

EXECUTIVE SUMMARY

DECARBONISATION PATHWAYS AND HOW FINANCE CAN ACCELERATE THE BUSINESS TRANSITION TO A LOW-CARBON ECONOMY IN THE GUANGDONG-HONG KONG-MACAO GREATER BAY AREA

ZHUOHUI HUANG, DAIYANG ZHANG, XIAOZHEN LI, XIAOQIAN JIANG, YING CUI,
YONGHONG LIU, XUELAN ZENG, LAWRENCE IU, BO YU, LING MIAO, XIAOLING HU,
KARINA CHOW, LAUREN CHAN, WEICHI LI AND JIAJUN HE



IIGF 中央财经大学
绿色金融国际研究院





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EXECUTIVE SUMMARY

HIGHLIGHTS

- The Guangdong–Hong Kong–Macao Greater Bay Area (GBA) is expected to lead by example in peaking carbon emissions and achieving carbon neutrality, as well as in creating a regional benchmark for green and low-carbon development. This is achievable.
- Clean electricity will contribute to the largest emissions reductions in the long-term for the key energy-consumption sectors of manufacturing, road transport, and buildings. In the medium term, energy efficiency improvement and cleaner energies in manufacturing and buildings, as well as a mode shift in transport, will be the key to decarbonisation.
- Our analysis estimates that the GBA needs approximately US\$1.84 trillion to achieve carbon neutrality by 2060, equivalent to around 1 percent of cumulative gross domestic product (GDP) during the 2020–60 period. We also estimate that \$200 billion to \$700 billion will be needed for road transport, with \$150 billion to \$300 billion required for the buildings sector.
- We recommend financial practices to accelerate the transition: establishing a cross-regional agency coordination mechanism in the GBA; facilitating interoperability of transition finance taxonomies and information disclosure standards on the Chinese mainland and in Hong Kong, as well as internationally; encouraging financial institutes and enterprises to set net-zero targets; facilitating development of regional carbon markets; developing a transition-related financial toolbox to scale up financing; and developing sector-specific financial solutions.

About this report

The need for action is urgent. Greenhouse gas (GHG) emissions rose over the past decade, reaching 59 gigatonnes of carbon dioxide equivalent (GtCO₂e) in 2019—roughly 12 percent higher than emissions in 2010 (IPCC 2022). In its 2023 synthesis report, the Intergovernmental Panel on Climate Change (IPCC) warned that ‘rapid and deep’ systemic changes are needed to limit global warming to the Paris Agreement’s 1.5-degree Celsius (1.5°C) goal, and GHG emissions need to peak before 2025, at the latest, and then reach net-zero CO₂ emissions in the early 2050s (IPCC 2023). As the world’s largest CO₂ emitter since 2005 (Climate Watch 2022), contributing 28 percent of the planet’s CO₂ emissions, China is critical to carbon emissions reduction.

The GBA is expected to lead by example in peaking carbon emissions and achieving carbon neutrality earlier than the national ‘30-60’ goals—China’s national goal of peaking its carbon emissions by 2030 and achieving carbon neutrality by 2060, as well as in creating a regional benchmark for green and low-carbon development.

This report aims to connect decarbonisation solutions with the finance required to accelerate

the net-zero transition in the GBA. It first applies a top-down approach to predict macro pathways for the whole GBA, then uses a bottom-up approach to analyse specific decarbonisation pathways and solutions for the key energy-consuming sectors—manufacturing, road transport and buildings—to highlight the actions most needed to achieve the 30-60 goal, as well as more ambitious goals to peak emissions and achieve carbon neutrality earlier. Based on the above decarbonisation pathways, this report estimates how much investment will be required and how challenges can be solved to ensure the finance needed to accelerate businesses’ transition to carbon neutrality.

Overall and sectoral transition pathways

The GBA is one of the engines driving China’s economic progress and a leader in the country’s socioeconomic and green development. Can it lead by peaking its carbon emissions and achieving carbon neutrality earlier than the national 30-60 goals? This study estimates the GBA’s carbon emissions from 2020 to 2060 using a top-down approach based on projected GDP and carbon intensity, and sets up three scenarios: the Baseline Scenario, the 30-60 Scenario and the 25-50 Scenario. Because the peak year and carbon



neutrality year vary from sector to sector, we use *Enhanced Policy Scenario* and *Zero-Emission Scenario* in the sectoral analysis as equivalents for the 30-60 Scenario and 25-50 Scenario in the overall GBA analysis.

Our analysis shows that ambitious actions are needed for the GBA's carbon emissions to peak earlier and achieve carbon neutrality.

The Baseline Scenario answers the question of whether and when carbon emissions will peak and carbon neutrality will be achieved if no stronger measures are taken. The 30-60 Scenario and 25-50 Scenario predetermine the peaking year and carbon neutrality year as assumptions, and the analysis answers the question of how fast emissions will need to be reduced to be consistent with the national 30-60 goals, and how much more sharply they need to be cut to peak by 2025 and achieve carbon neutrality around 2050.

- As the 14th Five-Year Plan (FYP) includes no new national or subnational targets for carbon intensity, under the Baseline Scenario we assume that in future five-year periods the rate of each city's carbon-intensity reduction remains what it was in the 13th FYP. Under this scenario, our results show that the GBA will

only reach its peak emissions in 2030, and a remaining 355 million tonnes of CO₂ emissions will need to be offset in 2060 (Figure ES-1), which seems beyond what is achievable.

- Under the 30-60 Scenario, to be consistent with the national 30-60 goals, carbon emissions in the GBA need to peak by 2030; carbon-intensity reductions equal to those of the Baseline Scenario can enable this. Emissions when peaking are 480 million tonnes of CO₂. But more ambitious actions need to start from 2030 to enable a sufficiently sharp emissions decline to achieve carbon neutrality by 2060. If carbon neutrality means a 90 percent emissions reduction and a 10 percent offset by forest sink and negative emissions technologies such as carbon capture, utilisation and storage (CCUS), as many other countries set their targets, an emissions cap goal will be needed beginning in 2030 and annual emissions reductions during the 2030-60 period will need to be around 7.5 percent.
- Under the 25-50 Scenario, if carbon intensity can be reduced by 24 percent in the 14th FYP, the GBA can peak its emissions by 2025. Emissions when peaking will be 467 million tonnes of CO₂. This will require much stricter

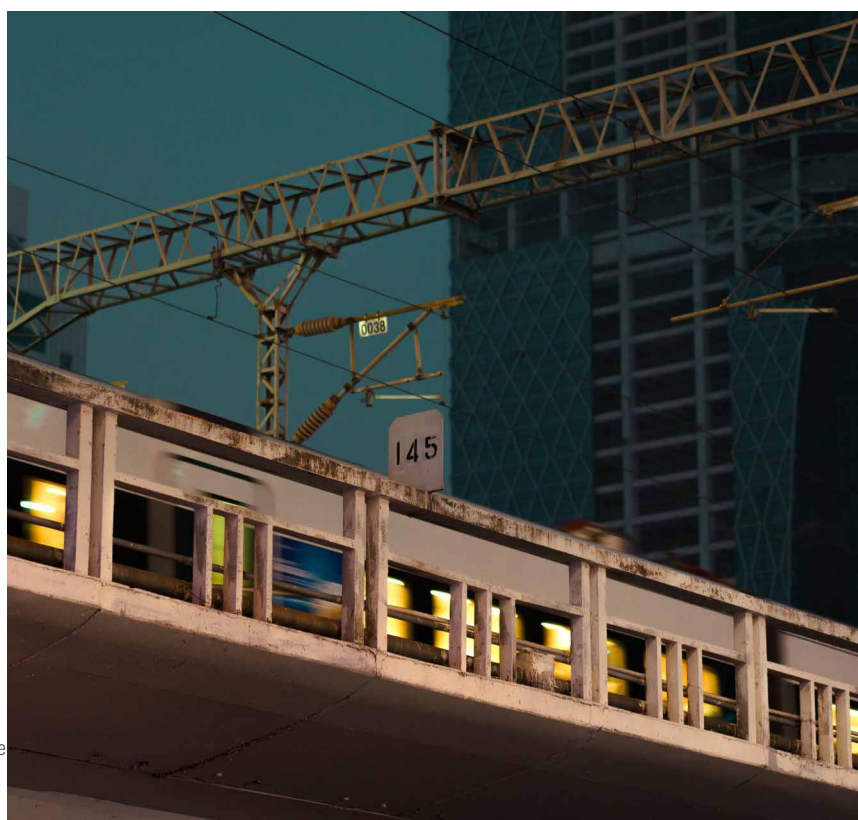
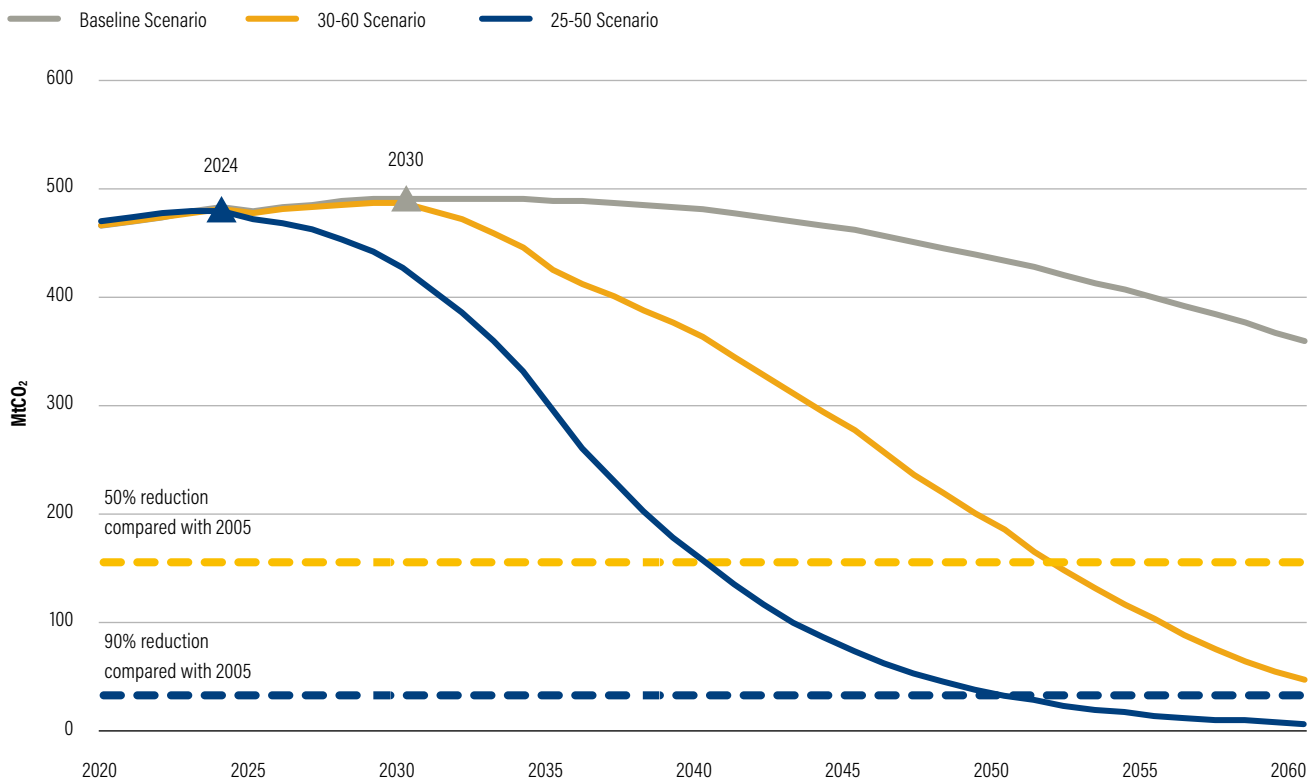


Figure ES-1 | Scenario analysis of carbon emissions in the GBA towards 2060



Note: MtCO₂ = million tonnes of carbon dioxide.
Source: Project team.

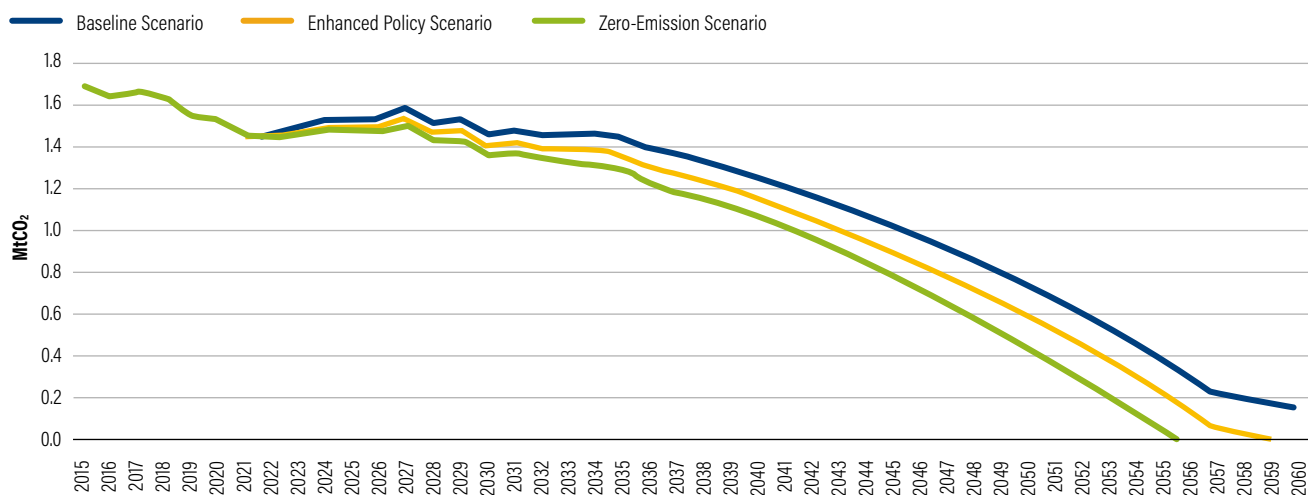
policies and measures because the target is higher than what was achieved in the 13th FYP in Guangdong—a 22.35 percent carbon intensity reduction, and emissions reductions from some measures such as energy efficiency will get harder. The annual rate of emissions reduction during the 2025–50 period should be around 16 percent if we want to achieve carbon neutrality around 2050. This scenario is consistent with advice in the newest IPCC report to ensure attainment of the Paris Agreement’s 1.5°C goal.

How can the 30-60 or even the 25-50 Scenario pathway be achieved? The GBA’s energy-related carbon emissions come mainly from three key sectors: manufacturing, building operations and road transport, which accounted for 32 percent, 31 percent and 20 percent of emissions, respectively, in 2020. This study provides in-depth analysis for the three sectors. A bottom-up approach was applied to model different scenarios for each sector.

Manufacturing

The GBA’s manufacturing is expected to peak its carbon emissions during the 15th FYP (2025–30) and to achieve carbon neutrality around 2055–60. ‘New Major Projects’ (projects with energy consumption greater than 10,000 tonnes of coal equivalent and approved by the Energy Bureau of Guangdong Province before 2021) would lead to increased carbon emissions in the Pearl River Delta during the 2020–30 decade. But different interventions in energy intensity (energy consumption per unit of industrial value added), phasing down fossil fuels use, energy conservation technologies, and decarbonised power and heating systems will result in emissions reductions. Emissions peak values are 154.2 million tonnes for the Baseline Scenario, 150 million tonnes for the Enhanced Policy Scenario and 147.2 million tonnes for the Zero-Emission Scenario. However, the Baseline Scenario will not achieve carbon neutrality by 2060, with a residual 16 million tonnes of emissions, and the GBA’s manufacturing

Figure ES-2 | Scenario analysis for industrial carbon emissions



Note: MtCO₂ = million tonnes of carbon dioxide.
Source: Project team.

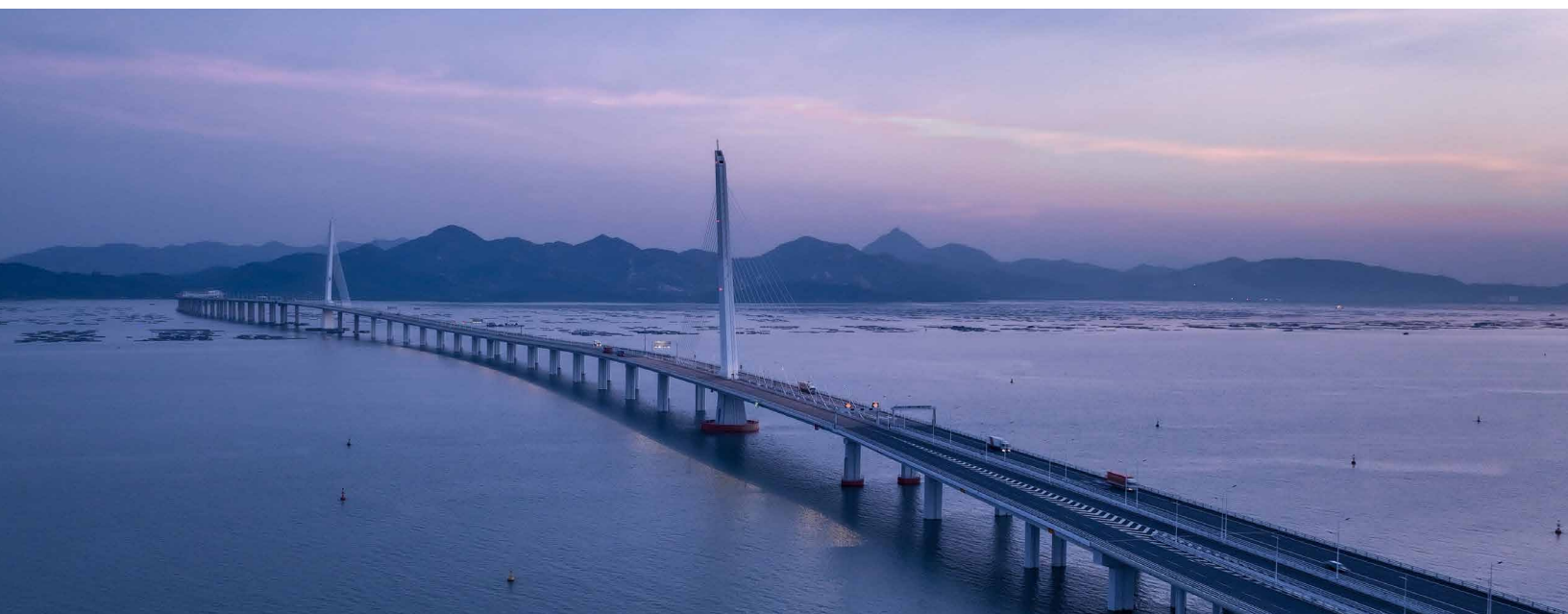
industrial sector is expected to achieve carbon neutrality during the 2055–60 period under the Enhanced Policy and Zero-Emission Scenarios (Figure ES-2).

The largest emissions-reduction potential lies in the following areas:

- **The most important contribution to carbon neutrality comes from decarbonised power generation and heating systems.** Decarbonised power and heating systems account for 74 percent of the total emissions-reduction potential from now to 2060. Phasing down fossil fuels in production accounts for 16 percent, energy conservation

5 percent and carbon removal technologies 5 percent (Figure ES-3). Power and heating generation can be decarbonised by leveraging advances in low-carbon electricity from the grid and switching to renewable energy to generate on-site electricity and heating. Decarbonised heating systems are also important to manufacturing, and the electrification of thermal processes should be one strategy to decarbonise heating systems and leverage decarbonised electricity sources.

- **Phasing down fossil fuels use, the second-largest contributor to emissions reduction,** can be achieved by substituting low- and no-carbon fuel and feedstocks to

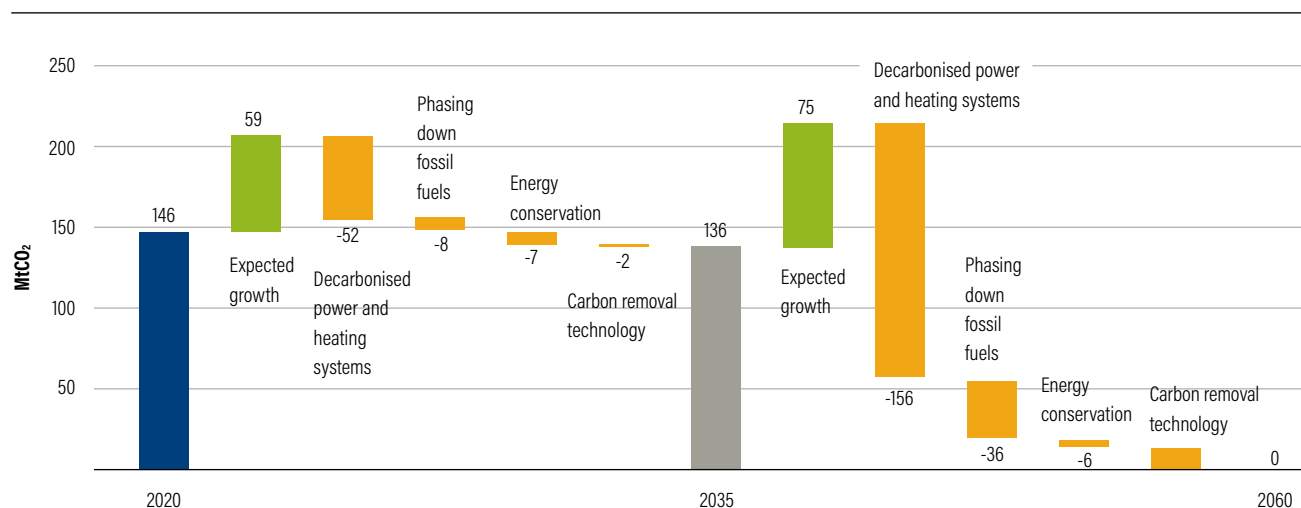


reduce emissions for industrial processes. Technical improvements can lower emissions, including upgrading furnaces to phase down coal and consume waste heat. Coal used in ceramic kilns, papermaking and textile boilers can be replaced with natural gas in the short and medium term. Innovation in hydrogen production can also reduce the use of fossil fuels (such as coal-based hydrogen production). Hydrogen energy can be produced using industrial by-product hydrogen from propane dehydrogenation, from electrolysis of water via off-peak power and clean energy. Coal-related carbon emissions can be

effectively reduced in the cement, steel and chemical industries over the long term. By 2060, low-emission fuels, including biodiesel, green hydrogen and methane produced from hydrogen, could replace approximately 50–60 percent of oil consumption in the petrochemical and chemical industries.

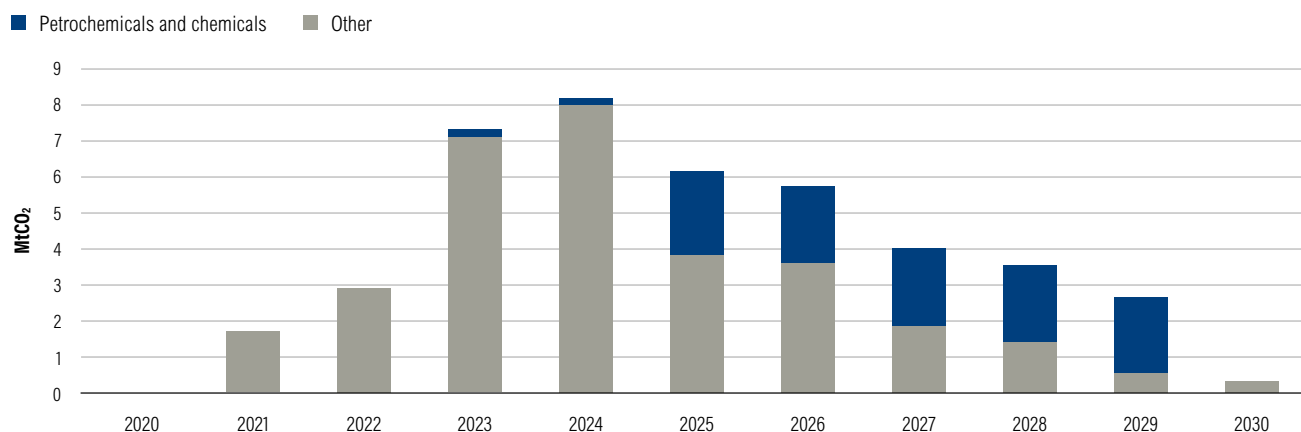
- **The petrochemical industry is a key sector for emissions peaking.** The petrochemical industry accounted for 18 percent of total energy use in Guangdong in 2020 and is the number one sector for energy use (Guangdong Provincial Bureau of Statistics 2021). There are five large

Figure ES-3 | Contribution of decarbonisation pathways in industries in the GBA



Note: MtCO₂ = million tonnes of carbon dioxide.
Source: Project team.

Figure ES-4 | Manufacturing carbon emissions increase from the 'New Major Projects' during the 2020-30 period



Note: MtCO₂ = million tonnes of carbon dioxide.
Source: Project team.

petrochemical bases in Guangdong and two in the GBA—Guangzhou and Huizhou. The Huizhou ExxonMobil Huizhou Ethylene Phase I Project will be completed and put into operation around 2025, leading to a large increase in emissions (Figure ES-4).

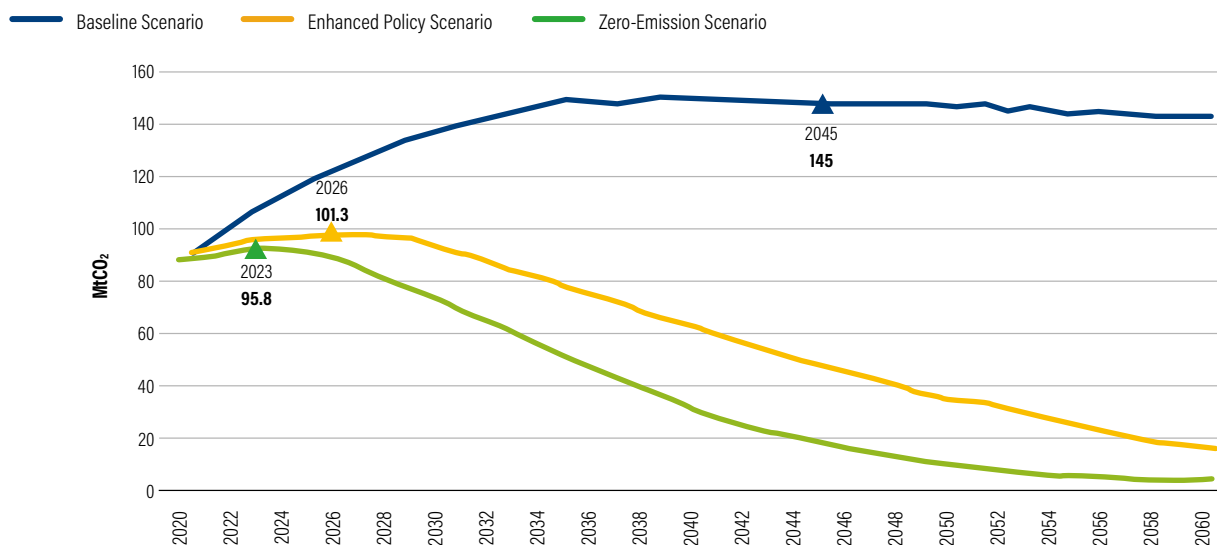
Road transport

Stricter policies could allow the GBA’s road transport sector to peak emissions by 2026 or even earlier. Carbon emissions from road transport in the GBA were 91.5 million tonnes in 2020. Private cars, light-duty vehicles and heavy-duty vehicles are the main sources of carbon emissions. Under the Enhanced Policy Scenario, road transport carbon emissions in the GBA would rise 31 percent above 2020 levels, peak around 2026, then fall to 20 million tonnes of CO₂—80 percent below the 2020 level—by 2060. In the Zero-Emission Scenario, road transport carbon emissions in the GBA would peak in 2023 and reach a near 100 percent reduction by 2060 (Figure ES-5). Carbon neutrality for road transport by 2060 is possible, but it will require greater determination and earlier actions, including more ambitious new-energy vehicle (NEV) promotion, fuel economy improvement, mode shift, reduced annual kilometres travelled, and clean electricity and green hydrogen.

The largest emissions-reduction potential lies in the following areas:

- **Outside of Guangzhou and Shenzhen (which is ahead of other cities in road transport decarbonisation), more aggressive emissions reduction measures have a dramatic impact on emissions.** We found that stricter measures would dramatically lower emissions peak in cities other than Guangzhou and Shenzhen in the Pearl River Delta and allow them to peak three years earlier than they otherwise would. This is because Guangzhou and Shenzhen have already adopted stricter policies, such as NEV promotion.
- **Gasoline and diesel will still be the main energy sources for a long time, but electricity and hydrogen will eventually become the main energy supply.** Under both the *Enhanced Policy Scenario* and *Zero-Emission Scenario*, the proportion of gasoline and diesel consumed drops rapidly after it peaks. However, by 2050 and 2041, respectively, under the two scenarios, the consumption of electricity and hydrogen can surpass gasoline and diesel and become the main energy supply (Figure

Figure ES-5 | Road transport carbon emissions projections in the GBA under different scenarios



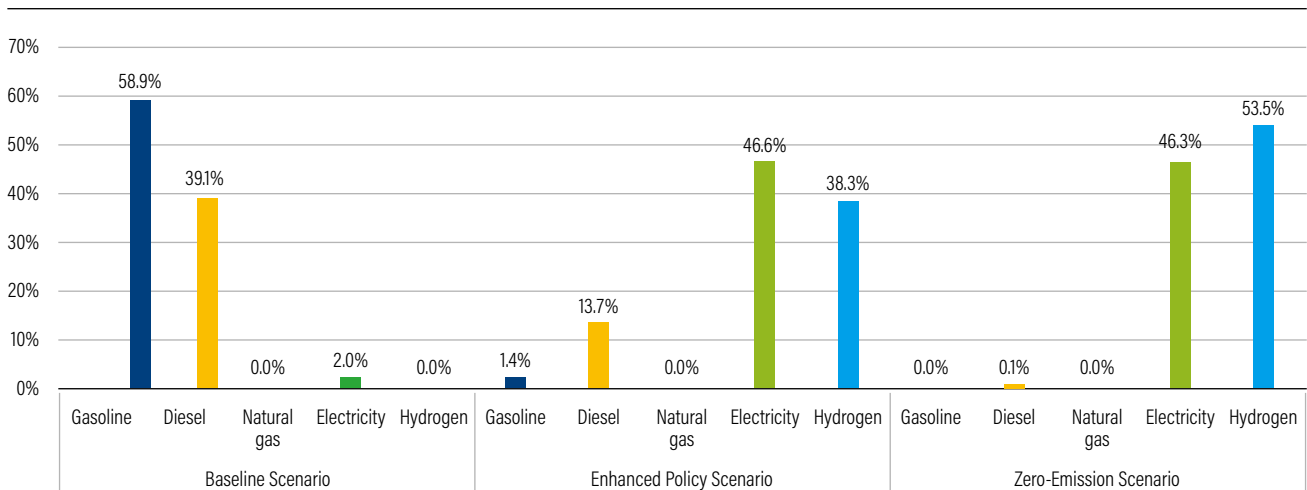
Note: MTCO₂ = million tonnes of carbon dioxide.
Source: Project team.

ES-6). This implies that intervention in internal combustion engine vehicles, such as improving fuel economy, shifting to public transport and the like, will still have significant impact. Meanwhile, the GBA's road transport infrastructure will need to be upgraded, especially in Guangzhou and Shenzhen, where NEVs are developing rapidly.

■ **Among all policies and measures, promotion of NEVs together with**

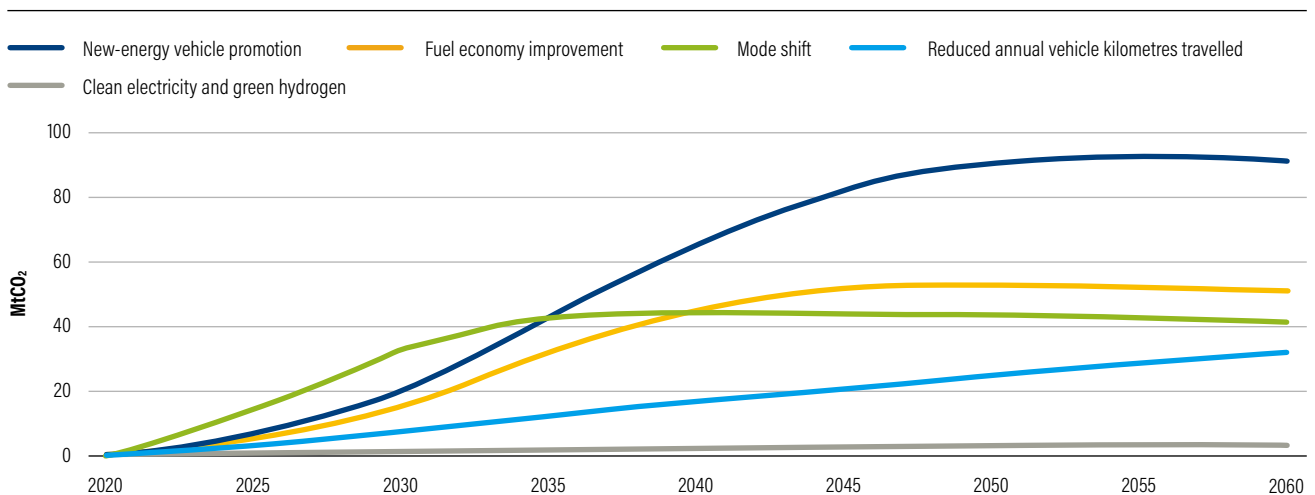
upstream clean electricity and green hydrogen will contribute the largest emissions-reduction potential in the long term. In the medium term, mode shift will be the largest contributor to decarbonisation. To compare the contributions of all measures, we analysed the emissions-reduction potential of five measures when any one of the measures is implemented alone. In the long run, a high proportion of NEVs has the greatest potential

Figure ES-6 | **Road transport carbon emissions projections in the GBA under different scenarios and proportion of different energies**



Source: Project team

Figure ES-7 | **Estimate of emission reduction potential of single measures under the Zero-Emission Scenario compared with the Baseline Scenario**



Note: MTCO₂ = million tonnes of carbon dioxide.

Source: Project team.

to reduce emissions, and its effect increases over time. Shifting passenger transport from private vehicles to public transit services and shifting road transport to railway and ships would bring larger emissions reductions than NEV promotion and fuel economy improvement before 2030 (Figure ES-7). This would require major investments in railway construction; more aggressive policies to expand public transit services and shift freight transportation from highways to railways and waterways; and multimodal transport, as well as green mobility in the Greater Bay Area.

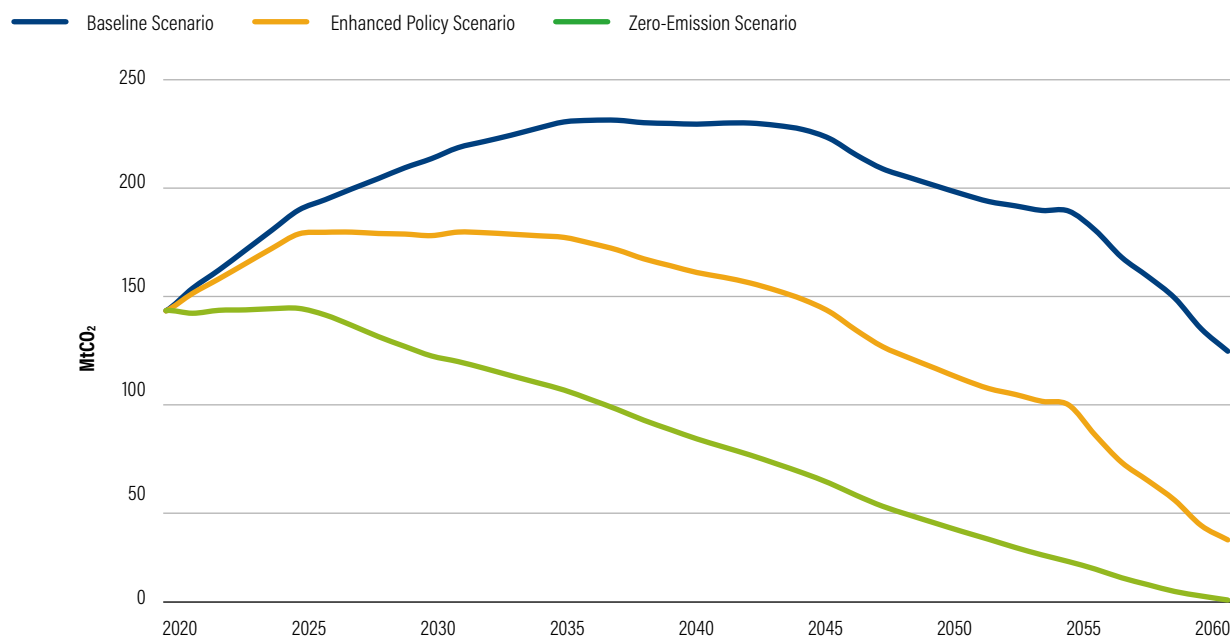
Buildings

The GBA's buildings sector is projected to peak its carbon emissions in 2025 at the earliest and achieve carbon neutrality by 2058. Under the Enhanced Policy Scenario, carbon emissions from buildings in the GBA will reach their peak in 2030 at 180 million tonnes of CO₂. Under the Zero-Emission Scenario, the GBA buildings sector emissions will peak at a lower level of 144 million tonnes by 2025 and will fall to less than 10 million tonnes by 2058 (Figure ES-8).

The largest emissions-reduction potential lies in the following areas:

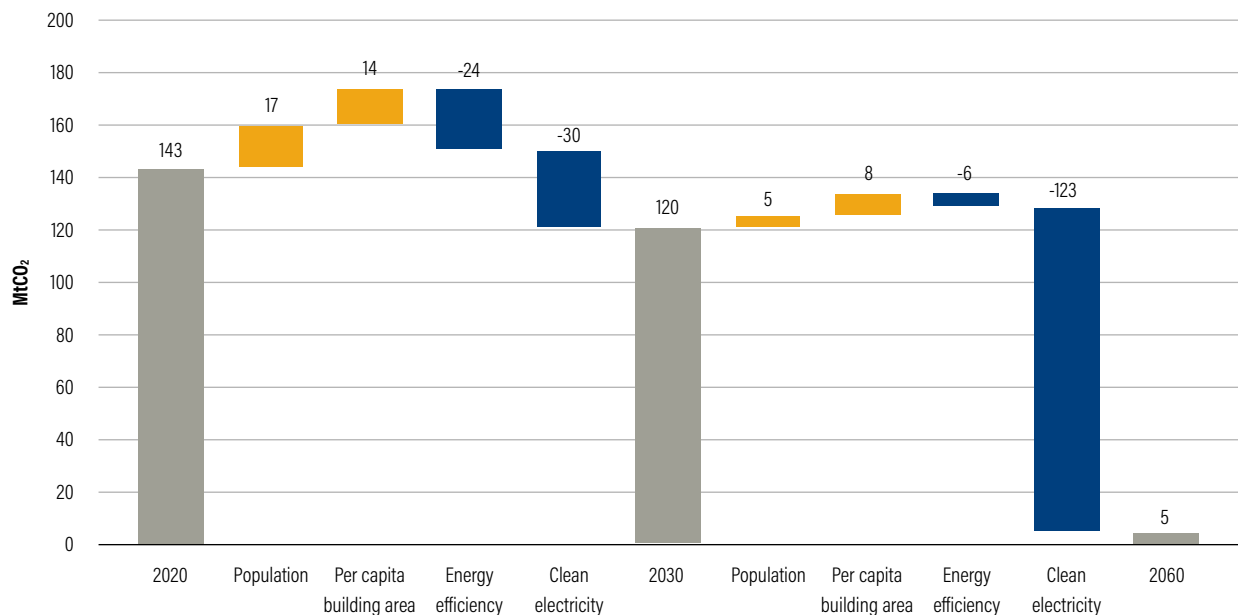
- **Both the stock and future increment of building emissions are mainly in public and commercial buildings.** Public and commercial buildings are responsible for 60 percent of emissions. Residential building area per capita in the GBA rivals that of the European Union and Japan, but public and commercial building area per capita is smaller and likely to grow. The GBA's residential area per capita was 35.7 square metres (m²) in 2020, which is very close to the 36 m² for Europe and Japan. The GBA's public and commercial buildings area per capita is only 13 m², lower than the 14–16 m² for Europe and Japan, and is expected to catch up in the near future. This indicates that public and commercial buildings have further emissions-reduction potential.
- **The three largest-emitting cities, Guangzhou, Shenzhen and Hong Kong, account for 60 percent of total emissions in buildings.** Buildings sector emissions across the GBA are varied. Usually, the higher the proportion of service industries,

Figure ES-8 | Scenario projections of carbon emissions in the buildings sector



Notes: MtCO₂ = million tonnes of carbon dioxide.
Source: Project team.

Figure ES-9 | Contributions of decarbonisation pathways in the buildings sector under the Zero-Emission Scenario



Note: MtCO₂ = million tonnes of carbon dioxide.
Source: Project team.

the greater the proportion of buildings emissions. Buildings emissions in Guangzhou and Shenzhen surpassed those of Hong Kong between 2017 and 2018.

- Energy efficiency is important to decarbonise the buildings sector in the near future, while decarbonised electricity contributes the largest potential for emissions reduction.** In the Zero-Emission Scenario, between 2020 and 2030, improved energy efficiency and energy conservation will contribute 45 percent of emissions reductions, and the use of renewable energy in buildings and electricity generation will provide 55 percent of reductions. Between 2030 and 2060, the use of renewable energy will contribute the most emissions reductions (96 percent) (Figure ES-9). Efficiency improvement measures should be emphasised ahead of the design and construction stages and can be a potent tool for restricting energy consumption and enabling emissions to peak earlier. Electricity drove most of emissions increase in buildings and accounts for 89 percent of emissions, indicating a high electrification rate of the GBA’s buildings

sector. The GBA can focus on shifting to low-emission fuel for electricity generation and use renewable energy for cooking, water heating and space cooling. Electricity, and especially high-efficiency electric heat pumps, will become the primary source of energy use for space cooling. In addition to renewable energy now used to heat water in buildings, solar thermal technology can be used for cooking, and various forms of bioenergy can be tapped as well.

Funding needs to support the transition and key challenges in existing financial practices to accelerate the transition. Finance plays a pivotal role in helping the GBA’s key sectors achieve the region’s decarbonisation goals. This study estimates the investment needed to stay on track with the overall and sectoral decarbonisation pathways suggested above.

Our analysis estimates that the GBA needs approximately \$1.84 trillion to achieve carbon neutrality by 2060, the equivalent of about 1 percent of cumulative GDP from now to 2060. We also estimate that \$200 billion to \$700 billion will be needed for road transport, and \$150 billion to \$300 billion for the buildings

Table ES-1 | Estimates on the investment needed for the GBA

PATHWAYS	INVESTMENT AREA	ESTIMATED AMOUNT UNDER ZERO-EMISSION SCENARIO (BILLION US\$)
Road transport		696
Increase EV and Fuel Cell Vehicles	Promotion of new-energy vehicles	365
	New chargers and charge stations	34
	New hydrogen refilling stations	4
Mode shift	Road transport to railway and water transport	300
Buildings sector		314
Green buildings	New green buildings	78
Improved energy efficiency	Ultra-low and near-zero buildings	1
	Retrofitting existing buildings	209
Distributed renewable energy	Install solar thermal Install photovoltaics Install heat pumps	26
Manufacturing and other energy-intensive industries		830
Total Investment needs		1,840

Note: EV = electric vehicles.

Source: Authors.

sector. Of the estimated \$1.84 trillion in financing required for the GBA’s decarbonisation by 2060, 55 percent would be needed in energy-intensive industries, such as petrochemicals, road transport and buildings. Table ES-1 breaks down the investment needs.

The above investment estimates are not fully met. They can be partly supported by green finance, but the shortfall remains. Why does this shortfall exist and what challenges do we face in trying to fill it?

This study summarises five challenges of unlocking finance to accelerate business decarbonisation given the GBA’s unique role in the ‘dual markets’:

- **More cross-regional policy coordination needed:** Government coordination at all levels across the GBA needs to be strengthened. The governments of key cities such as Guangzhou, Shenzhen, Hong Kong and Macao have not issued municipal-level planning guidelines that are drafted in tandem with each other. It is also not clear how the GBA will promote

the coordinated cross-regional development of ‘financing decarbonisation’, especially the emerging transition finance, which is important to support decarbonising of carbon-intensive industries and is an efficient supplement to green finance.

- **Ambiguous definition for transition activities:** Financing decarbonisation of carbon-intensive sectors will be essential to facilitate the transition of the real economy in the GBA. A clear definition of transition activities is needed, allowing a broader range of stakeholders to understand and appreciate financing carbon-intensive sectors. However, there is a lack of common taxonomy-based approaches to identify specific transition activities, sectoral decarbonisation targets and information disclosure standards in the key sectors that support the net-zero transition and ensure an alignment approach across jurisdictions in the GBA. A great number of assets in these industries do not meet the requirements of the existing green finance

taxonomy and thus cannot leverage green financial tools. Therefore, as a complement to green finance, China has started launching some tools for financing decarbonisation, including sustainability-linked bonds (SLBs), transition bonds and sustainability-linked loans (SLLs), to support the transition entities and activities. However, there is risk of greenwashing due to an ambiguous definition of transition activities. The People's Bank of China is leading on transition finance taxonomy, beginning with carbon-intensive sectors like coal-fired power generation, steel, building materials and agriculture (Ma 2022). Some leading international financial institutions are exploring transition finance frameworks to qualify and label financing that accelerates transition activities. For instance, in 2021 Standard Chartered Bank released its transition finance framework, which is designed for asset-based financing and aligns with the International Energy Agency's 2050 net-zero scenario.

- **Insufficient scientific guidance for transition plans:** To transition to lower carbon emissions, enterprises will need unified standards, transition goals and pathways. Many high-carbon enterprises in China have the will to transition, but they often lack sector-specific guidance and expertise to set the transition goals, the ability to prepare transition plans and pathways, and the understanding of how to access the financial market with credible tools and products to support the transition.
- **Limited financial tools to accelerate transition:** A wide range of well-defined and well-understood financing tools are prerequisites for financing the decarbonisation of high-carbon enterprises and their transition activities. The acceptance and liquidity of transition-related financial tools are also an indication of the maturity of the transition market. At present, while SLLs and SLBs are being adopted for setting clear GHG reduction targets during the financing terms, transition finance tools, bonds and loans remain limited. Financial tools in the form of equity investment, insurance and asset-backed securities are relatively undefined or non-existent.

■ **Unaligned carbon market mechanisms:**

There are now three carbon markets in the GBA, two pilot carbon markets on the Chinese mainland and one voluntary carbon market in Hong Kong. Due to differences in the allocation of carbon allowances and the regulation of the carbon market, the allowances in these three markets cannot be traded or mutually recognised, fragmenting the carbon markets in the GBA, which reduces the scale and liquidity of transactions and leads to the lack of comprehensive coverage of industries.

We offer six recommendations for finance to address the above challenges and fully exploit the supporting role of financing decarbonisation in the GBA:

1. Establish a cross-regional agency coordination mechanism for financing decarbonisation in the GBA. Given the fragmented nature of the GBA's finance market, it is imperative to establish a committee spanning regional agencies to coordinate transition finance. This committee, of which local policymakers and regulators should be key members, should aim to accelerate the GBA's sectoral transition by mobilising policy incentives and finance resources in support of transition activities and investment, drawing on the experience of green finance development in the region. This core coordination panel could be established based on the existing GBA Green Finance Alliance (GBA-GFA).

2. Facilitate interoperability of the Chinese mainland, international and/or Hong Kong transition finance taxonomies and information disclosure. To reduce transaction costs, improve market transparency and avoid transition washing in the region, it is necessary to promote interoperability of the transition taxonomies currently being developed on the Chinese mainland with international and Hong Kong standards whenever these taxonomies become available¹. It is also essential to find consensus on mandatory information disclosure for transition activities among different regulators, promote mandatory information disclosure such as that advocated by the Task Force on Climate-Related Financial Disclosures, and facilitate market readiness for adopting international

climate disclosure standards like those of the International Sustainability Standards Board in the region which will be served as a pioneer for China nationwide.

3. Encourage the GBA's financial institutions and enterprises to set net-zero targets. Setting net-zero targets is key to supporting businesses, including leading financial institutions and enterprises, to develop a credible technical roadmap and investment or financing plan for decarbonisation, with independent assessment for this progress. Existing green finance associations in the region, like GBA-GFA, Hong Kong GFA, and the Guangdong Green Finance Committee, can encourage financial institutions and enterprises to set net-zero targets, based on decarbonisation pathways from this study or other initiatives, such the Science Based Target initiative (SBTi) and the Hong Kong Exchange's *Practical Net-Zero Guide for Business*. The net-zero targets should be ambitious enough to achieve net-zero well before 2060. Some international banks that have joined SBTi, like Standard Chartered Bank, can play leading roles in target-setting, disclosure and engagement with corporate clients.

4. Develop a transition-related financial toolbox to scale up finance and accelerate the GBA's economy-wide transition. The huge investment demand for the GBA's decarbonisation, \$1.84 trillion, offers an enormous opportunity for financial institutions to mobilise private capital and scale up financial flows to transition activities and investments identified in the region and nationwide.

- **Debt:** Establish the GBA grant scheme to scale up the existing sustainability-linked and use-of-proceeds transition bonds in the identified sectors of manufacturing, buildings and transport. The scheme should adopt both policy supports on the Chinese mainland (e.g., subsidies for bond issuance and discount interest on green credit) and the Hong Kong Monetary Authority (HKMA) Green and Sustainable (GSF) grant scheme. In addition, carbon-related products can be innovated to link with carbon assets, such as Chinese Emissions Allowances (CEAs), China-Certified

Emissions Reductions (CCERs) and carbon credits recognised in the international market. The carbon-related products are embedded carbon assets in the structure of SLLs and other carbon-trading products. They support energy-intensive enterprises in developing transition targets and technical roadmaps which follow the requirements of the Sustainability-Linked Loan Principles issued by the Asia-Pacific Loan Market Association, as well as those of China or GBA regional transition finance taxonomies.

- **Equity:** Consider setting up a tax concession private equity fund to invest in companies that are adopting new low-carbon technologies, upgrading high-carbon industries by using digital technologies or incubating innovative small and medium-sized enterprises in the key sectors; and utilise potential revenue from carbon allowance auctions to establish the industrial low-carbon fund, in collaboration with local governments for decarbonisation technology investment and projects in the GBA.
- **Insurance:** Innovate insurance products, such as green building insurance, mandatory liability insurance for environmental pollution, carbon-reduction loss insurance, carbon asset-related insurance and new low-carbon equipment insurance, to insure energy performance during the financing tenor.

5. Develop industry-specific financial solutions for the key sectors in the GBA.

- **Manufacturing:** For the key energy-intensive industries identified by Chinese regulators, such as steel, petrochemicals, cement, ceramics and papermaking, financial institutions can partner with multinational corporations (MNCs) in those sectors to scale up sustainable supply chain finance (SSCF) along the value chain. Leveraging SSCF can assign value to MNCs' supply chain sustainability and provide tangible incentives to suppliers and their buyers.
- **Buildings:** Leveraging tools for financing decarbonisation to scale up green retrofitting via sustainability-linked loans, implement an effective energy performance contracting business model for green retrofitting, adopt



a green insurance mechanism in the GBA to address term mismatch, expand recognition of international green building certifications (such as the Financial Corporation Excellence in Design for Greater Efficiencies [EDGE] certificate) to attract international funding and conduct operational assessment and disclosure of energy data.

- **Transport:** Through policy incentives for new energy-based freight fleet, electric and hydrogen fuel cell vehicles, mobilise private capital for construction in the region of new-energy vehicle infrastructure, such as charging piles and hydrogen refuelling stations. Encourage local governments to issue sustainable municipal bonds to invest in railways and leverage SLL and transition financing for shipping financing (beyond International Maritime Organization and dual-fuelled vessels).

6. Use local and regional carbon markets to accelerate the GBA's transition. The national carbon market, which is expected to expand the covered sectors and reboot the transaction of CCERs, presents an opportunity to connect with the Chinese mainland CCER market, the Hong Kong 'Core Climate' and international voluntary carbon markets linking capital with climate-related products worldwide. The existing Guangdong and Shenzhen carbon emissions trading systems can also help accelerate the GBA's transition by pioneering expansion of the scope of regional carbon markets to include the covered sectors not included in the national carbon market: ceramics, textiles, data centres, buildings and transport. The possibility could also be explored of establishing a GBA regional carbon market linking to the Hong Kong market to pilot financial tools and derivatives.

ENDNOTES

1. For a discussion of “transition washing,” see Quinson (2021).

PHOTO CREDITS

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Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth’s resources at rates that are not sustainable, endangering economies and people’s lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

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We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

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世界资源研究所
WORLD RESOURCES INSTITUTE

WRI CHINA
RM K-M, 7/F, TOWER A, THE EAST GATE PLAZA,
#9 DONGZHONG STREET, BEIJING, CHINA, 100027
PHONE: 86 10 6416 5697
FAX:86 10 6416 7567
WWW.WRI.ORG.CN