated Driving): The highly automated driving system sustains all dynamic driving tasks and executes a minimum-risk manoeuvre under its designed operating conditions.</li> <li>◆ Level 5 (Fully Automated Driving): The fully automated driving system sustains all dynamic driving tasks and executes a minimum-risk manoeuvre under any driving conditions.</li> </ul>

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# Table of Indicators

**Figure 13. Indicators for regional/cities and industry level**

First-level Indicator	Second-level Indicator
Environment	Corporate CDP disclosure performance
	Corporate science-based climate commitments
	Air quality
	Energy use efficiency
	Water use efficiency
	Electricity use efficiency
	Public sector's contribution to environmental protection
	Urban greenness
Economic and Social Development	Economic development
	Economic contribution of tertiary industry
	Employment situation
	Public sector's contribution to education
Corporate Governance	Innovation and technological advancement
	Activeness of market players
Green and Sustainable Finance	Corporate ESG disclosure performance
	Activeness of market players
	Investor commitment to sustainable investing
Policy	Volume of sustainable debt instruments
	Number of ESG mutual funds
	Policies related to sustainable development in the GBA

Source: CECEPEC

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