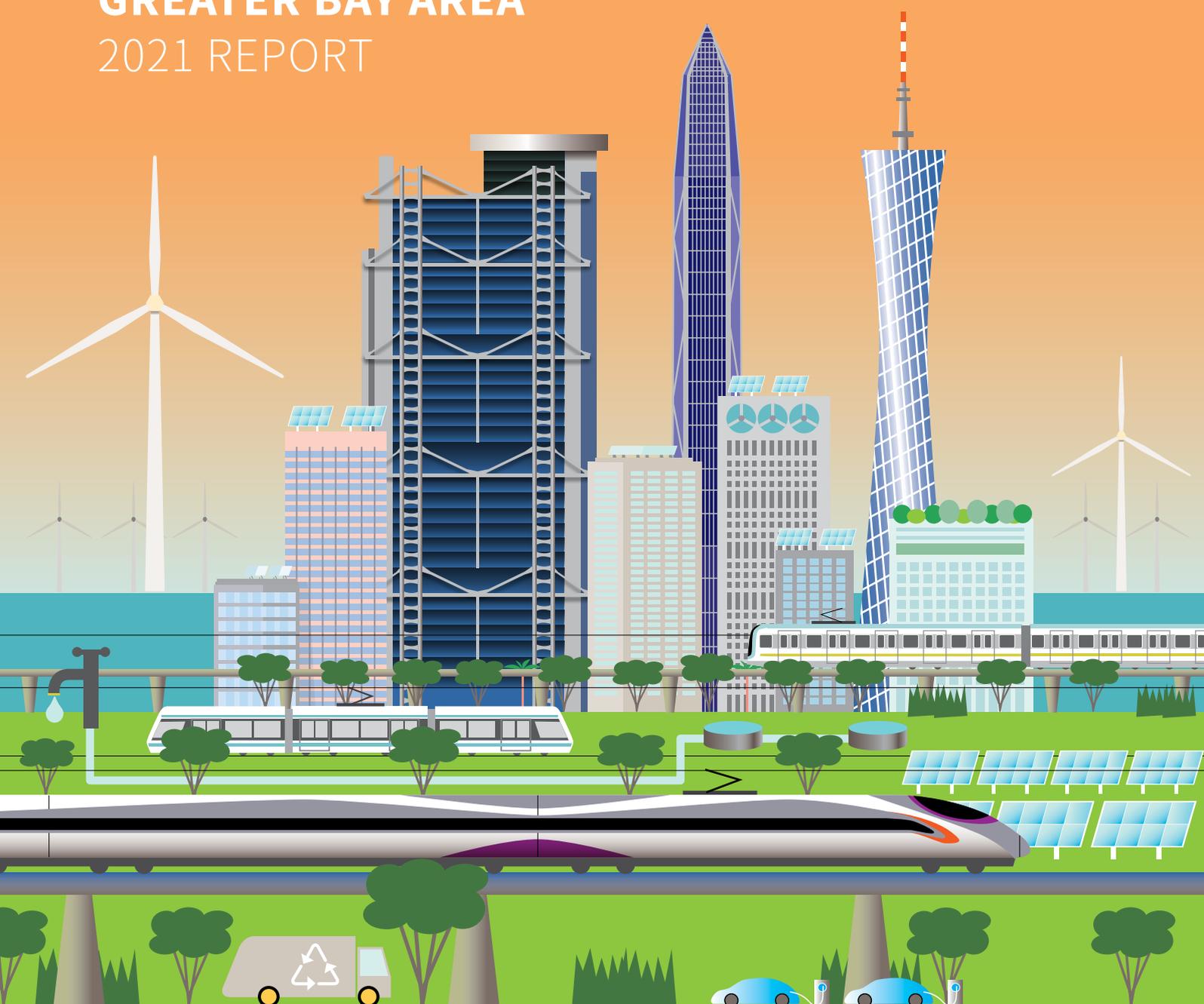




Green Infrastructure Investment Opportunities

THE GUANGDONG-HONG KONG-MACAO
GREATER BAY AREA

2021 REPORT



Executive summary

In the Guangdong-Hong Kong-Macao Greater Bay Area (the GBA), which consists of nine cities in Guangdong Province and two special administrative regions, i.e., Hong Kong and Macao, the effects of climate change and the risks associated with a greater than 2°C rise global temperatures by the end of the century are significant due to its high exposure to natural hazards and vast coastlines.

Investment in low carbon solutions will be essential for mitigating climate risk and meeting global emission reduction pathways under the Paris Climate Change Agreement. The Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area (the GBA Outline Plan) issued by China's State Council also emphasises green development and ecological conservation. Given climate volatility as a result of global warming is already happening in the GBA as well as the Chinese government's reinforced commitment to achieving climate targets, all new infrastructure should support climate mitigation goals and be resilient.

Green infrastructure: an opportunity for growth

The GBA governments aims to develop billions of dollars of new public works projects. There are already green infrastructure projects and assets of many different sizes and technologies undertaken across the GBA:



Renewable energy

- Guangdong planned to build 5.54GW wind capacity and 5.15GW capacity, and allocated USD16.87bn investment in renewable energy during 13th FYP.
- About 30GW capacity of offshore wind power with over USD69bn investment were planned by the end of 2030 in Guangdong.
- Hong Kong aims to increase the non-fossil fuels electricity generation to 25% for the medium term.
- China Southern Power Grid Corporation has committed that the proportion of installed clean energy in the GBA will reach 80% by 2035.



Overall infrastructure

- The major infrastructure projects in the 14th Five-Year-Plan (FYP) of Guangdong Province are expected to have a total investment of RMB5tn (USD776.9bn), of which green infrastructure investment is not less than RMB1.9tn (USD299bn), including rail transit, wind power, modern water conservancy, ecological civilization construction and new infrastructure construction.
- Hong Kong states that the government will spend USD12.9bn every year in infrastructure for the next five years.
- Macao government has initiated over 410 public construction projects, each worth USD125,313 or more in 2020, with a total value of USD1.7bn.



Sustainable water management

- USD38.5bn investment was planned in flood control, water supply, rural water conservancy and smart water conservancy during the 14th FYP.
- The Guangdong-Hong Kong-Macao Greater Bay Area Water Safety Guarantee Plan was issued in Jan 2021.



Green Buildings

- Guangdong has added more than 500 million m² of green building, the building energy saving has accumulated 8.58 million tons of standard coal energy saving capacity, and urban green buildings accounted for 62% of new buildings during 13th FYP.
- Hong Kong issued the Energy Saving Plan for Hong Kong 2015–2025+.
- The Guangdong Province Green Building Regulations issued in November 2020 is the first local regulation on green buildings.



Low carbon transport

- A total investment of USD135bn was planned in rail transit during 14th FYP.
- A total mileage of about 775 km are planned in the GBA, the total investment is about USD72.7bn.
- Hong Kong plans to spend around USD3.23bn for four new infrastructure projects which include a railway line.



Sustainable waste management

- In the Pearl River Delta region, USD4.35bn was invested in the construction of waste treatment facilities for urban and rural domestic waste during 13th FYP.
- Hong Kong set targets to reduce municipal solid waste (MSW) disposal rate by 40% per capita by 2022, from 1.27kg to 0.8kg per day.
- Macao aims to reduce per capita MSW disposal rate by 30% by 2026 (based on 2016 levels), from 2.11kg to 1.48kg per capita.



New infrastructure

- Guangdong plans to invest USD67.3bn in the construction of new infrastructure projects during the 14th FYP.
- Over 700 projects with a total investment of over USD153bn is set up in Guangdong, and the government estimates that at least USD101.23bn will be invested from 2020 to 2022.
- Guangdong aims to build 200 hydrogen fuelling stations by the end of 2022, and about 250,000 charging piles and 4,500 charging stations by the end of 2025.
- The investment associated with new infrastructure projects is expected to total around USD1.43tn to USD2.51tn for the next five-year period until 2025 in China.

Green finance comes into play in infrastructure financing

In order to attract investors looking for green, there needs to be a visible pipeline of infrastructure investment opportunities that align with internationally accepted definitions of green. A large and visible GBA green infrastructure pipeline could also help investors to understand that there is a sufficiently large pool of financially attractive investments that are also green. To this end, this report provides a sample pipeline that includes a list of 'green' and 'potentially green' projects (70 in total) taken from various publicly available sources, using the globally recognised Climate Bonds Taxonomy and Sector Criteria to determine the green eligibility of projects.

Currently, much of the investment in infrastructure in the GBA is being carried out through public funding and Public Private Partnerships (PPP) ventures. However, public funding is not sufficient to meet the growing demand for green infrastructure; new channels will be necessary to mobilise private capital.

That said, green debt instruments, such as green bonds, green asset-backed securities, and green loans, have been increasingly deployed to raise funds for infrastructure projects in the GBA. As China works towards achieving carbon neutrality target, with a raft policy measures in growing green finance market from governments on both national and local levels, the potential of green debt instruments as an infrastructure refinancing tool will be further unleashed.

Six recommendations for growing green infrastructure investment opportunities

To unlock the immense green infrastructure investment opportunities in the GBA, this report provides the following six recommendations:

1. Promote green securitisation: Guangdong Province is the second largest Green ABS-issuing province in China and has experience on issuance of low-carbon transport ABS. To attract investors to GBA's green ABS market, the market has to provide more reliable data on credit quality, defaults, recoveries and etc., besides, the discrepancies between China's local green definitions and the international ones need to be further bridged.

2. Promote the issuance of local government green bonds: Establishing green municipal finance for local governments to aggregate debt requirements and access lower cost of capital, which requires the collaborative efforts of finance, environmental and other departments of local governments in the Guangdong Province in identifying green infrastructure project pipeline and assessing associated funding needs.

Potential green municipal bonds in the Guangdong Province, will improve GBA's strategies on climate change, including decomposing China's Nationally Determined Contribution (NDC) to the local level, development of regional decarbonisation strategies and promoting the GBA to peak carbon emissions early.

3. Leverage Hong Kong's capital market to support infrastructure development in the GBA: Encouraging green infrastructure project owners to tap the capital market in Hong Kong with green debt instruments would help meet the growing demand of global institutional investors for onshore green assets, and at the same time improve the alignment of those issuance with international definitions such as Green Bond Principles and Climate Bonds Standard. Government incentives and GBA-wide capacity building for issuers are key to accelerate offshore green debt issuance.

4. Harmonisation of green definitions for various sectors: The GBA brings together two Special Administrative Regions: Hong Kong and Macao with nine cities in Guangdong, connecting onshore and offshore capital markets and having three legal systems present a great challenge as well as excellent opportunity for the GBA in developing a harmonised green definition and facilitate cross-border green investments into the region, especially in green buildings sector where multiple standards and rating systems are implemented.

5. Improve project visibility: Improving visibility for green infrastructure pipeline in the GBA will make it easier to attract investors interested in looking for green. An opportunity exists to develop an online database of green infrastructure projects, listed by sector and tagged as planned, under preparation or ready to offer.

6. Pave the way to green recovery with green infrastructure: In the post-COVID era, while countries around the world implement measures to reduce and recover from the economic impacts of the global pandemic, they also need to address the existential threat posed by climate change. The GBA governments are playing an important role on these agendas. Integration of sustainability and resilience into infrastructure projects in the GBA will be conducive to raising funds via green debt instruments.

About this report

This report highlights green infrastructure investment opportunities in the Guangdong-Hong Kong-Macao Greater Bay Area.

This report has been prepared to help meet the growing demand for green investment opportunities in the Greater Bay Area and to support the transition to a low carbon economy on both regional and national levels.

It aims to facilitate greater engagement on this topic between project owners, developers, and institutional investors. Green infrastructure and corresponding green finance instruments are explored in the report, with sector-by-sector investment options presented.

The report is intended for a wide range of stakeholders, including domestic investors, offshore pension funds and asset managers, potential issuers, infrastructure owners and developers, as well as relevant government ministries.

In developing this report, the Climate Bonds Initiative consulted with key Government bodies, industry, the financial sector, peak bodies, NGOs and think tanks. We would like to thank these partners along with the other organisations that contributed to the report.

Green Infrastructure Investment Opportunities (GIIO) Report Series

Green infrastructure presents a huge investment opportunity globally, with an estimated USD100tn worth of climate compatible infrastructure required between now and 2030, in order to meet Paris Agreement emissions reduction targets. However, there remains limited identifiable, investment-ready and bankable projects, particularly in emerging markets. There is also a lack of understanding of what types of assets and projects qualify for green financing.

In response to this challenge, CBI is developing a series of reports that aim to identify and demonstrate green infrastructure investment opportunities around the world. By so doing, it aims to raise awareness of what is green and where to invest, as well as to promote green bond issuance as a tool to finance green infrastructure.

The report series commenced with the GIIO Indonesia report, launched in May 2018 and now includes Australia & New Zealand, Brazil, Malaysia, Philippines and Vietnam reports. The pipeline of GIIO reports being developed includes further exploration of opportunities in Asia-Pacific as well as opportunities in Latin America.



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Exchange Rate January 1, 2021

1 USD = 6.52 RMB

1 USD = 7.75 HKD

1 USD = 7.98 MOP

Climate Bonds Initiative

The Climate Bonds Initiative is an international investor-focused not-for-profit organisation working to mobilise the USD100tn bond market for climate change solutions.

It promotes investment in projects and assets needed for a rapid transition to a low carbon and climate resilient economy. The mission

is to help drive down the cost of capital for large-scale climate and infrastructure projects and to support governments seeking increased access to capital markets to meet climate and greenhouse gas (GHG) emission reduction goals.

CBI carries out market analysis, policy research, market development; advises governments and

regulators; and administers a global green bond standard and certification scheme. CBI screens green finance instruments against its Climate Bonds Taxonomy to determine alignment and uses sector specific criteria for certification.

A simplified version of the Climate Bonds Taxonomy is on the back cover.

Green infrastructure: an opportunity for growth

In the Guangdong-Hong Kong-Macao Greater Bay Area (the GBA), the effects of climate change and the risks associated with a greater than 2°C rise in global temperatures by the end of the century are significant due to its vast coastlines and high exposure to natural disasters. Studies also suggest the region faces the highest flood risks in the world.¹

Investment in low carbon solutions will be essential for mitigating climate risk and meeting global emission reduction pathways under the Paris Climate Change Agreement. The Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area (hereon referred to as the GBA Outline Plan) issued by China's State Council also emphasises green development and ecological conservation.

Currently, much of the investment in infrastructure in the GBA is being carried out through public funding and PPP. However, public funding is not sufficient to meet the growing demand for green infrastructure; new channels will be necessary to mobilise private capital.

Adaptive and resilient infrastructure provision is also important, and it should become a core

part of the regional response to the climate emergency. Delayed action in transitioning to a low carbon economy increases the cost of change as well as the volatility and structural risks to the finance sector and underlying asset values. In this environment, major stakeholders in banking, finance and superannuation have a responsibility to act quickly.

Globally, there is significant demand for green investments. Green debt instruments, including green bonds and green loans — with proceeds used for climate-compatible and environmentally sustainable projects—provide useful tools for private investors looking to invest in green assets and projects. The first ever green bond from a GBA entity was issued in 2016 by Link REIT, a real estate investment trust in Hong Kong.

As of 31 December 2020, green bond issuance from the GBA entities amounted to USD16.9bn and the market is growing.

In order to attract investors looking for green, there needs to be a visible pipeline of infrastructure investment opportunities that align with internationally accepted definitions of green. A large and visible GBA green infrastructure

pipeline could also help investors to understand that there is a sufficiently large pool of financially attractive investments that are also green. In other words, there are viable alternatives to non-green assets and projects, and investors can make their preferences for green heard, which will in turn spur the creation of a larger pool of green investments.

There is often limited awareness and appreciation of what qualifies as 'green investment' beyond solar and wind energy. This knowledge gap has been holding governments back from developing pipelines of commercially viable, green infrastructure investment opportunities that would otherwise play a vital role in supporting the region's transition to a low-carbon economy.

Improving the general investment environment as well as promoting more green finance will help to fund the infrastructure necessary to meet climate targets. This means continuing to open up to investors looking for green and ensuring there is a pipeline of bankable, investment ready projects. These measures will ensure that the GBA is on the path to transitioning to a low-carbon economy and becoming more resilient to the impact of climate change and other global shocks.

Region Facts

Interest rate (cash rate):
3.85% (China) (as of June 2021),²
0.86% (Hong Kong) (as of April 2021),³
0.5% (Macao) (as of April 2021)⁴

Inflation rate:
1.3% (China) (as of May 2021),⁵
0.7% (Hong Kong) (as of April 2021),⁶
-0.64% (Macao) (as of April 2021)⁷

Government 10Y, M:
3.17% (China) (as of June 2021),⁸
1.146% (Hong Kong) (as of June 2021),⁹
N/A (Macao)

Balance of trade:
USD203.76bn (Pearl River Delta) (2019),¹⁰
USD-3.23bn (HKD -25.228bn) (Hong Kong) (as of Jan 2021),¹¹
USD-1.16bn (MOP -9.267bn) (Macao) (as of Jan 2021)¹²

Government debt to GDP:
52.63%(China) (2019),¹³
0.27% (Hong Kong) (2019),¹⁴
N/A (Macao)

Moody's rating:
A1(China) (as of 09/14/2020),¹⁵
Aa3(Hong Kong) (as of 01/20/2020),¹⁶
Aa3 (Macao) (stable)¹⁷



Source: Guangdong Statistical Yearbook 2020. Note: Statistics are as of 2019.

Snapshot: Macroeconomic outlook

Green finance presents an opportunity in improving macroeconomic conditions.

China staged an impressive recovery in 2020 – exhibiting a 2.3% GDP growth, despite prolonged lockdowns and a nationwide economic lull in Q1.¹⁸

As an economic powerhouse, GDP of the Guangdong Province surpassed RMB11tn (USD1.7tn) in 2020 for the first time¹⁹, ranking number 1 for 32 consecutive years among all Chinese provinces in terms of economic output. It reported a 6% increase in GDP in 2020, just slightly lower than the 6.3% recorded in 2019, the provincial economy remained intact amid the COVID-19 pandemic.²⁰

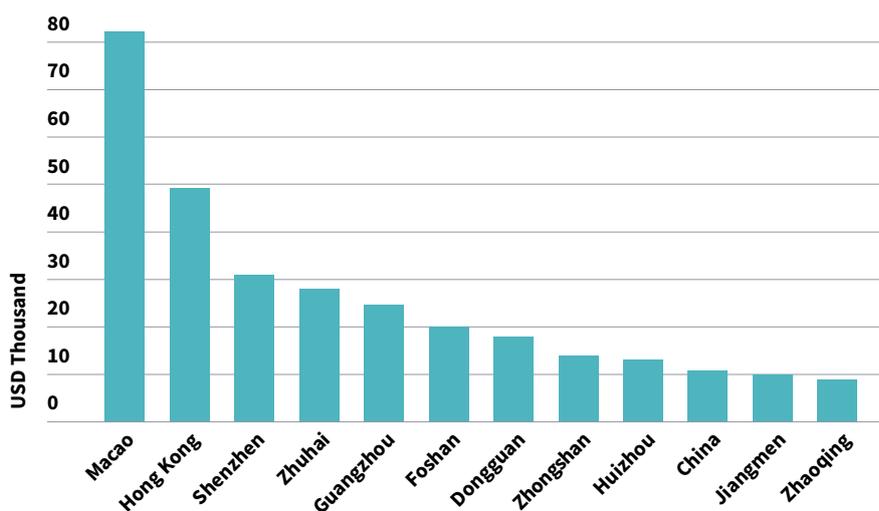
Guangdong has implemented effective measures to control the COVID-19 pandemic resulting in a strong economic recovery since the second half of 2020.²¹

Hong Kong and Macao were less immune to the impact of the COVID-19 pandemic with both cities experiencing an economic downturn last year. The Hong Kong economy contracted by 6.1% in 2020, the sharpest annual decline on record²² while Macao's GDP shrunk by almost 50%,²³ nearly destroying the economy.²⁴

According to the government, Hong Kong's economy is expected to grow by 3.5% to 5.5% in 2021 but with the high uncertainty associated with the pandemic.²⁵ Macao's economy is expected to continue to struggle in 2021, as the global tourism and the local casino sector were hit hard by COVID-19. Macao's economy is not expected to return to its pre-pandemic size before 2022.²⁶

Before the coronavirus outbreak, among the eleven regions in the GBA, the GDP per capita of nine regions exceeded the national average in 2019.

GDP per capita in the GBA in 2019



Source: Wind.

The industrial structure of the GBA has reflected the extent of decentralisation and diversification. While the tertiary industry in Hong Kong, Guangzhou, Macao and Shenzhen has been the main driving force for their economic development, the growth in the secondary industry in other regions of the GBA makes a greater contribution to the GDP.

The proportion of primary, secondary and tertiary industries in Guangdong Province stands at 4.3: 39.2: 56.5 in 2020. The added value of advanced manufacturing and high-tech manufacturing accounted for 56.1% and 31.1% of the above-scale industries, respectively, and the added value of modern service industry accounted for 64.7% of the service industry. The pace of industrial transformation and upgrading has accelerated. At present, Guangdong Province has formed seven trillion-level industrial clusters, including electronic information, green

petrochemicals, smart home appliances, and advanced materials.²⁷

As the economy is put under pressure during the COVID-19 pandemic, infrastructure is necessary for a return to economic growth. And green infrastructure is critical to achieving this. Green infrastructure has positive environmental and economic benefits. It can create prosperity by increasing competitiveness, productivity and employment opportunities; extending the reach, reliability and efficiency of the national electricity grid, without creating air pollution; broadening the economic base; creating new markets; and providing inclusion and connectivity across the GBA.

Therefore, **ensuring infrastructure is green would help to enhance the region's resilience to future shocks and help to build a more sustainable society.**

The GBA Outline Plan

The GBA is a key strategic component of China's national development blueprint. It aims to promote in-depth cooperation among nine cities in Guangdong Province and the Special Administrative Regions of Hong Kong and Macao, with the aim of developing a world-class city cluster by way of reforms, innovation and opening up.

On 18 February, 2019, China's central government authorities issued the Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area, marking the official start of the implementation of the GBA national strategy. The GBA Outline Plan not only makes clear the role and position of each city, it also sets mid-term and long-term development targets, guiding the current and future development and cooperation of the GBA.

One of the six basic principles of the plan is 'to pursue green development and ecological conservation'. It also outlines seven areas of development which include 'taking forward ecological conservation' and 'developing an international innovation and technology hub'.

As for the roles of the GBA cities, Guangzhou, Shenzhen, Hong Kong and Macao are named as the four 'core cities', with specific development areas identified for each:

Guangzhou will serve as an international business and trade centre and integrated transportation hub, as well as an important centre to cultivate science and technology education.

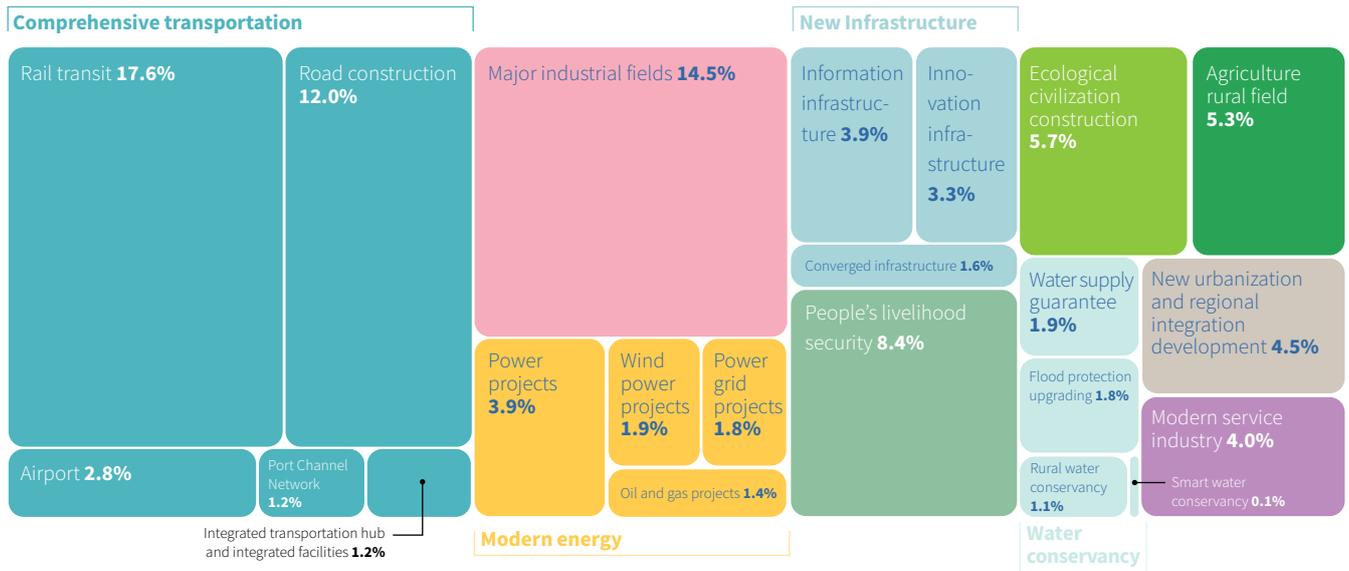
Shenzhen, as a special economic zone, a national economic core city and a national innovation city, will accelerate its internationalisation and urban modernisation and continue its role as a major innovation hub for the region.

Hong Kong, as a leading global city for finance, transportation and logistics, will continue to strengthen its position as a global offshore RMB business hub and international asset management and risk management centre. Other goals include promoting the development of high-end industries, strengthening innovation and technology, nurturing emerging industries and increasing global competitiveness.

Macao's responsibilities as part of the GBA include promoting business cooperation with Portuguese-speaking countries and promoting its example of a multicultural Chinese city.

The four core cities will drive Zhuhai, Foshan, Huizhou, Dongguan, Zhongshan, Jiangmen and Zhaoqing to best utilise the strengths of each city and foster coordination and development within the city group.

Investment by sector in Guangdong Province during the 14th FYP



Snapshot: Infrastructure spending

Infrastructure pipelines have been growing, with more opportunities emerging for outside investment.

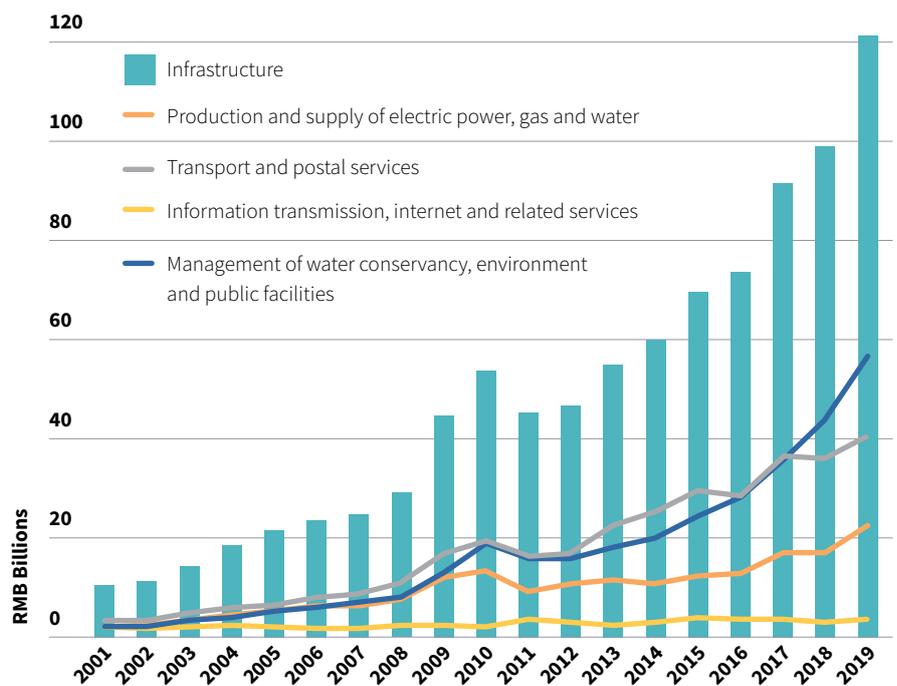
Infrastructure planning and spending in the GBA is ambitious. The GBA Outline Plan has a strong emphasis on infrastructure, including transportation, information technology and water infrastructure. It calls for closer integration in both physical infrastructure, such as bridges, highways and railways, and institutional infrastructure, such as information systems.

In July 2020, the National Development and Reform Commission (NDRC) approved the Guangdong-Hong Kong-Macao Greater Bay Area Intercity Railway Construction Plan. 13 intercity railways and five hub projects are planned, with a total mileage of about 775 kilometres. The total investment in recent construction projects is about RMB474.1bn (USD72.7bn).

The major infrastructure projects in the 14th FYP of Guangdong Province are expected to have a total investment of RMB5tn (USD776.9bn), of which green infrastructure investment is not less than RMB1.9tn (USD299bn), including rail transit, wind power, modern water conservancy, ecological civilization construction and new infrastructure construction.

In Hong Kong, the Chief Executive's 2020 Policy Address states that the government will spend HKD100bn (USD12.9bn) a year on infrastructure for the next five years.²⁸ The Macao government has initiated over 410 public construction projects, each worth MOP100,000 (USD125,313) or more in 2020, with a total value of MOP14.2bn (USD1.7bn).²⁹ The Macao Urban Development Master Plan (2020–2040) is under public consultation and will be issued in 2021.

Infrastructure investment in Guangdong Province



Source: Guangdong Statistical Yearbook 2020.

New infrastructure has recently become a top development priority for the GBA, and refers to infrastructure that is 'digital, smart, and innovative'. In October 2020, Guangdong Provincial Government issued the 'Three-Year Implementation Plan for Promoting the Construction of New Infrastructure in Guangdong Province (2020–2022)', proposing to build high-quality 5G networks, artificial intelligence, blockchain and other new technology infrastructure clusters, and promote ten smart projects such as smart energy, smart transportation, and smart cities.³⁰ A preliminary pipeline of more than 700 projects with a total investment of over RMB1tn (USD153bn) is set up.

Guangdong Province's government estimates that at least RMB660bn (USD101.23bn) will be invested during 2020–2022.³¹

China Development Bank (CDB) formulated the 'Action Plan for China Development Bank to Support the Construction of the Guangdong-Hong Kong-Macao Greater Bay Area (2019–2022)', asserting that from 2019–2022, CDB will provide a total of RMB1tn (USD153bn) in financing to the GBA.³²

Before COVID-19, the infrastructure investment in Guangdong Province had already seen a rapid growth. The overall infrastructure investment growth rate in 2019 was 22.3%³³ higher than in 2018.

Snapshot: Climate change risks and mitigation measures in the GBA

Climate change has already had significant adverse impacts on the GBA, including rising temperatures and sea levels, increased rainfall and floods, and other extreme weather events.

The GBA, surrounded by mountains on three sides and facing the sea to the south, has a subtropical monsoon climate. The eleven GBA cities are located at the confluence of three major rivers, Dongjiang, Xijiang and Beijiang and the numerous canals that transverse them. They also sit in a floodplain that is only about 2 meters above sea level which renders the GBA susceptible to regular diurnal tides as the average peak tidal level is about 2.02 meters. Thus, the potential of fluvial, pluvial and coastal flooding and landslides also render the GBA vulnerable.³⁴

According to climate-related studies, there are six climate change trends in the GBA³⁵:

- Summer high temperatures and heat waves will intensify;
- Fewer rainy days but average rainfall intensity will increase;
- More extreme rainfall events;
- More extremely wet years but the risk of extremely dry years will remain;
- Global sea level rise will lead to coastal changes all over the world, including Hong Kong;
- Threat of storm surges associated with tropical cyclones will rise, and the intensity of landfall typhoons will increase.

Climate change has already brought serious loss in the GBA. In 2019, various meteorological disasters caused a total direct economic loss

of about RMB430m (USD65.95m), and the death of 16 people.³⁶

Climate change and environmental degradation are also sources of structural change that affect economic activities and, in turn, the financial system. There are two types of risks that climate change poses to the economic and financial systems, namely physical risk and transition risk. These risks may lead to economic consequences including business disruptions, costs of improving resilience and adaptation, lower productivity and the shift to an economy with low-carbon emissions, which then in turn may cause financial fallout, such as potential financial market and credit losses, equity and bond price declines, carbon asset write-downs and falling property values.³⁷

For the GBA, sectors including aviation, domestic transportation, real estate, agriculture and finance are vulnerable to climate and environmental-related risks.

China's 2060 carbon neutrality target and decarbonization pathway

Global climate change caused by the emission of carbon dioxide and other greenhouse gases has become one of the greatest challenges facing mankind in this century. Under the framework of the Paris Agreement, achieving carbon neutrality by the middle of this century is the fundamental measure for the global response to climate change. In the Paris Agreement, China has committed to reducing its carbon intensity of GDP by 60% - 65% from 2005 levels by 2030 and peak CO₂ emissions by 2030 at the latest.

In a ground-breaking speech at the UN General Assembly in September 2020, Chinese President Xi Jinping stated that the country will scale up its Nationally Determined Contributions (NDCs) by adopting more vigorous policies and measures, and the government aims to

'have CO₂ emissions peak before 2030 and achieve carbon neutrality before 2060.'³⁸ This statement is expected to provide additional impetus for Chinese government agencies, municipalities, and industry sectors to set up decarbonisation targets.

Shortly after making the Carbon Neutrality 2060 pledge, China's President announced the country's further commitment at the Climate Ambition Summit on 12 December 2020 that by 2030 China will:

- lower its carbon dioxide emissions per unit of GDP by over 65% from the 2005 level,
- increase the share of non-fossil fuels in primary energy consumption to around 25%,
- increase the forest stock volume by 6bn m³ from the 2005 level, and
- bring its total installed capacity of wind and solar power to over 1.2bn kilowatts.³⁹

In March 2021, the Chinese government released the 14th Five-Year Plan (FYP) (2021–2025), which sets a 18% reduction target for CO₂ intensity and 13.5% reduction target for energy intensity. As for climate change, the 14th FYP outline reaffirms the implementation of the NDC for 2030 (without listing specific new targets). It also demands that the nation to formulate an action plan towards peaking CO₂ emission before 2030 as soon as possible.⁴⁰

To achieve Carbon Neutrality, the principal emitting sectors will need to reduce their emissions by between 65% and 105% by 2050.⁴¹ And there are various studies about the decarbonisation pathway based on different scenario and models. The general measures and investment needs for each sector are

According to Chinese Academy of Environmental Planning's estimate, there will be RMB9.3tn (USD1.4tn) and RMB 11.5tn (USD1.76tn) investment needed respectively during the 14th FYP and 15th FYP periods for 2030 carbon emission peak.⁴² China International Capital Corporation Limited (CICC) has estimated that China requires approximately RMB139tn (USD21.32tn) in green investment by 2060 of which about RMB22tn (USD3.37tn) is needed up to 2030. China's every year green investment demand accounts for about 2% of its total GDP.⁴³

The massive investment demand for carbon neutrality cannot solely rely on government funding. Therefore, the green financial system that aims to mobilise private capital to carry out green investments will play a key role in the process of achieving carbon neutrality.

Sector	Key development areas
Power generation	<ul style="list-style-type: none"> • Renewable energy • Energy storage • Carbon capture and storage
Transportation	<ul style="list-style-type: none"> • Electrification and hydrogen run rail and metro • Electricity vehicles for Individuals • Sustainable fuel for aviation and shipping
Industry	<ul style="list-style-type: none"> • Power generation/heat generation decarbonisation • Energy efficiency • Technology innovation
Buildings	<ul style="list-style-type: none"> • Energy efficiency • Heating decarbonisation
Agriculture	<ul style="list-style-type: none"> • Biogas project • Waste management • Afforestation and reforestation

Green finance trends and opportunities in the GBA

Global demand for green is growing

There is a strong green finance momentum globally and significant further growth potential.

Green-labelled products have become globally recognised as an effective means of directing investment capital towards climate change mitigation and climate change resilience and adaptation projects, including green infrastructure. The growing level of interest from investors in green projects has resulted in the development and growth of innovative financial products including green, social, ESG and sustainability bonds and loans; and green index products.

Green bonds are currently the most developed segment of thematic instruments, carrying greater recognition from the investor base. Globally, the volume of green bond and loan issuance has risen sharply from USD171bn in 2018 to USD269.5bn in 2020, buoyed by strong interest from both investors and issuers. Cumulative issuance of green bonds to date has now reached USD1tn, but there is still a long way to go. To finance the goals of the Paris Agreement, it is estimated that green bond issuance needs to reach USD1tn per annum by the early 2020s. For emerging markets in particular, there is a large gap between green infrastructure requirements and the size of green bond markets.

China's quarterly green bond issuance (2016-2020)



Source: Climate Bonds Initiative

Green finance trend and policy in China

Following the growth of green credit lending fostered by the ground-breaking Green Credit Guidelines issued by the former China Banking Regulatory Commission (CBRC) in 2012, China's green bond market has seen the greatest amount of policy and activities since 'green finance' took off in China in 2015. Supported by various directives, China's green bond market grew from almost zero to the second largest in the world in just a few years.

Green bond policy is a key driver of this growth. In December 2015, the Green Bond Endorsed Project Catalogue was issued by the People's Bank of China (PBoC),⁴⁴ which clarified the eligibility criteria for green projects, management of proceeds, and reporting requirements. Green bonds issued by financial entities are subject to this catalogue, and the green projects were classified into six themes: energy saving; pollution prevention and control; resource conservation and recycling; clean transportation; clean energy; and ecological protection and climate change adaptation.

Timeline of China's key green bond policies

2015

NDRC

Guidelines on Issuing Green Bonds

Kickstarted green bond market in China

PBoC

Notice of the People's Bank of China on Green Financial Bonds (PBoC Document No.39 [2015])

Kickstarted green bond market in China

2016

Seven Ministries including the Central Bank

Guidelines for Establishing the Green Financial System

Indicated the direction of further development of the green bond market

Shanghai Stock Exchange

Notice on Launching the Pilot Program of Green Corporate Bonds

Accelerated the development of the corporate bonds⁴⁵

2017

CSRC

Guiding Opinions of the China Securities Regulatory Commission on Supporting the Development of Green Bonds

Encouraged the issuance of corporate bonds

National Association of Financial Market Institutional Investors

Guidelines on Green Note of Non-Financial Enterprises

Green bond policy guidelines are available for all bond markets in China

PBoC and CSRC

Guidelines on the Evaluation and Certification of Green Bonds (Interim)⁴⁷

Regulated evaluation and Certification of green bonds

Shenzhen Stock Exchange

Notice on Launching the Pilot Program of Green Corporate Bonds

Accelerated the development of the corporate bonds⁴⁶

2020

PBoC, NDRC, CSRC

Green Bond Endorsed Project Catalogue (2020 Edition) (Consultation Version)

Harmonized different standards of green bonds, and promoted the integration of the domestic green bond market

2021

NAFMII

Notice on Clarifying Relevant Mechanisms of Carbon Neutrality Bond

Ensure that the funds raised by carbon neutrality bonds should only be used for green projects

PBoC, NDRC, CSRC

Green Bond Endorsed Project Catalogue (2021 Edition)

Excludes coal and other fossil fuels from the list of eligible projects, and incorporates DNSH principle

On 21 April 2021, PBoC, NDRC, and China Securities Regulatory Commission (CSRC) jointly released the official version of the Green Bond Endorsed Project Catalogue (2021 Edition). The joint release unifies the green bond guidelines in China which will become the main rulebook to follow in the future. It also excludes controversial categories such as 'Clean Utilisation of Coal' and 'Clean Fuel', narrowing the gap between China onshore green bonds-related guidelines and the expectations from international investors. Compared with the 2020 Edition, it incorporates language around the Do No Significant Harm (DNSH) principle and indicates the future possibilities of rolling out a 'transition finance' standard.

Green finance is growing in the GBA

The GBA Outline plan defines the goal of building a green finance centre in the Greater Bay Area and makes different plans for Hong Kong, Guangzhou, Macao and Shenzhen.

Hong Kong

Green finance centre, and to set up an internationally recognised green bond certification institution.

Guangzhou

Pilot zone for green finance reform and innovation, and to study the establishment of an innovative futures exchange that takes carbon emission as its first trading commodity.

Macao

To develop special financial products and services such as leasing, explore Macao's development taking account of complementarity with nearby regions, and study the feasibility of establishing in Macao a securities market denominated and cleared in RMB, a green finance platform and a Sino-Lusophone countries financial services platform.

Shenzhen

Pilot zone for development in insurance innovation, to further enhance the level of connectivity between Hong Kong and Shenzhen markets and promote cooperation between Macao and Shenzhen with respect to special financial products, launch FinTech pilot projects, and boost the development of FinTech carriers.

Other Municipalities (e.g., Zhuhai)

To leverage their own strengths, and develop financial products with distinct characteristics.

Timeline of key green finance policies in the GBA

June, 2017

Overall Plan for Building a Green Finance Reform and Innovation Pilot Zone in Guangzhou City, Guangdong Province

The pilot zone will be the first to carry out green finance reform and innovation pilot projects in Huadu District, Guangzhou

May, 2020

Opinions on Financial Support for the Guangdong-Hong Kong-Macao Greater Bay Area

26 measures were introduced to further promote financial opening up, innovation, and deepen cooperation

September, 2018

Hong Kong Strategic Framework for Green Finance

Enhance ESG considerations and promoting Hong Kong as an international green finance centre

July, 2020

Implementation Plan for Providing Effective Financial Support for the Guangdong-Hong Kong-Macao Greater Bay Area

Contains 80 detailed, supplementary measures that implement the financial support to the GBA

January, 2019

Guiding Opinions on Building a Green Financial System in Shenzhen

Measures to promote green finance in Shenzhen

November, 2020

Shenzhen Special Economic Zone Green Finance Regulations

China's first law and regulation in the field of green finance

July, 2019

Implementation Opinions on Promoting the Reform, Innovation and Development of Green Finance in Guangzhou

Specific plans and measures to promote the reform, innovation and development of green finance in Guangzhou

There are multiple green finance policies issued in the GBA, to support the development of green finance at the different levels, covering policy framework design, regulatory policies, incentives and restraint mechanisms, etc. The detailed policies are listed in **Annex I**.

Local governments, including Hong Kong, Shenzhen city, Guangzhou city, Guangzhou Development District and Huadu District of Guangzhou also issued their detailed rules and incentives for promoting green finance regarding green credit, green loan, green bonds and green insurance (see **Annex II**). For instance, as for the issuance of green bonds,

- **Hong Kong:** covering bond issuance expenses (e.g. arrangement, legal, audit, listing fees, etc.) for eligible first time green and sustainable

bond issuers, grant up to HKD2.5m or HKD1.25m; and covering transaction-related external review fees, capped at HKD800,000 per bond issuance/loan.

- **Shenzhen,** a subsidy of up to RMB500,000 at 2% of the issuance scale
- **Guangzhou,** a subsidy of up to RMB1m at 10% of the issuance cost (on the exchange market and the inter-bank market); a subsidy of up to RMB1m at 20% of the issuance cost (on the regional equity market);
- **Huadou District:** a subsidy of up to RMB1m at 1% of the bond issuance
- **Guangzhou Development District:** a 10% discount rate of the accumulated interest payment

Growing appetite for green label in the GBA before the COVID-19 pandemic

Internationally aligned green bonds from the GBA-domiciled issuers between 2016 and 2020 amounted to USD16.9bn. Prior to the COVID-19 pandemic, the GBA green bond market grew at a CAGR of 69%, mainly driven by Hong Kong and Guangdong-domiciled issuers. In 2019, PBoC placed through its Macao Branch a green bond worth USD963m, which marked the inaugural issuance in Macao.

In response to the growing emphasis of the GBA development plan from both state and local levels, issuers such as Zhuhai Da Heng Qin Investment, Agricultural Development Bank of China (ADBC) and the Industrial and Commercial Bank of China issued GBA-themed green bonds in 2019, with proceeds dedicated to the green development in the region.

Buildings was the dominant theme of GBA green bonds in 2020, accounting for 41% of the total volume, driven by the green buildings-related issuance in Hong Kong. Transport (21%) and Energy (15%) were the next largest use of proceeds categories of GBA green bonds.

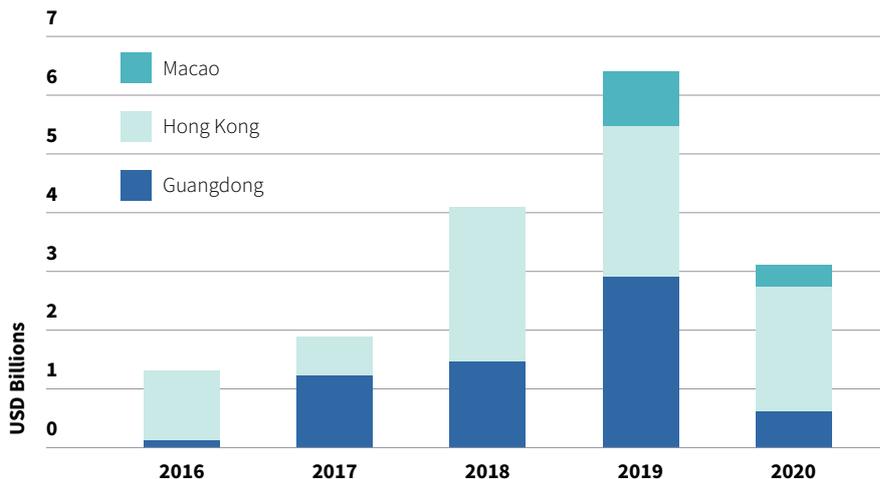
Green asset backed securities (ABS) remains a common issuer type for green bonds in Guangdong. Cumulative issuance has reached USD2.4bn (or accounted for 38%) since 2016. Securitisation – the process through which an issuer creates ABS backed by financial assets such as mortgages or lease receivables – enables companies and lenders to sell off existing financial assets to free up capacity for more business. ABS are sold to investors who receive a return drawn from the cash flows of the underlying assets.

Over the last five years, the majority of the green ABS in the GBA have been transport-related, brought to the market by repeat issuers such as Guangzhou Metro and Shenzhen BYD Company Limited. Other green ABS deals were issued by China Merchants Bank Co. Ltd., Shenzhen Energy Environmental Engineering Co. Ltd., China Resources Leasing Co. Ltd., and Guangzhou Transportation Group.

Financing low-carbon transitions in the GBA

Addressing climate change requires fundamental and rapid transformations across all sectors of the economy, including those with the largest and hardest-to-abate emissions. Such transformations cannot be achieved through incremental improvements to established modes and systems alone. Climate action to date has been neither broad nor deep enough to be responsive to the scale of the challenge faced. The question is no longer why or whether the global economy needs to move swiftly towards

Internationally-aligned green bonds were on the rise before COVID-19



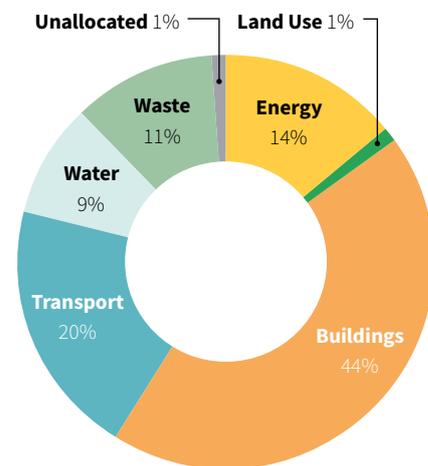
Source: Climate Bonds Initiative

a low-carbon, climate-adapted, sustainable model, but rather how to urgently finance and operationalise the required transition.

As one of China's economic powerhouses and a leading manufacture hub, the GBA is an integral part of the country's overarching national strategy to reach its nationally determined contribution (NDC) and has an instrumental role to play in decarbonising its economy by pushing ahead the low-carbon transition of hard-to-abate sectors, i.e. the brown sectors.

In the Financing Credible Transitions White Paper published in September 2020 by Climate Bonds Initiative, we put forward a robust, flexible and inclusive framework, which helps promote an economy-wide transition. The White Paper emphasises five key principles underpinning an ambitious transition:

Buildings remain GBA's dominant theme in 2020



Source: Climate Bonds Initiative

5 principles for an ambitious transition



1. In line with 1.5 degree trajectory

All goals and pathways need to align with zero carbon by 2050 and nearly halving emissions by 2030.



2. Established by science

All goals and pathways must be led by scientific experts and be harmonised across countries.



3. Offsets don't count

Credible transition goals and pathways don't count offsets, but should count upstream scope 3 emissions.



4. Technological viability trumps economic competitiveness

Pathways must include an assessment of current and expected technologies. Where a viable technology exists, even if relatively expensive, it should be used to determine the decarbonisation pathway for that economic activity.



5. Action not pledges

A credible transition is backed by operating metrics rather than a commitment/pledge to follow a transition pathway at some point in the future. In other words, this is NOT a transition to a transition.

Green infrastructure investment opportunities

The GBA governments aim to develop billions of dollars of new public works projects. Most major infrastructure projects in the GBA are listed on the central government's official web portals or are published by local governments.

There are already green infrastructure projects and assets of many different sizes and technologies undertaken across the GBA. These range from the USD12.8bn railway project through to a USD2.8m distributed photovoltaic power generation project. A list of 70 projects has been compiled into a sample pipeline (see **Annex VI**).

This report uses the globally recognised Climate Bonds Taxonomy and Sector Criteria to determine which projects and assets are green. There are also other existing green standards and schemes adopted in China and internationally. Most of these apply to either the development and retrofitting of buildings, or a broad set of infrastructure projects and assets (see **Annex V** for more details).

Investors currently have insufficient tools to ensure that their investments are making a positive impact. Having common definitions of 'green' across global markets allows investors, potential issuers and policy makers to identify green assets and attract investment more conveniently and effectively.

Ideally, the GBA's governments could adopt a best practice standard to identify green projects during infrastructure planning and collate these in a single list. The GBA could then prioritise projects that are in line with international definitions of 'green' and provide clear 'green' labelling when preparing future infrastructure pipelines.

Providing this level of visibility for green infrastructure investment opportunities could facilitate increased access to private sector capital for the GBA's economic development, the acceleration of the GBA's transition to a low carbon economy and help to meet global institutional investor demand for green assets.

Methodology⁴⁸

The following section explores green infrastructure investment opportunities across the GBA in six key sectors: low carbon transport, renewable energy, sustainable water management, sustainable waste management, green buildings and new infrastructure.

There are various ways for an investor to gain exposure to a specific project, asset or portfolio. The possible investment pathways will vary depending on the asset ownership structure, the stage in the asset's financing lifecycle, and the investor's mandate. This can vary between projects with public and private funding.

Accordingly, we use the following metrics to classify the green infrastructure investment opportunities by project status:

- Completed projects: high profile, recently completed projects
- Projects under construction: major projects that are under construction
- Planned projects: major projects that have not yet begun construction but have been announced and/or have undergone business case planning and/or have been allocated budget.

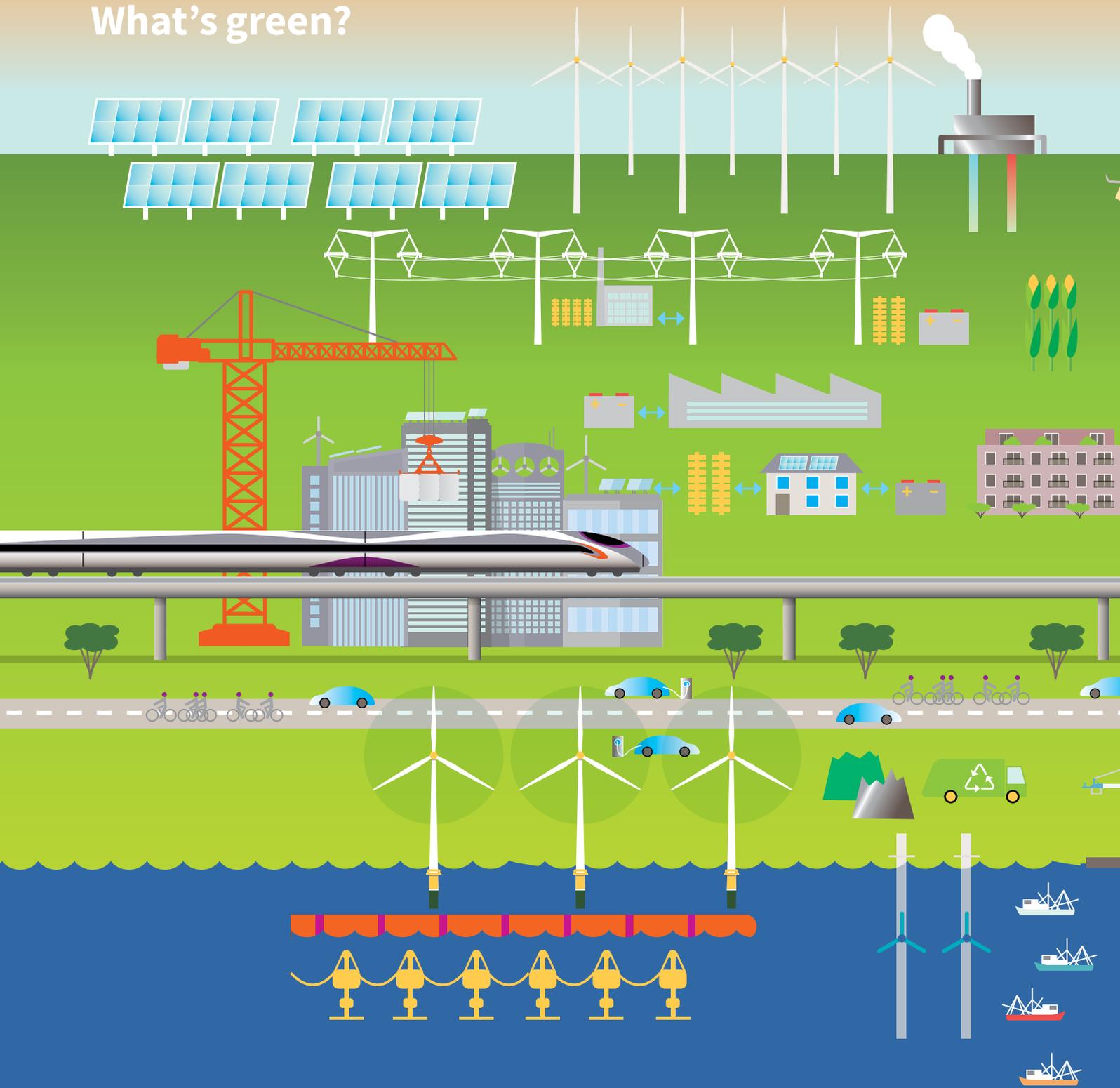
Case studies and a sample pipeline have been developed for this report to show the different types of opportunities available in the short and medium-term future in the GBA. The case studies include both greenfield and brownfield projects and assets that could have been or could potentially be financed or refinanced via green bonds.

Climate Bonds Taxonomy and the Climate Bonds Standard and Certification Scheme

The Climate Bonds Taxonomy features eight climate-aligned sectors (see **back cover**).

The purpose of the Taxonomy is to encourage common broad 'green' definitions across global markets in a way that supports the growth of a cohesive green bond market. The Climate Bonds Standard & Certification Scheme is used to provide a labelling scheme for bonds and other debt instruments. The Sector Criteria for the Climate Bonds Standard & Certification Scheme provide eligibility conditions or thresholds which must be met for assets to be in line with a rapid trajectory toward a 2050 zero-carbon future. The criteria are developed based on climate science by technical expert groups with input from industry.

What's green?



Geothermal:



According to the Geothermal Energy Association, 39 countries could supply 100% of their electricity needs from geothermal energy, yet only 6% to 7% of the world's potential geothermal power has been tapped.⁴⁹

Drawdown Agenda

Solar:



The world installed a record number of new solar power projects in 2017, more than net additions of coal, gas and nuclear plants put together.⁵¹

UNFCCC

Hydropower:



Hydropower is the largest source of renewable electricity in the world, producing around 17% of the world's electricity from over 1,200 GW of installed capacity, and is expected to remain the world's largest source of renewable electricity generation by 2022.⁵⁰

International Energy Agency



Transport (rail):



75% of the world's countries have established strategies and targets to improve the environmental performance of their transport sector within their Intended Nationally Determined Contributions (INDCs). One-fifth of the transport-related (I)INDCs include measures in the railway sector.⁵²

UNFCCC

Water:



The UN says the planet is facing a 40% shortfall in water supply by 2030, unless the world dramatically improves the management of this precious resource.⁵³

UNFCCC

Buildings:



Building-related emissions account for about one-third of global GHG emissions and could double by 2050, making building efficiency a critical part of the COP21 agenda.⁵⁴

GreenBiz



Low carbon transport

Transportation modes and ancillary infrastructure that produce low or zero direct carbon emissions. This can include national and urban passenger rail and freight rail networks, Bus Rapid Transit (BRT) systems, electric vehicles, and bicycle transport systems.

Sector overview

The GBA Outline Plan identifies building a Modern Comprehensive Transport System as one of the substantial supports for socio-economic development in the GBA. The transportation sector needs to lower its carbon footprint, as transportation is one of the main sectors responsible for GHG emissions, especially in Guangzhou and Shenzhen.⁵⁵ The sector also needs to adapt to the challenge of rapid population growth and urbanisation, which will pose a significant mobility challenge to urban areas in the future.

The Guangdong provincial government has already expanded and improved its public mass-transit systems to reduce GHG emissions. A total investment of RMB1.46tn (USD223.9bn)⁵⁶ was planned during 13th Five-Year Plan, 47% of which was in rail transit – about RMB680bn (USD104.29bn). In addition, Guangzhou city allocated more than RMB85.6bn (USD13.1bn) of funds for rail transit construction from 2011–2020.⁵⁷

There is still huge potential for transportation infrastructure development. The daily train frequency of each city in the GBA is unevenly distributed: Guangzhou (1173 classes/day), Shenzhen (682 classes/day) are much higher than other cities, such as Jiangmen on the west bank of the Pearl River Estuary (22 classes/day). The highway density is way above the national average of 0.5 km/km² – for example, Dongguan is 21 km/km². But Jiangmen (1.1km/km²) and Zhaoqing (1.0km/km²) still have room for growth.

Investment opportunities

The low carbon transport opportunities in the GBA include rail (passenger and freight) and mass-transit systems (including metro, light rail, bus rapid transit and tram).

In July 2020, the NDRC approved the Guangdong-Hong Kong-Macao Greater Bay Area intercity railway construction plan,⁵⁸ which aims to create a 'Great Bay Area on the track' by integrating and connecting the high-speed rail, regular-speed rail, urban (suburban) rail and other rail networks to achieve one-hour access between major cities in the GBA, two-hour access from major cities to inland cities in Guangdong Province, and three-

hour access from major cities to neighbouring provincial capitals. The plan also sets the development targets – that the rail network will hit 4,700 kilometres by 2025, and will reach 5,700 kilometres to fully cover cities above the county level by 2035.

In terms of increasing connectivity between GBA cities and the ports in Hong Kong and Macao, whilst Shenzhen and Hong Kong are already connected by Beijing-Kowloon Railway and Guangzhou-Shenzhen-Hong Kong high-speed rail, Zhuhai and Macao are also joining the high-speed rail, intercity railway and Macao light rail at Zhuhai Station and Hengqin Station.⁵⁹

A total investment of RMB880bn (USD135bn) was planned in rail transit during 14th FYP in Guangdong Province.⁶⁰

The Hong Kong government also plans to spend around HKD25bn (USD3.23bn) for four new infrastructure projects which include a railway line considered as strategic to modernise the city, as well as to stimulate economic growth.⁶¹

Financing options

Transportation infrastructure is still mainly funded by government budget. The total investment in recent construction projects planned in the Guangdong-Hong Kong-Macao Greater Bay Area Intercity Railway Construction Plan is about RMB474.1bn (USD72.7bn). Half of that investment will be provided by local fiscal coffers in Guangdong Province and the cities along the rail route. It is also actively attracting private capital to participate, and funds other than invested capital are resolved through bank loans, etc.⁶²

A variety of funding structures are available to encourage private sector involvement in the long-term financing required for such projects including green bonds, outright asset acquisitions, PPP and the securitisation of green assets.

Green bonds provide indirect exposure for investors to specific projects and assets, and provide attractive credit and liquidity credentials for institutional investors. In 2017, the China Development Bank issued a RMB5bn (USD766.87m) 'Guangdong-Hong Kong-Macao Greater Bay Area Clean Transportation Construction' themed green bond.⁶³ The Industrial and Commercial Bank of China (ICBC) also issued a USD3.15bn 'Guangdong-Hong Kong-Macao Greater Bay Area' themed green bond with proceeds allocated for low-emission transportation in 2019.⁶⁴ Guangzhou Metro Group and Shenzhen Metro Group also issued several green bonds for railway construction.

In addition, Guangdong Province – the second largest Green ABS issuance province – had the

Highlights in the GBA

- Rail (passenger and freight)
- Mass-transit systems (including metro, light rail, bus rapid transit and tram)

majority of its total RMB20.3bn (USD3.11bn) issuance backed by low-carbon transport assets. Guangzhou Metro brought an ABS deal to the market in 2019 that is made up of six tranches, totalling RMB3bn (USD460m). This deal is secured on subway ticket revenue receivables. The use of proceeds from this deal are also green – RMB1.5bn (USD230m) of the proceeds will be allocated to six rail transit projects (subway construction work). The rest, RMB1.5bn (USD230m), will be used to repay bank loans and to supplement general working capital.

The Huadu District in Guangzhou city uses innovative ways to support green project financing. For example:

- The Huadu District called upon banks to provide a RMB5.4bn (USD828m) benchmark interest rate green credit to support public transportation companies to upgrade over 9,000 pure electric buses through cross-border green financing. This has the potential to reduce more than 650,000 tons of carbon dioxide emissions per year.⁶⁵
- The Huadu Branch of China Construction Bank (CCB) has innovated its 'green leasing and financing' (绿色租融保) business model, and made full use of the financing advantages of CCB's overseas institutions to provide Guangzhou Public Transport Group with a financing solution of about RMB2bn (USD306.75m) for the replacement of 3,138 new energy buses.⁶⁶

Government-backed concessional loans are a new structure which provides greater leverage against the revenue streams of transport (i.e. fares). Another innovative mechanism is 'value capture', which refers to the value that is generated for private landowners from infrastructure and surrounding business operations. Hong Kong MTR is famous for its 'Rail plus Property' model – the government provides MTR land 'development rights' and enables MTR to make money from the property-value increases due to the construction of rail lines. This model is helping MTR's railway system to operate on a self-sustaining basis, and even to make a profit.⁶⁷

More direct investment pathways include participation in consortium debt arrangements and/or equity stakes in individual projects via PPP or other public-private ownership and financing structures.

Guangzhou Huadu New Energy Bus Project:

Proponent: Guangzhou Huadu Bus Co., LTD

Location: Huadu District, Guangzhou

Status: Complete

Classification: Transport, Public Passenger Transport, Buses

Description: Guangzhou Huadu Bus Company is a passenger transport company specialising in urban bus and rural shuttle passenger transport in Huadu District. This project entails purchasing 100 electric buses to replace 100 traditional fuel vehicles for bus line operation. The new electric buses were officially put into operation at the end of December 2017.

Output: These 100 electric vehicles can reduce about 3,671 tons of carbon dioxide each year.

Cost: RMB78m (USD11.96m)

Financial structure: The construction investment capital is RMB2m, and the remaining RMB76m is from financial lease



Shenzhen Metro Line 13 PPP Project⁶⁸:

Proponent: Shenzhen Municipal Transportation Bureau

Location: Shenzhen

Status: Planned

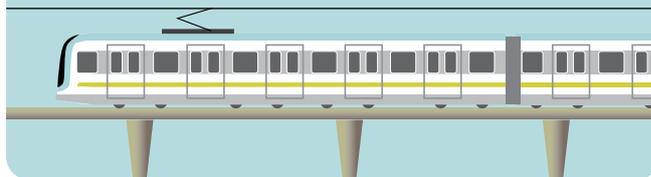
Classification: Transport, public passenger transport, trains/infrastructure

Description: The Line 13 project starts from Shenzhen Bay Port Station and ends at Shangwu North Station, passing Keyuan Avenue, Tongfa Road, Shahe West Road, Baoshi Road and Tianxin Avenue. The total length of the line is about 22.4km, and it is laid underground. There is one parking lot on the whole line. The line adopts a marshalling of 8 type A vehicles, and the DC1500V catenary is powered.

Output: The northern extension of Shenzhen Metro Line 13 effectively connects the transportation links between Shenzhen and Dongguan.

Cost: RMB5.6bn (USD859m)

Financial structure: PPP+Build-Operate-Transfer (BOT)



Modern Tram Demonstration Line Project in Gaoming District, Foshan, Guangdong Province⁷⁰:

Proponent: Transportation and Urban Administration of Gaoming District, Foshan

Location: Foshan

Status: Complete

Classification: Transport, public passenger transport, trains

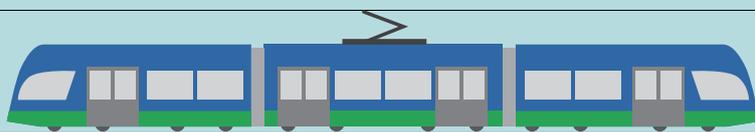
Description: The first phase of the project covers Cangjiang Road Station to Zhihu Station. The line is about 6.6km long. There are 10 stations, including 1 transfer station. The operating vehicle of the

project adopts a 100% low-floor, articulated modern tram powered by hydrogen energy, with a 3-section marshalling, spacious interior, 60 seats, and a maximum capacity of 270 passengers. On the east side and the northwest side of Zhihu Lake, there is 1 parking lot and 1 hydrogen refuelling station. The dispatching command centre is set in the comprehensive building of the parking lot.

Output: This is the world's first commercially operated hydrogen energy tram.

Cost: RMB1.07bn (USD164m)⁶⁹

Financial structure: PPP+BOT



Renewable energy

Energy generation, transmission or storage technology that has low or zero carbon emissions. This can include solar energy, wind energy, bio-energy, hydropower, geothermal energy, marine energy or any other renewable energy source.

Sector overview

The GBA is at the downstream of China's energy supply chain, far away from mining areas. Resource constraints, together with extreme weather, tight market supply and demand, and international geopolitics mean that the region is susceptible to energy supply security risk. The power supply of the nine cities in the Pearl River Delta mainly comes from local coal power, gas power, nuclear power, and power transmission from west to east. The total installed power generation capacity totals around 99GW, of which the west-to-east power⁷¹ transmission accounts for about 30%.

Meanwhile, total energy consumption of the nine cities in the Pearl River Delta increased at an average annual rate of 5.68% from 2005–2017, which was much higher than for Guangdong Province over the same period (3.1%). In 2019, coal, oil, gas and other energy accounted for 34.2%, 25.9%, 8.7% and 31.2% of the primary energy consumption, respectively, in the Pearl River Delta.⁷² Coal still accounts for the largest share of energy consumption.

Guangdong planned to build 5.54GW wind capacity and 5.15GW capacity from 2015–2020, and allocated RMB110bn (USD16.87bn) investment in renewable energy according to Guangdong's 13th FYP.⁷³

Investment opportunities

Looking ahead, wind and solar energy generation continue to have the greatest potential for investment.

Guangdong aims to achieve 22% of renewable energy for its primary energy consumption by the end of 2025. At the same time, it will install pumped storage power stations in Huizhou and Zhaoqing as part of the energy security project.⁷⁴

Guangdong Province has made a plan for wind power capacity and manufacturing: it will install about 30GW of offshore wind power with over RMB540bn (USD69bn) investment by the end of 2030, and form an offshore wind power industry system with coordinated development of machine manufacturing, key component production, offshore construction and related service industries. Guangdong should become the international leader in offshore wind power equipment R&D, manufacturing and services.⁷⁵

Eighteen major channels for west-to-east power transmission have been built in the southern region. The annual power transmission received

by the GBA is equivalent to reducing the consumption of 57m tons of standard coal in the GBA. China Southern Power Grid Corporation has committed that the proportion of installed clean energy in the GBA will reach 80% by 2035 to support the development and utilisation of clean energy and increase the supply of clean and low-carbon electricity outside the region.⁷⁶

Hong Kong commits to reduce its carbon intensity by 65% to 70% using 2005 as the base. However, the electricity generation is by far the biggest contributor to carbon emissions making up about 70%. The Hong Kong government aims to increase the non-fossil fuels electricity generation to 25% for the medium term.⁷⁷ It is set to announce the revamped 'Hong Kong's Climate Action Plan' in the middle of 2021, with more aggressive carbon reduction strategies and measures to achieve its carbon neutrality target by 2050, as it has pledged.⁷⁸

At present, Hong Kong has a number of small wind projects, with total electricity generating capacity of less than 1MW. However, there are two possible offshore sites suitable to develop wind power on a commercial scale.⁷⁹ The government has earmarked HKD1bn (USD127m) of the proceeds raised from its Green Bond Programme for the provision of small-scale renewable energy installations in government buildings, venues and community facilities, and is also actively exploring the development of large-scale renewable energy projects, such as floating photovoltaic systems at impounding reservoirs and at suitable landfills.⁸⁰

Financing options

The Chinese government encourages large-scale investments from the private sector in the construction of new energy industries such as wind, solar, geothermal and biomass.⁸¹ In order to leverage more private investments, the central government also calls for the creation of a fund of funds that invests in the public fund to form new venture capital funds or increase the equity of existing venture capital funds to target start-up

Highlights in the GBA

- Wind energy
- Solar energy

companies that pursue innovation in industries including new energy.⁸²

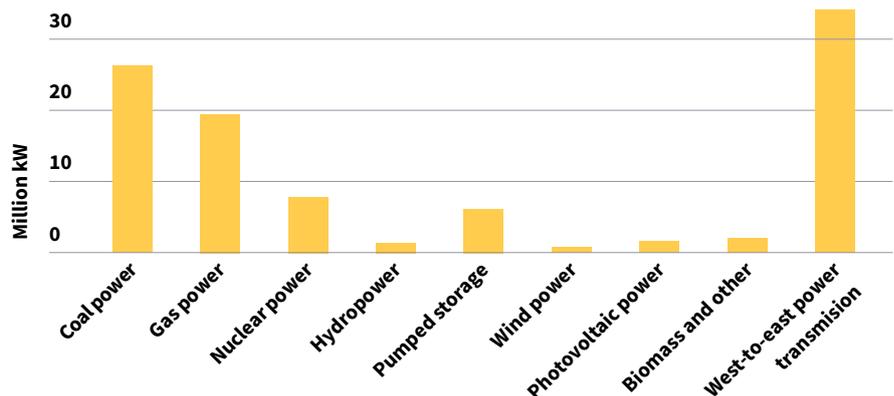
In terms of the renewable energy subsidies, national subsidies for onshore and offshore wind power are planned to be withdrawn from 2021 and 2022, and there will be no new subsidies for the photovoltaic industry after 2021. The tax incentives are still available, including deductions for corporate R&D expenses, 'three exemptions and three halves'⁸³ for income tax, and value-added tax deduction for input tax included in newly purchased machinery and equipment.⁸⁴ Guangzhou Huangpu District, Guangzhou Development Zone, Guangzhou High-tech Zone have also subsidise distributed photovoltaic power generation since 2021.⁸⁵

The Hong Kong Government supports private development of renewable energy projects such as rooftop solar panels or wind systems by introducing the feed-in-tariff rates at HKD3-5/kWh (or USD0.384 - 0.641/kWh)⁸⁶ depending on the generation capacity, which is estimated to reduce the payback period of most renewable energy systems within ten years.

Renewable energy project developers and asset owners should have access to a wide variety of funding options from banks, specialised project financiers, investment funds direct investors and the capital markets. Green bonds are best suited to large renewable energy projects or portfolios of assets and can be structured in a number of ways, including covered bonds, ABS, corporate use-of-proceeds bonds, and project bonds. Aggregation of smaller projects can be done through green securitisation or through banks originating green loans and refinancing in the green bond market.

Renewable energy funds are also being used to support greenfield renewable energy projects and stimulate innovation.

Installed power generation capacity in the nine cities in the Pearl River Delta



Source: Wu, Zhao et al (2020)⁸⁷.

CGN Huizhou Port 1 Offshore Wind Farm Project⁹⁰

Proponent: CGN New Energy Investment (Shenzhen) Co., Ltd. South China Branch

Location: Huizhou

Status: Under construction

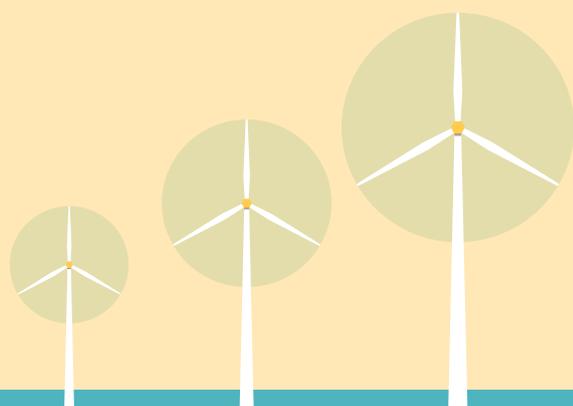
Classification: Energy, electricity & heat production, wind, generation facilities (power & heat)

Description: The project includes wind turbine foundation construction, wind turbine installation, submarine cable laying, civil construction and equipment installation of onshore centralised control centre.

Output: 400,000 kilowatts of wind turbines

Cost: RMB8.18bn (USD1.25bn)

Financial structure: 20% of the total investment was self-financed by CGN New Energy (Huizhou) Co., Ltd.'s, and the remaining investment was settled through bank loans.⁸⁹



Fengkai County Duping Decentralised Wind Power Project⁸⁸

Proponent: Fengkai County Xiehe Wind Power Co., Ltd.

Location: Zhaoqing

Status: Completed

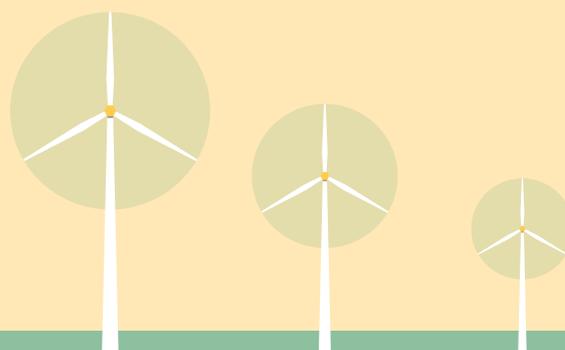
Classification: Energy, electricity & heat production, wind, generation facilities (power & heat)

Description: The planned capacity of the project is 20MW, a new 35kV switchyard will be built. The wind power generation will be connected to the newly built 35kV switchyard through the collection line. The wind farm switch station is connected to the Duping 35kV substation through a 35kV overhead line, and the power transmission distance is about 4km. It is planned to install 8 wind turbines with a stand-alone capacity of 2500kW, with a hub height of 95m.

Output: An annual on-grid power of 400.4 million kWh.

Cost: RMB162.4m (USD24.85m)

Financial structure: 20% of the total investment of the project is from self-financing, and the remainder is supported by domestic bank loans.





Sustainable water management

Assets that do not increase greenhouse gas emissions or aim at emission reductions over the operational lifetime of the asset, address adaptation, and increase the resilience of surrounding environments. This covers both built and nature-based water infrastructure.

Water management projects could include water capture and collection, water storage, water treatment (with methane emissions treatment), flood defence, drought defence, stormwater management, and ecological restoration/ management.

Sector overview

The GBA is densely populated and is home to world's largest seaport group, airport group, and numerous national high-tech enterprises. It is also a typical climate vulnerable area, affected by typhoons, heavy rains, thunder and lightning, strong winds, high temperatures and other natural disasters.⁹¹

The water supply of Hong Kong and Macao mainly relies on Guangdong Province. With the exception of Huizhou, Jiangmen and Zhaoqing, the water resources per capita of the other nine cities are substantially lower than that of Guangdong Province. In particular, the per capita water resources in Shenzhen and Dongguan are far below the critical value of severe water shortage (500 m³) recognized in the world, which has become one of the main factors restricting regional economic development.⁹²

Major water supply projects are being developed to solve the water shortage in the east coast of the GBA. The Pearl River Delta Water Resources Allocation Project deployed by the State Council aims to solve the water shortage in Guangzhou, Shenzhen and Dongguan and provide emergency and backup water sources for Hong Kong and other places. The planned total investment is about RMB35.4bn (USD5.43bn).⁹³ Pinggang-Guangchang Raw Water Supply Guarantee Project is another large-scale water transfer project shared by Zhuhai and Macao. It is a major water supply project under the Guangdong-Macao Cooperation Framework Agreement, and the total investment is RMB856m (USD131.29m).⁹⁴

The GBA Outline Plan emphasizes the management of water resources, water environment and water-related projects in the Pearl River Estuary region, including implementing comprehensive environmental remediation actions on black and odorous water bodies in urban areas, controlling total discharge of pollutants into rivers or the sea and enhancing the conservation of marine resources and environment.

Guangdong Province has also set a comprehensive water management plan during 2015–2020⁹⁵ with specific targets. Altogether there are 88 water conservancy construction projects during the 13th FYP, totalling RMB180.3bn (USD27.6bn) in value.⁹⁶

Investment opportunities

Water infrastructure that are most in need in this region includes facilities related to flood control, water supply, rural and urban wastewater treatment, water environment remediation.

The Guangdong-Hong Kong-Macao Greater Bay Area Water Safety Guarantee Plan was issued in Jan 2021,⁹⁷ which identifies three key challenges to address in the GBA: first, the lack of water safety guarantee capability due to the low water conservation and utilisation efficiency, insufficient capacity of urban and rural water supply, and shortcomings in flood control and disaster mitigation; second, large amounts of waste water, insufficient hydrodynamic force and weak exchange capacity of inland rivers as well as the aquatic ecological damage necessitate the improvement of the water ecological environment; and third, the insufficient water management system.

During the 14th FYP period, Guangdong plans to consolidate and upgrade about 2,000 km of dikes in the GBA, and invest RMB251bn (USD38.5bn) in the fields of flood control, water supply, rural water conservancy, and smart water conservancy.⁹⁸

To safeguard public health and aquatic life, the Hong Kong Environment Bureau (ENB) and the Environmental Protection Department (EPD) are committed to improving water quality in Hong Kong. EPD has devised the Harbour Area Treatment Scheme (HATS)⁹⁹ and Sewerage Master Plans (SMPs)¹⁰⁰ to provide a blueprint of the sewerage infrastructure required to collect sewage and direct it to treatment facilities in order to dispose it into the sea in an environmentally acceptable manner.

Macao's Policy Address for the Fiscal Year 2021 has also planned several projects including flood prevention projects and sewage treatment plant building and upgrading.¹⁰¹

Financing options

The majority of water-related infrastructure in China continues to be publicly owned. This is unlikely to change in the medium-term. That said, it is by far the most market-oriented infrastructure sector in China. Foreign investors are permitted to participate along with local operators and private investors in the form of PPP.¹⁰² Given the need for water

Highlights in the GBA

- Flood control
- Water supply
- Rural and urban wastewater treatment
- Water environment remediation

infrastructure, more private investments should be encouraged to enter and contribute to closing the financing gap.

Over the last two decades, water supply and wastewater treatment has become a mixture of public provision by local government departments and contracting out through BOT, Transfer-Operate-Transfer (TOT) and concession agreements to first international and now national utility companies. New rules require that *all* new environmental infrastructure should be provided by a PPP mechanism.¹⁰³

The sector is seeing positive signs of further opening up and hence attracting new investment opportunities. In June 2020, the National Development and Reform Commission (NDRC) announced a cut back on its 'negative-list', lifting a rule stipulating that the construction and operation of urban water supply and drainage pipeline networks for areas with a population of 500,000 or more must be controlled by Chinese companies.¹⁰⁴ Green bonds could complement the funding of public water infrastructure. In 2020, only 10.4% of the green bond use of proceeds went to the water and sanitation sector in China. The Guangdong Provincial Government issued the first environmental special bond '2020 Pearl River Delta Water Resources Allocation Project Special Bond (Green Bond)' in 2020, with an issuance amount of RMB2.7bn (USD414m), to raise funds for the construction of the Pearl River Delta water resources allocation project.¹⁰⁵ This is an example of how green and sustainability bonds are well suited to fund water infrastructure.

China Development Bank issued RMB7.9bn loans to support water environment governance projects in Dongguan and Zhaoqing in 2020.¹⁰⁶

The Pearl River Delta Water Resources Allocation Project¹⁰⁷

Proponent: Guangdong Water Pearl River Delta Center Co., Ltd.

Location: The Pearl River Delta

Status: Under Construction

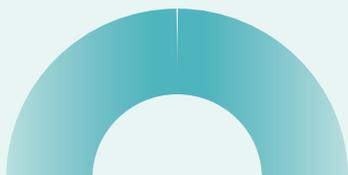
Classification: Water, Water infrastructure, Water distribution

Description: The project is one of 172 major national water conservancy projects and has been included in the GBA Outline Plan. The project diverts water from the Xijiang water system to the eastern part of the Pearl River Delta. The total length of the water delivery line is 113 kilometres.

Output: The average long-term water supply volume of the project design is 1.708 billion m³.

Cost: RMB35.4bn (USD5.4bn)

Financial structure: The central government contributed RMB3.42bn, the Province contributed RMB667m, the project company's capital was RMB14.86bn (shared by Guangdong Group, Guangzhou, Dongguan, and Shenzhen), the project loan was RMB15.71bn, and the Nansha branch project fund was RMB751m (from Guangzhou City).



PPP Pilot Project for Sponge City Construction in Guangming New District, Shenzhen¹⁰⁸

Proponent: Environmental Protection and Water Affairs Bureau of Guangming New District, Shenzhen

Location: Shenzhen

Status: Under Construction

Classification: Water, Water infrastructure

Description: The project constructs a water purification plant with a processing capacity of 300,000 m³/d, and a sewage pipe network with a total length of about 994 kilometres.

Output: After the completion of the project, the sewage collection rate and treatment rate of the new area will be greatly increased, the problem of the daily discharge of 38 thousand m³ of industrial wastewater from the Huaxing Optoelectronics G11 project will be solved, and the comprehensive treatment of the water environment of the Maozhou River Basin will be consolidated.

Cost: RMB1.58bn (USD242m)

Financial structure: PPP, it includes several models: Design-Reconstitution-Operate-Transfer (DROT), Design-Build-Operate-Transfer (DBOT), Engineering-Procurement-Construction-Operate (EPCO), Design-Build-Transfer-Operate (DBTO).



Upgrading of San Wai Sewage Treatment Works – Phase 1¹⁰⁹

Proponent: Environmental Protection Department of the Government of the Hong Kong Special Administrative Region

Location: Hong Kong

Status: Under Construction

Classification: Water, Water infrastructure, Water treatment

Description: The daily capacity of the facilities will be expanded from the prevailing level of 164,000 m³ to 200,000 m³ to cater for additional flows owing to population growth in Yuen Long District. The project is expected to be commissioned by the first quarter of 2021. The upgraded San Wai Sewage Treatment Works (SWSTW) will adopt many energy-efficient and renewable energy technologies such as photovoltaic system, solar water heater system, the adoption of fresh air demand control ventilation, a rainwater harvesting system for landscape irrigation to conserve water, and a portion of treated effluent (about 275,000 m³ per year) will be further filtered and reused for chemical preparation within the plant.

Output: The Hong Kong Green Building Council has awarded a provisional certification at the Platinum rating of BEAM Plus New Buildings scheme to the administration building and maintenance workshop of the upgraded SWSTW for having achieved, amongst others, about 30% reduction of carbon dioxide emissions.

Cost: HKD2.57bn (USD331.6m)

Financial structure: PPP+BOT



PPP project of ecological restoration of the black and odorous water of the Heiwu River in Doumen District

Proponent: Water Resources and Water Quality Monitoring Centre of Doumen District

Location: Zhuhai

Status: Under Construction

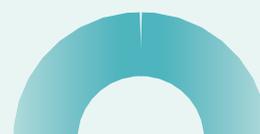
Classification: Water, Water infrastructure, Water treatment

Description: The project covers 8 black and odorous rivers with a total remediation length of 21.05 kilometres. It has been included in the national black and odorous river remediation scope. This project focuses on the purification and improvement of river water quality, water ecological restoration and landscape construction goals, and improves the environmental quality of river water by adopting remediation measures such as source control and interception, internal source control, and water ecological restoration.

Output: 8 rivers turned into clear and bright ecological rivers.

Cost: RMB577.27m (USD88.5m)

Financial structure: PPP+BOT. The project received assistance from the Pledged Supplementary Lending (PSL) Mortgage Supplementary Loan Policy of Agricultural Development Bank Guangdong Branch. Annualised investment income reaches 3.695%¹¹⁰.





Sustainable waste management

The efficient use of resources to cut down on waste production, coupled with collection and disposal systems that promote reuse and recycle, thereby minimising residual waste going into waste-to-energy facilities. Where waste must go to land fill, there are gas capture systems installed to minimise emissions as well as measures to minimise run-off and other negative impacts on surrounding environments.

Sector overview

The permanent resident population of the GBA was approximately 72.67 million in 2019. The two largest cities, Guangzhou and Shenzhen, had an average increase of more than 3% in the permanent population over the past ten years. With the further improvement of the infrastructure, along with accelerated net population inflow, the volume of waste removal and transportation in the GBA will continue to increase.

Effective solid waste management is the backbone of a city's sustainability and liveability. The GBA Outline Plan states that it aims to improve levels of detoxifying, reducing and recovering resources from solid waste. In the GBA, the governments have increased efforts in reducing city solid waste.

The Department of Environmental Protection of Guangdong Province has published a Three-Year Solid Waste Management Plan (2018–2020). Solid waste management goals at a provincial level mandate that by 2020, Guangdong is to achieve over 99% safe disposal rates when dealing with industrial hazardous waste and medical waste, to achieve over 98% harmless treatment rate of MSW, and over 95% treatment rate of rural domestic waste.¹¹¹

In the Pearl River Delta region, a total investment of RMB28.33bn (USD4.35bn) was invested in the construction of waste treatment facilities for urban and rural domestic waste from 2015–2020.¹¹²

Investment opportunities

In Hong Kong, ENB has released the Blueprint for Sustainable Use of Resources 2013–2022, with targets to reduce the MSW disposal rate by 40% per capita by 2022, from 1.27kg to 0.8kg per day.¹¹³ The Blueprint suggests building a network of integrated waste management facilities to turn MSW to energy and constructing various facilities to handle large quantities of organic wastes being disposed of on a daily basis. The Blueprint also recommends the implementation of producer responsibility schemes as a major policy tool to promote resource recovery and

the creation of a circular economy. As for the waste-to-energy (WTE), the existing and under construction WTE plants are expected to provide about 1% of electricity needs by 2024, and another 0.5% may be possible with new projects.

The Macao Environment Protection Department also aims to reduce per capita MSW disposal rate by 30% by 2026 (based on 2016 levels), from 2.11kg to 1.48kg per capita.¹¹⁴ The law on Macao Construction Waste Management System will come into effect in 2021, to regulate the use and charging of landfills, and to strengthen the mechanisms for monitoring and penalising illegal disposal of construction waste. Macao is also planning to further strengthen plastic restrictions, formulate regulations restricting the import of styrofoam tableware, and facilitate kitchen waste reduction and recycling.¹¹⁵

The Guangdong Province Urban and Rural Domestic Waste Management Regulation came into effect on 1 Jan 2021, to further tighten the waste classification.¹¹⁶ Companies and individuals who don't follow the classification regulations for disposing of domestic garbage can be fined – a maximum of RMB500,000 for companies and RMB500 for individuals.

E-waste dismantling and processing is another challenge for Guangdong Province, and three new e-waste dismantling and processing enterprises have been planned in Zhaoqing, Yangjiang, and Jiangmen in order to increase the dismantling and processing capacity of e-waste by 90,000 tons/year, and to improve the dismantling of e-waste technical equipment and resource utilisation level to promote the large-scale, industrialised, and professional development of the industry.¹¹⁷

Financing options

Most of the major waste management assets and projects in China are publicly owned, with public financing used primarily for waste treatment facilities and WTE processing infrastructure. Waste treatment facilities usually demand significant capital. Development via PPP or through the issuance of green bonds could offer options for municipalities to fund projects.

PPP is a key avenue for the private sector to invest in sustainable waste management projects. Local governments are actively encouraging social capital to participate in the investment and operation of domestic waste treatment facilities through direct financing, indirect financing, franchising, investment subsidies, and government purchases of services. And Guangdong Province encourages financial institutions to provide financing support for the construction of domestic waste treatment facilities projects, to carry out equity and debt

Highlights in the GBA

- Recycling facilities
- Low emission waste-to-energy facilities

financing, to develop debt and equity investment plans, as well as ABS and other financing tools, to extend the investment period, and guide insurance funds to be used for domestic waste treatment facilities construction projects with stable income and long payback periods.

Green bonds are also a viable pathway to invest in the GBA's green projects, as local governments encourage waste management facilities projects to use corporate bonds, project income bonds, and medium-term notes to raise investment funds through the bond market.

Kaiping Solid Waste Comprehensive Treatment Centre Phase I Section I PPP Project¹¹⁸

Proponent: Kaiping City Environmental Sanitation Management Office

Location: Jiangmen

Status: Complete

Classification: Waste and pollution control, Waste to energy

Description: The project includes 9 facilities including a domestic waste incineration power plant, a sanitary landfill area, a leachate treatment centre, a sludge drying plant, an organic waste treatment centre, an office management area, a parking lot and an entrance constructed wetland park.

Output: Total scale: Two 300 tons/day incinerators and one 15MW steam turbine generator set. It will effectively alleviate the pressure of the 'garbage siege' in Kaiping City, and enable domestic waste to be reduced, harmlessly treated, and recycled.

Cost: RMB526.53m (USD80.67m)

Financial structure: PPP+BOT



Shenzhen East Environmental Protection Power Plant¹¹⁹

Proponent: Shenzhen Energy Environmental Protection Co., Ltd.

Location: Shenzhenn

Status: Complete

Classification: Waste and pollution control, Waste to energy

Description: The project is located in Pingdi, Longgang District. Construction of 6 sets of 850 ton/day waste incineration production lines in the main plant area, equipped with 4 sets of 4GW steam turbine generator sets, supporting construction of fly ash landfill and slag landfill areas, and construction of 825 kw rooftop solar photovoltaic power generation systems and 2,000 kw biogas generator sets.

Output: The eastern project is the world's largest single-body waste incineration power plant. The waste incineration treatment scale is 5,000 tons per day, and the annual waste treatment is about 1.665 million tons.

Cost: RMB4.39bn (673.3m)

Financial structure: PPP+BOT



Integrated Waste Management Facilities Phase 1¹²⁰

Proponent: Environmental Protection Department of the HKSAG Government

Location: Hong Kong

Status: Under construction

Classification: Waste and pollution control

Description: The Integrated Waste Management Facilities (IWMF) aims to substantially reduce the bulk size of MSW and recover useful resources. The IWMF will be developed in phases. IWMF Phase 1 is located on an artificial island of about 16 hectares near Shek Kwu Chau (SKC) and is expected to be fully commissioned by 2025. It will have a treatment capacity of 3,000 tons of MSW in total each day and will adopt advanced incineration as the core treatment technology. IWMF Phase 1 will also be equipped with a mechanical sorting and recycling facility capable of recovering useful materials from up to 200 tons of MSW per day.

Output: Major expected impacts:

- i. 3,000 tons of treatment capacity of mixed municipal solid waste (MSW) per day
- ii. 1.35 million kilowatt-hours (kWh) of electricity generated / saved per day
- iii. 465,000 tons of greenhouse gas emissions avoided or reduced per year, in carbon dioxide equivalent (CO₂e)

Cost: RMB4.39bn (673.3m)

Financial structure: PPP+BOT



Guangzhou Fifth Resources Thermal Power Plant Project¹²¹

Proponent: Guangzhou Environmental Protection Investment Group Co., Ltd

Location: Guangzhou

Status: Complete

Classification: Waste and pollution control, Waste to energy

Description: The project is equipped with 3 sets of 750 tons/day grate incinerators and 2 sets of 25MW condensing steam turbine generator sets. The flue gas purification adopts 'in-furnace denitrification (SNCR) + semi-dry deacidification + (activated carbon + dry) injection + bag type dust removal' combined process. The main construction work includes projects such as the main plant of the waste incineration treatment plant, auxiliary production and business buildings, and sewage treatment stations, as well as external projects such as external water, external electricity, and special roads for garbage transportation.

Output: The designed maximum treatment capacity of domestic waste is 2,250 tons/day, the actual treatment scale is 2,000 tons/day, and the annual designed treatment capacity is 730,000 tons.

Cost: RMB1.38bn (USD211.66m)

Financial structure: Self-financing + bank loans. RMB110.58m (USD16.96m) is financed by loans, accounting for 80% of the total funds for construction projects. The Huadu District finance department will subsidise the green loan of the project at 1% of the loan amount, with a maximum subsidy of RMB1m per year.



Green buildings

Commercial and residential buildings, new or upgraded, operating with low-carbon emissions. Credentials and emissions performance are demonstrated through an accepted rating or 'green' assessment process.

Sector overview

Globally, the buildings and construction sector has been a large contributor of CO₂ emissions, remaining at around 39% of total carbon dioxide emissions,¹²² in which, 28% is from operational emissions, and 11% from 'upfront' carbon that is associated with materials and construction processes.¹²³ According to the International Finance Corporation (IFC), the green building sector represents a USD16tn investment opportunity by 2030 in East Asia Pacific.¹²⁴

With the implementation of the GBA Outline Plan and the improvement of the interconnection of urban infrastructure, the GBA will attract a large number of talents along with the increasing housing demand. The cost of living in first-tier cities diverts part of the population and the pressure of home ownership to surrounding cities, and drives the rigid demand for housing in surrounding cities.

Thus, embracing low-carbon development approaches for buildings is essential for making the GBA a low-carbon, climate-resilient green economy.

China has implemented a green building certification system - China Green Building Three-Star Certification since 2006. The new version of Green Building Evaluation Standard GB/T 50378 was formally implemented in 2019, and it has four levels: basic, one-star, two-star, and three-star.

In Hong Kong, building accounts for 90% electricity consumption or 60% GHG.¹²⁵ The Building Environmental Assessment Method (BEAM) Plus is the leading green building certification. It has four ratings: Bronze, Silver, Gold, and Platinum.

Macao uses the Green Building Evaluation Standard (Macao Version) managed by the China Green Building and Energy Saving (Macao) Association. It has three levels: one-star, two-star, and three-star.¹²⁶

During the 13th FYP period, Guangdong Province has added more than 500 million m² of green buildings, and the energy saving in existing buildings has accumulated 8.58 million tons of standard coal energy saving capacity, and urban green buildings accounted for 62% of new buildings.¹²⁷

Investment opportunities

Strong support from the government and the development of green buildings enabling regulations creates promising opportunities for a growing number of green buildings and retrofit projects in the GBA.

The Guangdong Province Green Building Regulations issued in November 2020 are the first local regulations on green buildings. The Regulations requires that newly-built civil buildings¹²⁸ be constructed in accordance with green building standards, and in the future, all new civil buildings will reach the basic level of green buildings or above except for farmers' self-built houses within the province, achieving the goal of 'all green'. The Regulations also requires the nine cities within the GBA to accelerate the development of two-star or above green buildings.¹²⁹

Hong Kong issued the Energy Saving Plan for Hong Kong 2015-2025+, with clear targets that:

- New government buildings with construction floor area of >5,000 m² with central air-conditioning or >10,000 m² to achieve at least BEAM Plus Gold; and
- New public housing to achieve at least BEAM Plus Gold ready.¹³⁰

Other than the government, investors and financiers can drive green buildings investment. As data from IFC articulates that green building can save operational costs, achieve higher sale premiums and faster sale times, have higher occupancy rates and higher rental income.¹³¹ In addition, investing in green buildings would help investors to be more resilient to financial, regulatory and reputational risks associated with the transition to low-carbon economies.

Financing options

Low-carbon residential and commercial buildings in the GBA are one of the more attractive sectors for private investors. Consequently, the vast majority of the capital required for construction, ownership and refinancing of green buildings is provided by the private sector without government support. The private sector uses a wide variety of equity, debt and project finance structures for green building development, including investment funds, green loans and green bonds. Government-owned green buildings have also been financed with sub-sovereign green bonds.

In 2018, the Hong Kong government announced the Government Green Bond Programme (GGBP) with a borrowing ceiling of HKD100bn (USD12.8bn) to demonstrate its commitment to promoting green finance. The inaugural green bond issued in May 2019, attracting orders more than four times

Highlights in the GBA

- Residential and commercial buildings

the issuance size and 27.53% of the proceeds are allocated to two green building projects: West Kowloon Government Offices and Inland Revenue Tower in the Kai Tak Development.

Going beyond buildings energy efficiency, there are also huge opportunities for both emissions reductions and green financing in broader urban planning and development (such as district heating and cooling) as well as in industrial efficiency. The definitions of what can be included as Paris Agreement-aligned within industrial energy efficiency are still being discussed within the Climate Bonds Initiative, the European Taxonomy and globally. It is likely, however, that any such definitions will fit within the ambitious efforts to align hard-to-abate sectors with the Paris Agreement as articulated recently in the Climate Bonds white paper 'Financing Credible Transitions'.¹³² The Case Studies below demonstrated the diversity of financial structures adopted to fund green buildings in the GBA, including the use of green bonds:

Hengqin International Finance Centre Building

Proponent: Zhuhai Huafa Comprehensive Development Co., Ltd.

Location: Zhuhai

Status: Complete

Classification: Buildings, Commercial buildings

Description: The building is located in the central area of Shizimen Central Business District. It functions as an international Grade A office building, business apartments and commercial service facilities. The supporting parking lot is a green park on the ground, the supporting parking space is underground, and the construction area is about 20,000 m².

The project obtained a two-star green building design label certificate issued by the Department of Housing and Urban-Rural Development of Guangdong Province in 2016. It is estimated that the building energy saving rate will reach 55.16%, the non-traditional water source utilisation rate will be 41.69%, and the ratio of recycled building materials will be 13.09%.

Output: It is estimated that 904.03 ton of standard coal equivalent of energy saving, 2,340.53 ton of greenhouse gas emissions (in terms of CO₂), 20.73 t of SO₂, 0.18 t of soot reduction, 121,315.05 ton of water saving for appliances, and 33,305.17 ton of rainwater can be achieved each year.

Cost: RMB4.3bn (USD659.5m)

Financial structure: Self-financing with green bond

PPP project of urban comprehensive development and operation in Zhongshan (Shiqi) Headquarters Economic Zone, Zhongshan City, Guangdong Province¹³⁴

Proponent: Shiqi District Office of Zhongshan Municipal People's Government

Location: Zhongshan

Status: Under construction

Classification: Buildings, Commercial buildings

Description: Infrastructure construction includes site levelling, roads, landscape greening, integrated pipe corridors, river-crossing tunnels, bridges and culverts, underground roads and water systems. Public supporting projects include kindergartens, provincial-level standard primary schools, community health service centres, cultural and sports facilities, garbage transfer stations, substations, air corridors, public transportation and transfer centres, etc.

Output: Underground comprehensive pipeline corridors refer to a public tunnel used to lay municipal pipelines such as electricity, communication, radio and television, water supply, drainage, heat, gas, etc. in the city underground. It can coordinate the planning, construction, and management of various municipal pipelines, and solve the problems of repeated excavation of roads, dense overhead line networks, and frequent pipeline accidents, which is conducive to ensuring city safety and improving city functions.

Cost: RMB4.13bn (USD633m)

Financial structure: PPP+Engineering Procurement Construction (EPC)

The project adopts a combined return mechanism of 'user payment + feasibility gap subsidy'. The integrated pipe gallery, social parking lot and transfer centre are operating projects. Part of the return on investment is obtained by charging users, and the remaining investment costs and benefits. Part of it is paid to the project company by the financial department according to the stipulated budget through the form of feasibility gap subsidy.

West Kowloon Government Offices¹³³

Proponent: ZProperty Agency of the HKSAR Government

Location: Hong Kong

Status: Complete

Classification: Buildings, Commercial buildings

Description: The new Government Offices towers are situated at the West Kowloon Reclamation area, not far from the Hong Kong West Kowloon Station for the High-Speed Rail (Hong Kong Section). The twin-tower offices have a total construction floor area of about 98,000 square metres. The Offices opened in 2019 and now house the operations of 9 Government departments. The towers adopt many energy-efficient and renewable energy technologies such as:

- Photovoltaic system to convert the solar radiation into usable electricity;
- Solar hot water system to absorb solar thermal radiation to heat up water, thereby minimising the electricity consumption from electric water heaters;
- Water-cooled chillers (fresh water cooling tower) to reduce the use of electricity;

- Demand control of fresh air supply with carbon dioxide sensors to minimise the amount of fresh air supply to save energy for heating up or cooling down the supplied air to maintain the desired temperature of the building;
- Automatic demand control of chilled water circulation system to reduce the energy consumption on pumping power to conserve energy;
- The deployment of occupancy / motion sensors to control the supply of air-conditioning and lighting by zones;
- The use of environmentally friendly and recycled materials.
- Daylight suntubes for underground carparks
- A rainwater harvesting system for landscape irrigation to conserve water

Output: The Hong Kong Green Building Council has awarded a provisional certification at the Gold rating of BEAM Plus New Buildings scheme to the project for having achieved, amongst others, about 40% reduction of carbon dioxide emissions (based on the assessed result in the BEAM Plus Provisional Assessment Report).

Cost: HKD4.74bn (USD612m)

Financial structure: PPP, Contractor design-build, government operation, financing with green bond

New infrastructure

Sector overview

New infrastructure has become a top development priority for the GBA in recent years. It generally refers to infrastructure that is 'digital, smart, and innovative'. On 20 April, 2020, the NDRC clarified that new infrastructure projects could be divided into three categories:

1. Information-based infrastructure such as 5G, industrial Internet of things, artificial intelligence (AI), and blockchain;
2. Converged infrastructure supported by applications of new technologies such as the Internet, big data, and AI. These could include smart transportation and smart energy;
3. Innovative infrastructure that supports scientific research, technology, and product development. Examples could be major technology infrastructure, science education infrastructure, industrial technology, and innovation infrastructure.

At Climate Bonds, new infrastructure projects are screened against the Information, Communications and Technology (ICT), Energy and Low Carbon Transport Criteria of the Climate Bonds Taxonomy to determine their green eligibility.

New infrastructure has been part of China's post-COVID-19 relief package. The country is ramping up plans to construct new digital infrastructure with a new wave of government support for private sector participation. According to the estimates from CCID Think Tank Electronic Information Institute and Haitong Securities, the investment associated with new infrastructure projects is expected to total around RMB10tn (USD1.43tn) to RMB17.5tn (USD2.51tn) for the next five-year period until 2025 in China.¹³⁵

The GBA Outline Plan identifies the role of the GBA as state-level new areas (new development areas with the full support of Chinese central government), national innovation demonstration zones and national high-tech industrial development zones. Thus, the GBA is one of the most active players in new infrastructure constructions.

Different levels of government issued a multitude of policies and plans in support of new infrastructure projects¹³⁶ in the Three-Year Implementation Plan for Promoting the Construction of New Infrastructure in Guangdong Province (2020-2022). 89 projects are included in the 5G sector, with an investment of about RMB97bn (USD14.9bn); 66 projects are included in AI with investments of about RMB28.1bn (USD4.3bn); 50 projects are in the industrial Internet field with investments of about RMB7.6bn (USD1.17bn); there are 9 smart charging projects with an investment

of about RMB3.6bn (USD552.15m), and 40 projects in other fields with investments of about RMB118.6bn (USD18.2bn).¹³⁷

Guangdong Province plans to achieve full coverage of 5G networks in urban and rural areas by 2025. The total number of 5G base stations will reach 250,000, the number of 5G network users will exceed 100 million, and the penetration rate of 5G network users will reach over 80%.¹³⁸

As planned in the 2020 Key Construction Project Plan of Guangdong Province, there are six new 5G network and data centre-related projects, with a planned investment of USD17.2bn, an increase of approximately USD3bn from the previous year. In addition, AVIC Cloud Data Co., Ltd. will start the construction of two data centres in Guangzhou and Shenzhen.¹³⁹

China is planning to raise the ratio of electric cars and plug-in hybrids, and has revised its new energy vehicles NEVs credit score programme for 2021–2023 to form a long-term mechanism to develop the industry and aim to ensure that by 2025 new energy vehicles will account for 20% of total vehicles.¹⁴⁰

As for the GBA, the NEVs will see a particularly steep rise in demand over the coming years due to promotional policies, such as electrification of the bus fleet, purchase subsidies and free car license plates, as well as market conditions and better industry chain of NEVs. In Shenzhen, public buses were already fully electrified in 2017, and Guangzhou and Zhuhai achieved this in 2018. Other cities in the Pearl River Delta were set to meet such targets by 2020 (of which pure electric buses account for over 85%)¹⁴¹ In addition, all new or newly added cruise taxis and ride-hailing cars should have been using NEVs since 2018.¹⁴²

Guangdong Province also provided subsidies to NEVs (both electric vehicles and hydrogen fuel cell vehicles), and electric vehicles charging stations and hydrogen fuelling stations from 2017 to 2020,^{143,144} while Shenzhen and Guangzhou started a new round of NEVs subsidies in 2020.^{145,146}

The Guangdong government is currently promoting EVs infrastructure and aims to build about 200 hydrogen fuelling stations by the end of 2022^{147,148} and about 250,000 charging piles and 4,500 charging stations by the end of 2025.¹⁴⁹ It requires newly built public parking lots and on-street toll parking spaces to be built with fast charging piles at a ratio of not less than 30%, and new residential parking spaces to be 100% built with charging facilities or reserved for construction and installation conditions.¹⁵⁰ Subsidies have been provided to the charging pile project and electricity swap facility project in Guangzhou Huangpu District, Guangzhou Development Zone, Guangzhou High-tech Zone since 2021.¹⁵¹ The Hong Kong

Highlights in the GBA

- ICT
- New energy vehicles facilities construction
- New energy vehicles manufacturing

Environment Bureau is also subsidising existing private residential estates to install electric vehicles charging-enabling infrastructure in car parks, and Hong Kong's first roadmap on the popularisation of electric vehicles is expected to be launched in 2021.¹⁵²

The investment of NEVs manufacturing projects in the GBA has boosted growth. The GBA has formed core clusters of new energy vehicles in Guangzhou, Shenzhen, and Foshan, attracting high-quality construction projects to gather and develop. Dongguan, Zhongshan, Huizhou, Zhaoqing and other regions are focused on developing key components and new materials supporting projects, achieving coordinated development of regional layout, and enhancing industrial scale and competitiveness. In terms of publicly planned investment projects, there are five in Guangzhou, one in Foshan, two in Zhuhai, and three in Zhaoqing, with a total production capacity of more than 3.1m vehicles. Investors include GAC, FAW-Volkswagen, and Evergrande, ZTE, Baoneng and Xiaopeng.¹⁵³

Financing options

While the new infrastructure sector has more potential to attract private investment, it is also dependent on particular technologies. For instance, research facilities and satellite communications normally have a higher government investment ratio, whereas application developments, virtual reality, 3D printing, and smart robot production are typically comprised of private investments, and have relatively low industry barriers for foreign investment.¹⁵⁴

China released the Catalogue of Industries for Encouraging Foreign Investment (2020 Edition) in 2020, which further encourages foreign-invested enterprises to participate in the high-tech development of its manufacturing industry.

Local governments are also encouraged to use fiscal funds, special bonds, corporate bonds, credit, financial leasing and other fiscal and financial instruments. For example, to establish a green channel for new infrastructure project entities and investment institutions to issue corporate bonds and local government special bonds.¹⁵⁵ Special bonds have increasingly been used as an off-budget source of financing for local government projects and investors of special bonds will be repaid with project cash flows.¹⁵⁶

As a pilot zone for green finance reform and innovation in Guangzhou, Huadu District supports the development of green industries by increasing green credit investment. In 2019, financial institutions in the district provided more than RMB12bn (USD1.84bn) in financing for green enterprises, and the financing interest rate was about 1% lower than the loan interest rate of general enterprises.

- Industrial and Commercial Bank of China Huadu Branch’s innovative supply financing has helped the development of new energy vehicles. From 2017 to the end of

2019, it handled 21,237 auto supply chain financings for Dongfeng Nissan, with a total amount of RMB49.3bn (USD7.56bn) and a financing interest rate of 4.35%, which has been reduced the financial cost of RMB80m (USD12m) for dealers.¹⁵⁷

- By providing products and services such as ‘electric pile financing’ (电桩融), the Huadu branch of CCB granted a certain amount of credit loans to the charging stations, and the charging stations correspondingly pledged the charging rights for charging pile operations to CCB.¹⁵⁸

Thus far, only a handful of information technology projects have been financed with green bonds. However, increased connectivity represents huge potential for GHG emissions reduction, particularly through reduced transportation. We expect to see more transactions in this space in the GBA and beyond.

Smart EV Manufacturing Base¹⁶⁰

Proponent: Xpeng Inc.

Location: Guangzhou Economic and Technological Development Zone

Status: Under construction

Classification: Transport, private passenger transport, supply chain facilities

Description: The new Smart EV manufacturing base is planned to be completed and put into production by the end of 2022, and will be an intelligent manufacturing base with five process workshops including assembly, final assembly, coating and welding, and packaging. It will house a broad range of functions, including research and development, manufacturing, vehicle testing, sales and other smart mobility functions.

Output: It will significantly expand the Company’s production capacity and accelerate XPeng’s momentum to achieve its goals in innovation, technological advancement and growth.

Cost: RMB4bn (USD600m)

Financial structure: Guangzhou GET Investment, a wholly owned investment company of Guangzhou Economic and Technological Development Zone, will invest up to RMB1.3bn to construct the Smart EV manufacturing base and provide or facilitate RMB1.2bn in financing to purchase of manufacturing equipment in the form of fixed-return redeemable investment (with an annualized return of 4%) or long-term bank loans that Guangzhou GET Investment will help the Xiaopeng to secure with effective annual interest rates of no more than 4%, after subsidies that are expected to be made available by the local government.¹⁵⁹



Yanling Three-dimensional Charging Pile Parking Lot Project¹⁶¹

Proponent: Guangzhou Changyun Group Co., Ltd. Wholly-owned subsidiary of Guangzhou Public Transport Group

Location: Guangzhou

Status: Under construction

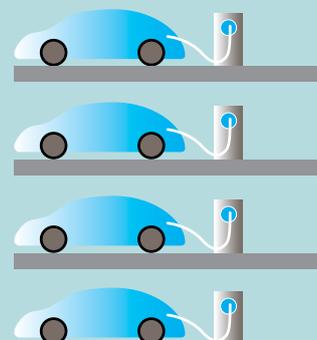
Classification: Transport, public passenger transport, infrastructure

Description: The project is to provide multi-functional three-dimensional parking and charging integrated complexes for buses, such as transfer and connection, parking charging, repair and maintenance. It is located at No. 171 and 173 Yanling Road, Tianhe District, Guangzhou. The planned total land area is 22,670.40 m², currently used as a bus station, obtained through allocation, and the land ownership certificate has been processed.

Output: A total of 550 parking spaces for motor vehicles, including 381 parking spaces for buses, 169 parking spaces for cars, and 193 charging piles.

Cost: RMB447.61m (USD68.65m)

Financial structure: Self-financing, of which RMB310m (USD47.5m) is from green bond issued by Guangzhou Public Transport Group.



Unlocking immense green infrastructure investment opportunities in the GBA

GBA is set to become a world-class city cluster and an international innovation and technology hub. Together, the GBA Outline Development Plan, the 13th FYP and local strategies spanning different sectors have resulted in tremendous infrastructure investment needs.

The greening of infrastructure not only helps to attract global capital seeking environmental impact, but it also builds resilience into fundamental facilities and systems that support the sustainable future of the GBA and reduce its vulnerability to climate change. Therefore, it is critical for the GBA to accelerate investment in green infrastructure at scale and speed.

Since infrastructure projects have such long lifetimes, it is vital to ensure that infrastructure built now is supportive of the long-term decarbonisation necessary to achieve the goals of the Paris Agreement.

GBA is leading in green finance development. Multiple green finance instruments are encouraged with incentives and innovative approaches are adopted to support green infrastructure financing. Green debt instruments are increasingly being used to refinance infrastructure projects.

The growth of green infrastructure pipelines and green finance (including the green bonds) can be aided by key policy and institutional changes. Such measures could raise the profile of green infrastructure, support critical finance channels for infrastructure development stakeholders, diversify risks and create more options for investors.

Recommendations for doing so are as follows:

1. Promote green securitisation: Guangdong Province already has experience issuing low-carbon transport ABS. Well-structured ABS bring a wider range of issuers and projects to the green bond market. This facilitates improved diversification and liquidity in the market, which can attract additional investors and lower investment risk and volatility. Having a wide range of instruments and hence investable options with differing pricing, risk and tenor - such as municipal bonds, corporate bonds, project bonds, ABS and covered bonds - allows more issuers and projects to come to market. It also creates more options for institutional investors, each of whom may have differing criteria in regard to asset allocation, risk tolerance and diversification.

To attract investors to GBA's green ABS market, the market has to provide more reliable data on credit quality, defaults, recoveries, recovery timing and loss-given default and make it easier to structure, assess and price transitions.

Green debt instruments have been increasingly deployed in infrastructure financing in the GBA

Green Debt Instruments/ Sectors	Green Bonds	Green ABS	Green Loans	Government Green Bond Programme
Low Carbon Transport	✓	✓	✓	
Renewable	✓		Traditional Bank Loans	
Energy	✓		Traditional Bank Loans	✓
Water	✓	✓	Traditional Bank Loans	✓
Waste	✓		✓	✓
Green Buildings	✓			
New Infrastructure	✓			

2. Promote the issuance of local government green bonds: This could include incentives such as credit enhancement for local governments or establishing green municipal finance for local governments to aggregate debt requirements and access lower cost of capital. China saw the first green municipal bond in June 2019, issued by the Ganjiang New Area in Jiangxi Province with proceeds funding two utility tunnel projects.

Issuing green municipal bonds requires the collaborative efforts of finance, environmental and other departments to identify green infrastructure project pipelines and assess funding needs. This can lead to enhanced teamwork and synergies across different parts of government on addressing climate risks.

Potential green municipal bonds from the Guangdong Province, the current Government Green Bond Programme of Hong Kong Special Administrative Region of the People's Republic of China (SAR) and future green bond issuance by the Macao SAR government, will improve regional strategies on climate change, including decomposing China's NDC to the local level, regional decarbonisation strategies and peaking GBA carbon emissions early.

3. Leverage Hong Kong's capital market to support infrastructure development in the GBA: Hong Kong Stock Exchange (HKEX) is the largest venue for China's offshore green bond listing. Encouraging green infrastructure project owners to tap the capital market in Hong Kong with green debt instruments would help meet the growing demand of global institutional investors for onshore green assets, and at the same time improve the alignment of those issuance with international definitions such as Green Bond Principles and Climate Bonds Standard.

Government incentives (such as grants) and GBA-wide capacity building for issuers are key to accelerate offshore green debt issuance.

4. Harmonise green definitions: The GBA brings together two Special Administrative Regions, connecting onshore and offshore capital markets, and has two legal systems and three jurisdictions. This presents a challenge and an excellent opportunity for the GBA in developing harmonised green definitions and facilitating cross-border green investments into the region.

Especially in green buildings sector where multiple standards and rating systems are implemented, having a harmonised green definition will open up the investment opportunities to various investors and boost the development of green buildings in the GBA.

5. Improve project visibility: For investors, researching green infrastructure investment opportunities in the GBA takes time. Improving visibility for such pipeline will make it easier to attract investors interested in looking for green. An opportunity exists to develop an online database of green infrastructure projects, listed by sector and tagged as planned, under preparation or ready to offer.

6. Pave the way to green recovery with green infrastructure plan: While countries around the world implement measures to recover from the economic impacts of COVID-19, they also need to address the existential threat posed by climate change. There have been calls for policymakers to tackle these problems together through 'build back better' and 'Just Transition' strategies. The GBA governments are playing an important role on these agendas. Integration of sustainability and resilience into infrastructure projects in the GBA will be conducive to raising funds via green debt instruments.

Annex I: Selected green finance policies in the GBA

Policy target region	Regulator	Policy name	Date issued	Description
Guangzhou	PBoC, NDRC, Ministry of Finance, Ministry of Environmental Protection, the former China Banking Regulatory Commission, CSRC, the former China Insurance Regulatory Commission	Overall Plan for Building a Green Finance Reform and Innovation Pilot Zone in Guangzhou City, Guangdong Province ¹⁶²	23 June 2017	Clarified the main objectives of the pilot zone, key reform and innovation tasks, national policy support, and local government support matters, and clarified that the pilot zone will be the first to carry out green finance reform and innovation pilot projects in Huadu District, Guangzhou
Huadu District	The former Local Taxation Bureau and National Taxation Bureau of Huadu District, Guangzhou City (State Administration of Taxation, Guangzhou Huadu District Taxation Bureau)	Compilation of Tax Preferential Policies for the Development of Green Finance Industry in Huadu District, Guangzhou City	28 November 2017	A total of 106 local tax preferential policies are included to help the construction of green financial reform and innovation pilot zones.
Hong Kong	The Government of the Hong Kong Special Administrative Region of the People's Republic of China (the HKSAR Government)	Green Bond Grant Scheme (GBGS) ¹⁶³	15 June 2018	Subsidise eligible green bond issuers in obtaining certification under the Green Finance Certification Scheme (GFCS) established by the Hong Kong Quality Assurance Agency.
Hong Kong	Hong Kong Securities and Futures Commission	Strategic Framework for Green Finance ¹⁶⁴	21 September 2018	It covers three major areas: enhancing listed company, asset manager and investment product disclosures and their consideration of ESG factors, especially environmental and climate risks; facilitating the development of green or ESG-related investment products, and supporting investor awareness and capacity building; and promoting Hong Kong as an international green finance centre.
Guangdong Province	The former Guangdong Banking Regulatory Bureau	Implementation Opinions on Accelerating the Development of Green Finance in Guangdong Banking Industry ¹⁶⁵	12 October 2018	Continue to increase financial support in key areas such as green manufacturing, energy conservation and environmental protection, pollution prevention, clean energy, green buildings, green transportation, green agriculture, resource recycling, new energy, new materials, innovate exclusive products for green enterprises and encourage green consumption finance.
Hong Kong	The Government of the Hong Kong Special Administrative Region of the People's Republic of China (the HKSAR Government)	Government Green Bond Programme ¹⁶⁶	15 November 2018	Borrow up to a maximum principal amount outstanding at any time of HKD100bn (USD12.9bn) or equivalent under the GGB Programme.
Shenzhen	Shenzhen Municipal People's Government	Guiding Opinions on Building a Green Financial System ¹⁶⁷	8 January 2019	Support the development of green credit, listing and refinancing of green enterprises, carry out pilot projects of green bond business, develop green asset securitisation, encourage small and medium-sized enterprises to issue green collective bonds, explore the establishment of green industry investment funds, and promote green insurance market development and equity market development.
GBA	Central Committee of the Communist Party of China, State Council	Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area	18 February 2019	Put forward the basic principles, strategic positioning, development goals and spatial layout of the GBA.

Policy target region	Regulator	Policy name	Date issued	Description
Hong Kong	Hong Kong Monetary Authority	Strategic framework to promote the development of green finance ¹⁶⁸	7 May 2019	Phase I – developing a common framework to assess the ‘Greenness Baseline’ of individual banks and providing technical support to banks. Phase II – engaging the industry and other relevant stakeholders in a consultation on the supervisory expectations or requirements. Phase III – implement, monitor and evaluate banks’ progress in this regard.
Guangzhou	General Office of Guangzhou Municipal People’s Government	Implementation Opinions on Promoting the Reform, Innovation and Development of Green Finance in Guangzhou ¹⁶⁹	16 July 2019	Specific plans and measures to promote the reform, innovation and development of green finance in Guangzhou.
GBA	PBoC, China Banking and Insurance Regulatory Commission (CBIRC), CSRC, and State Administration of Foreign Exchange (SAFE)	Opinions on Financial Support for the Guangdong-Hong Kong-Macao Greater Bay Area ¹⁷⁰	14 May 2020	Supplement and expand upon the policies governing financial services under the GBA Outline Plan. 26 measures were introduced to further promote financial opening up and innovation, and deepen financial cooperation between the Mainland, Hong Kong and Macao.
GBA	Guangdong Financial Supervisory Authority—in association with PBoC Guangzhou Branch, CBIRC Guangdong Office, CSRC Guangdong Office, PBoC Shenzhen Central Sub-branch, CBIRC Shenzhen Office, and CSRC Shenzhen Branch	Implementation Plan for Providing Effective Financial Support for the Guangdong-Hong Kong-Macao Greater Bay Area	31 July 2020	Contains 80 detailed supplementary measures that implement the financial support to the GBA, and is, therefore, of strategic importance to promoting financial cooperation between the three regions and the coordinated economic and social development of the GBA.
Macao	Macao Monetary Authority, Environmental Protection Agency and Macao Association of Banks	Proposal for ‘Jointly Promoting the Development of Green Finance in Macao’ ¹⁷¹	20 August 2020	Advocating the integration of green concepts into the long-term development of society, and enhancing the awareness and participation of all sectors of green businesses and green finance; encouraging Macao financial institutions to develop diversified green financial products, standardising the use of countries in related businesses, and encouraging independent and impartial third-party certification to enhance product credibility and competitiveness in the international market.
Shenzhen	Standing Committee of Shenzhen Municipal People’s Congress	Shenzhen Special Economic Zone Green Finance Regulations ¹⁷²	5 November 2020	China’s first law and regulation in the field of green finance. The regulations will come into effect on 1 March 2021 and will require some financial institutions to make environmental information disclosure mandatory from 1 January 2022. The Regulations provide a guarantee for Shenzhen to establish a financial ecological environment and a business environment under the rule of law more conducive to the development of emerging green industries and the greening of traditional industries. They also provide an early demonstration for the development of green finance under the rule of law nationwide.
Hong Kong	The HKSAR Government	Government’s Green Bonds Programme ¹⁷³	24 February 2021	To issue about USD23bn (HKD175.5bn) green bonds in next five years, having regard to the market situation, aiming to cover a larger variety of project types and bond features. Working towards achieving a carbon neutrality target.

Annex II: Green finance incentives in the GBA

Target region	Time	Description
Hong Kong ¹⁷⁴	10 May 2021 – 9 May 2024	<p>General Bond Issuance Costs: covering bond issuance expenses (e.g., arrangement, legal, audit, listing fees, etc.) for eligible first-time green and sustainable bond issuers.</p> <ul style="list-style-type: none"> The grant amount for each green and sustainable bond issue is equivalent to half of the eligible expenses, up to the following limits: HKD2.5m where the bond, its issuer or its guarantor(s) possess a credit rating by a rating agency recognised by the HKMA, or HKD1.25m where none of the bond, its issuer or its guarantor(s) possess a credit rating by a rating agency recognised by the HKMA. <p>External Review Costs: covering transaction-related external review fees (e.g., including pre-issuance external review and post issuance external review or reporting) for eligible green and sustainable bond issuers and loan borrowers, including first-time and repeated issuers and borrowers.</p> <ul style="list-style-type: none"> Full cost of eligible expenses paid to recognised external reviewers, capped at HKD800,000 per bond issuance/loan.
Shenzhen ¹⁷⁵	8 January 2019 – 7 January 2022	<p>Green credit</p> <ul style="list-style-type: none"> A single maximum of 50% of the actual loan principal loss will be given to the cooperative bank as a subsidy if bank grants credit loans to green and low-carbon enterprises. The company will be given discounts according to 50% of the actual interest paid by the loan project. <p>Green bonds</p> <ul style="list-style-type: none"> For enterprises in Shenzhen city that have successfully issued green bonds, a subsidy of up to RMB500,000 will be given to a single project and a single company at 2% of the issuance scale. Incorporate the green collective bonds of small and medium-sized enterprises into the scope of re-guarantee for collective issuance of bonds in Shenzhen city. <p>Green insurance</p> <ul style="list-style-type: none"> Implement green insurance premium subsidies.
Guangzhou ¹⁷⁶	Since 16 July 2019	<p>Green finance organisation</p> <ul style="list-style-type: none"> Newly established or newly moved-in legal person financial institutions will be given a one-time reward of no more than RMB25m based on the paid-in capital scale. Newly established or newly moved-in financial institutions' regional headquarters as well as the professional subsidiaries (excluding equity investment institutions) approved or filed by the national financial regulatory authority will be given a one-time reward of RMB2m. <p>Green enterprises</p> <ul style="list-style-type: none"> Support green enterprises to list on domestic and foreign exchanges or list on the New Third Board and Guangdong Equity Exchange Centre for financing, and provide subsidies at different levels. <p>Green credit</p> <ul style="list-style-type: none"> Bank institutions whose green loan balances have increased to RMB2.5bn (inclusive) in the previous year will be given a subsidy of 0.02% of the loan balance increase, with a maximum of RMB1m. <p>Green insurance</p> <ul style="list-style-type: none"> The policy-based micro-loan guarantee insurance fund provides a premium subsidy of 1% of the loan principal to eligible borrowers, and the insurance company is compensated for the indemnity expenses caused by non-performing loans, according to regulations. <p>Green bonds</p> <ul style="list-style-type: none"> Enterprises that newly issue green bonds on the exchange market and the inter-bank market will be given a one-off subsidy of up to RMB1m at 10% of the issuance cost. For new green bonds issued in the regional equity market, a maximum of 20% of the issuance cost will be given a one-off subsidy of no more than RMB1m.

Target region	Time	Description
Guangzhou Development District ¹⁷⁷	30 July 2020 – 23 April 2025	<p>Green finance organisation</p> <ul style="list-style-type: none"> For the establishment of green branches, a one-time reward of RMB6m will be given. For the establishment of green financial institutions such as green branches and green finance business units (business centres), a one-time reward of RMB1m will be given. <p>Green loan</p> <ul style="list-style-type: none"> Eligible banking financial institutions will be given cumulative rewards in stages. Each banking financial institution will reward up to RMB2m per year. For companies and projects that have obtained green loans from banking financial institutions, a discount of 1% (annual interest rate) of the actual loan amount will be given, with a discount period of three years. <p>Green bonds and asset securitisation</p> <ul style="list-style-type: none"> An interest subsidy is given to each bond during its duration, and the discount rate is 10% of the actual accumulated interest payment each year. The issuer of green asset securitisation products will be rewarded in a proportion of 1% of the issued amount. <p>Green insurance</p> <ul style="list-style-type: none"> For the purchase of innovative green insurance products such as loan guarantee insurance, engineering quality potential defects insurance, green agriculture insurance, drug replacement liability insurance, carbon emission quota pledge loan guarantee insurance, etc., subsidies are provided at 50% of their premiums, with a maximum subsidy per enterprise per year of RMB300,000. Rewards will be given to insurance financial institutions that introduce insurance funds to support the development of green enterprises or projects. <p>Green fund</p> <ul style="list-style-type: none"> The guiding fund operates through the mode of establishing or increasing capital to participate in sub-funds in cooperation with social capital, focusing on investing in green enterprises and projects that can generate environmental benefits and reduce environmental costs and risks. <p>List of green companies</p> <ul style="list-style-type: none"> A total of RMB8m will be awarded to green enterprises listed on the domestic and foreign capital markets according to shareholding system reform, guidance and acceptance, and successful listing in stages. Provide hierarchical rewards to green enterprises listed on the New OTC Market. Reward green enterprises listed on the Guangdong Equity Exchange Centre and China Securities Private Equity Market.
Huadu District ¹⁷⁸	19 March 2020 – 18 March 2025	<p>Green credit</p> <ul style="list-style-type: none"> For enterprises registered in Huadu District to obtain green loans through commercial loans, subsidies will be given at 1% of the loan amount, with a maximum subsidy of RMB1m per year for each enterprise. Enterprises registered outside Huadu District and in Guangdong Province that obtain green loans through commercial loans through green branches in Huadu District will be subsidised at 0.5% of the loan amount, with a maximum subsidy of RMB500,000 per company per year. <p>Green insurance</p> <ul style="list-style-type: none"> Enterprises registered in Huadu District or the project site in Huadu District will be subsidised at 30% of their green insurance premiums, and each company will receive a subsidy of up to RMB100,000 per year. <p>Green bond</p> <ul style="list-style-type: none"> Institutions or enterprises that issue green bonds in Huadu District will be subsidised at a rate of 1% of the actual bond issuance. Each institution or company will subsidise up to RMB1m per year. <p>Risk compensation</p> <ul style="list-style-type: none"> For financial institutions in the district that carry out green financial services such as green credit and green bonds for enterprises in Huadu District, risk compensation will be given at 20% of their losses, up to RMB1m.

Annex III: Green debt instruments

Debt Instrument	Definition	Example
Supranational and sovereign green bonds	Proceeds are allocated to nominated projects and assets. Debt securities carry the credit rating of the issuing nation.	2017: Republic of France, EUR7bn Green OAT issued by the French Treasury
Sub-sovereign green bonds	Proceeds are allocated to nominated projects and assets within the sponsoring region. Credit rating is based on that of the issuing municipality and the credit quality of the underlying assets.	2019: Jiangxi Province of China, RMB300m (USD42m) The first municipal green bond from China, proceeds allocated to the construction of a comprehensive underground trench and intelligent urban underground utility tunnel project.
General obligation green bond	Proceeds allocated to nominated projects and assets within the sponsoring region. They are backed by balance sheet assets. The bond will carry the credit rating of the issuing entity.	2017: DBS Group, USD500m Proceeds allocated to green buildings, transport, renewable energy, energy efficiency, waste and adaptation.
Green revenue bond	Proceeds are allocated on nominated projects and assets. As the green bonds are backed at least partially by the issuer's revenue stream, bonds carry the credit rating of the issuing entity.	2014: State of Hawaii, USD150m ABS deal secured on the green infrastructure fee collected by utility companies via electricity bills. The bond raised funds to provide loans to finance renewable energy and for energy efficiency projects.
Green structured finance	Debt securities backed by a pool of underlying assets. Proceeds are allocated only to nominated projects and assets. The credit risk is dependent on the asset risks.	2018: National Australia Bank, AUD200m Secured notes for the refinancing of wind and solar assets. The structure is backed by loans to Australian renewable energy developers.
Green securitisation Green tranches in ABS and MBS deals	Debt securities backed by a pool of underlying assets. Proceeds are allocated only to nominated projects and assets. The credit risk is dependent on the asset risks.	2019: Guangzhou Metro Group Co. Ltd., RMB3bn in 6 tranches - RMB1.5bn for rail transit projects and RMB1.5bn to repay bank loans and to supplement general working capital. This deal is secured on subway ticket revenue receivables.
Green convertible bond	Proceeds are allocated on nominated projects and assets. The security can be converted into a predetermined amount of the company's common stock. The bond will carry the credit rating of the issuing entity.	2019: Jinneng Science & Technology Co., Ltd. RMB1.5bn, 1.5m pieces of convertible corporate bond with every piece valued RMB100.
Green exchangeable bond	A type of hybrid security consisting of a straight bond and an embedded option to exchange the bond for the stock of a company other than the issuer (usually a subsidiary or company in which the issuer owns a stake) at some future date and under prescribed conditions.	2019: China Three Gorges Corporation (CTG), RMB20bn issued green exchangeable bonds to individual investors online and to institutional investors offline. This was the first issuance of green exchangeable corporate bonds in the Chinese securities market, and the biggest so far.
Green project bond	Proceeds are allocated on nominated projects and assets. Credit rating is based on the quality of the backing green assets and the returns stream of the underlying project.	2016, AP Renewables, PHP10.7bn (USD226m) green bond, certified under the Geothermal Criteria of the Climate Bonds Standard. The Asian Development Bank provided credit enhancement by guaranteeing 75% of the bond.
Environmental impact bonds / pay-for-results green bonds	Proceeds allocated to nominated green projects/ assets. Part of the project's risk is transferred from the issuer to investors. The payments to investors are conditional to the project achieving an expected outcome after a third-party evaluation has been conducted.	2016: DC Water and Sewer Authority, USD25m private placement to finance the construction of infrastructure to slow surges of stormwater. If the outcome meets expectations, no contingent payment will be due to investors. If it exceeds expectations, DC Water will make an outcome payment to investors. If it does not meet expectations, investors will make a Risk Payment Share to DC Water.

Debt Instrument	Definition	Example
Private placement	Green bond placed directly with the investor/s. Details of the deal such as pricing and maturity may remain confidential, but the issuer is expected to disclose details on the nominated projects and assets to be financed.	2018: Sichuan Railway Investment Group Co., Ltd., RMB1bn (USD144m) private placement green bond for the construction of inter-city high-speed railway of 220.65km in length to will connect 4 cities in the Sichuan Province, with a maximum speed of 350km/h.
Green loans, syndicated loans and credit lines	Provide lending to encourage market development in climate-aligned sectors in line with the Climate Bonds Taxonomy and in compliance with the Green Loan Principles. Interest rates are based on borrower credit scores or an ESG score assigned by an ESG rating agency.	2019: Industrial and Commercial Bank of China, London Branch, USD400m BNP Paribas & HSBC signed a mandate letter on a dual currency green term loan facility.
Mezzanine and subordinated debt	Proceeds are allocated on nominated projects and assets. Hybrid capital investments, from development banks seeking to support private investment in the senior debt or from investors with a higher risk appetite.	2020: Energias de Portugal, S.A., EUR750m subordinated green notes. EDP priced the fixed to reset rate subordinated notes issuance with an early redemption option exercisable by EDP 5.25 years after issue, final maturity date in July 2080 and a yield of 1.75% (coupon of 1.7%) up to the first reset date to happen 5 years and 6 months after issuance.
Dual recourse	Unlike asset-backed securities created in securitization, the covered bonds (sometimes known as “dual recourse”) continue as obligations of the issuer; in essence, the investor has recourse against the issuer and the collateral.	2016: Bank of China, USD500m (RMB3.38bn, EUR451m) A three-year green issue backed by a portfolio of 11 green bonds from six issuers. The deal is the first from China to be marketed as a covered bond.

Annex IV: Common green equity instruments in Asia

Equity Instrument	Definition	Example
Public Private Partnership (PPP)	A long-term contract between a public entity and a private party aimed at developing and supporting a public asset or service. The private party takes on significant risk and management responsibility, and remuneration is linked to performance.	The Shenzhen Gongming Water Purification Plant Phase II PPP Project involves the investment, financing, design and construction of a water purification plant which can treat one million tons of water per day. The PPP structure of this project is build-operate-transfer. ¹⁷⁹
Joint venture, partnership	Business agreement between two or more parties that pool their capital, skills and resources to achieve a specific project or business activity.	The Shenzhen Metro Line 13 PPP project has a joint venture structure with MTR Consulting and the China Railway Electrification Bureau EEB holding 83% and 15% respectively, with the remaining 2% held by a subsidiary of the Shenzhen government.
Private equity (PE), venture capital, and unlisted equity funds	Fund allocations to innovative pilot scale green projects including for qualified green infrastructure. Aid project developers and entrepreneurs to secure a funding stream for green projects. PE often incorporates green indicators into the process.	The Renewable Energy Asia Fund (REAF I) and REAF II invest in small hydro, wind, geothermal, solar and biomass projects in Asian developing markets, with a primary focus to date in India, the Philippines, and Indonesia. ¹⁸⁰ REAF made equity investments in small renewable energy projects such as on-grid solar, wind, waste-to-energy and hydropower projects of between 5 MW and 100 MW in these three countries. ¹⁸¹
Subsidiary/project financing vehicles/ YieldCos	Use of proceeds to fund a portfolio of (off-balance sheet) green projects. Private or publicly traded vehicles consisting of pools of long-term cash-generating green assets, may have tax advantages.	City Developments Limited (CDL) issued an S\$100m (USD71m) senior secured Certified Climate Bond in April 2017 through its wholly owned subsidiary CDL Properties Ltd to refinance an intercompany loan extended by CDL to CDLP for Republic Plaza, one of Singapore's tallest skyscrapers and a premium Grade A office building in the heart of Singapore's Central Business District. US YieldCos Terraform Global and Terraform Power were established by SunEdison in 2015 and issued green bonds to finance solar, hydro and wind assets.
Green Exchange-Traded Funds (ETFs)	The fund buys green bonds to replicate a public index.	Solactive/Carbon Care Asia's Sustainability Bond Index has been created and hopes to generate sufficient interest to get ETFs going, providing new liquidity (from retail investors, for example) to the green bond market.

Annex V: Green standards applicable in the GBA

Green Standard	Description	Sector(s)	Applicability in the GBA
Green Industry Guiding Catalogue (2019 Edition) ¹⁸²	The Guiding Catalogue issued by seven agencies including NDRC in 2019 provides policies and guidelines for the other policy makers to follow when formulating relevant guidelines for green financing products, including green bonds.	Energy-saving, environmental protection, clean production, and clean energy industries	The Catalogue can be applied in the GBA.
Green Bond Endorsed Project Catalogue (2021 Edition) ¹⁸³	The 2021 Edition was jointly released by PBoC, NDRC, CSRC on 21 April 2021. It harmonises different standards of green bonds, and promotes the integration of the domestic green bond market.	Energy saving pollution prevention and control, resource conservation and recycling, clean transportation, clean energy, and ecological protection and climate change adaption.	The Catalogue can be applied in the GBA.
Administrative Measures for the Certification of Green Enterprises and Green Projects in the Green Finance Reform and Innovation Pilot Zone in Guangzhou City, Guangdong Province ¹⁸⁴	These Measures were issued by Huadu District Government Office, Guangzhou City in 2019, and they are applicable to the application, identification and management of green enterprises and green projects in the Green Finance Innovation Pilot Zone of Guangzhou City, Guangdong Province.	Clean energy, energy saving, green buildings, green transportation, green industrial equipment manufacturing, ecological agriculture and forestry, pollution prevention and control, resource conservation and recycling, and ecological protection and climate change adaption.	The Certification can be applied in Guangzhou City, Guangdong Province. Companies registered in Hong Kong and Macao invest in projects located in Guangzhou City, which are also applicable to this certification method.
Administrative Measures for the Certification of Green Projects and Green Enterprises in Guangzhou Development Zone, Huangpu District, Guangzhou City (for Trial Implementation) ¹⁸⁵	These Measures were issued by Guangzhou Development District Financial Work Bureau, Guangzhou City in 2020, and they are applicable to the application, identification and management of green enterprises and green projects. The management of green project certification includes independent application, third-party certification and evaluation, and government service supervision.	Green upgrading of industrial parks, green strategic emerging industries, industrial green transformation and upgrading, green urban infrastructure, green transportation infrastructure, ecological environment industry.	These Measures are applicable to the application, identification and management of green projects within Huangpu District, Guangzhou Development Zone and their entrusted management, and parks under their jurisdiction.
Hong Kong Green Finance Certification Scheme (GFCS) ¹⁸⁶	This scheme, issued by Hong Kong Quality Assurance Agency in 2016, aims to help the financial sector explore new commercial and business opportunities in the green finance market, promoting a common understanding of green finance, and fostering environmentally-friendly investments.	Green finance	The Certification Scheme can be applied in the GBA.
Assessment Standard for Green Building, (GB/T 50378-2019) ¹⁸⁷	The new Assessment Standard for Green Building was approved by Ministry of Housing and Urban-Rural Development (MoHURD) as a national standard, and was put into effect on 1 August 2019. In this Standard, the definition, assessment criteria and assessment method of green building are clarified, which plays a significant role in promoting green building development in China.	Building	The Standard can be applied in the Guangdong Province.

Green Standard	Description	Sector(s)	Applicability in the GBA
Assessment Standard for Green Building (Macao Version) ¹⁹⁰	The Macao version was issued in 2015, and it follows the China Assessment Standard, and according to the actual situation of the Macao SAR, some provisions have been modified, supplemented or replaced.	Building	The Standard can be applied in the Maca.
Building Environmental Assessment Method (BEAM) Plus ¹⁹¹	BEAM Plus assessment is Hong Kong's leading initiative to offer independent assessments of building sustainability performance.	Building	The Assessment Method can be applied in Hong Kong.
Climate Bonds Taxonomy ¹⁹²	Climate Bonds Taxonomy is used to identify green projects and assets which are aligned with achieving the goals of the Paris Agreement. This excludes fossil fuel power generation, internal combustion engine personal vehicles and new roads and infrastructure that facilitate their movement, as well as freight rail that is primarily used for fossil fuel transportation.	Energy, Transport, Water, Buildings, ICT, Waste, Nature Based Assets, Industry and Commercial activities.	The Taxonomy can be applied in the GBA.
Environmental Management Systems (ISO 14001) ¹⁹³	<p>The ISO 14001 standard specifies requirements for an effective environmental management system (EMS). It provides a framework that an organisation can follow to better control its environmental impacts.</p> <p>The majority of China ISO 14001 certificates are issued by certification bodies which are accredited by CNAS (China National Accreditation Service), China's member of the IAF (International Accreditation Forum).</p>	Waste, commercial activities	The standard can be applied in China. ¹⁸⁸ As of January 2019, over 210,000 organisations have passed the ISO14001 certification and obtained the ISO14001 certificate. ¹⁸⁹
China energy management systems (GB/T 23331-2012/ISO 50001: 2011) ¹⁹⁴	This standard is equivalent to international standard ISO 50001:2011. The ISO 50001 standard establishes an international framework for the supply, use and consumption of energy in industrial, commercial and institutional organisations. Implement an ISO 50001 compliant sustainable energy management system and demonstrate an organisation's commitment to continuously improving energy performance, leading to economic benefits and reduced greenhouse gas emissions.	Renewable energy, energy efficiency	The standard can be applied in Guangdong Province and does not include Hong Kong and Macao.

Green Standard	Description	Sector(s)	Applicability in the GBA
China Certified Emission Reductions (CCERs)	CCERs are issued by the relevant national institution for voluntary carbon emissions management. CCERs, as a supplementary mechanism of the emission trading market, are a kind of accredited carbon asset and can be used for companies' compliance as well as for a company's or personal voluntary emission reduction.	<p>Project type limit for offset:</p> <p>Guangdong¹⁹⁵:</p> <ol style="list-style-type: none"> 1. Emission reduction projects mainly from CO₂ or CH₄, which means these two GHGs emission reductions should be more than 50% of all GHG emission reductions. 2. Non-hydro CCER, non-electricity generation, heat addition and complementary energy (including heat, press and gas) CCER projects from coal, oil and natural gas (except coal bed gas). 3. Non-CDM projects whose emission reductions were generated before they were registered with the UN CDM EB. <p>Shenzhen¹⁹⁶:</p> <ol style="list-style-type: none"> 1. Some renewable energy and new energy projects like wind power generation, solar power generation and waste incineration power generation, village biogas and biomass power generation. 2. Clean transportation emission reductions. (3) Ocean carbon sequestration. (4) Forestry carbon sink. (5) Agricultural emission reductions. 	CCERs can be applied in Guangdong Province and Shenzhen according to the pilot CCERs project type limit.
PuHui Certified Emission Reductions (PHCER) ^{197, 198}	Guangdong launched the first batch of the PHCER pilot schemes in July 2015. By quantifying and pricing energy saving and emission reduction behaviours of small and medium-sized enterprises, households and individuals, the Province established an encouraging mechanism that combines commercial incentives, incentive policies, and trading of certified emission reductions.	Forestry, distributed photovoltaics, high-efficiency energy-saving air conditioners, household air source heat pump water heaters, bicycle riding.	PHCER can be applied in Guangdong Province. After participating in PHCER, companies or individuals should not re-declare CCER.

Annex VI: Sample green pipeline

This sample pipeline includes a list of 'green' and 'potentially green' projects taken from various publicly available sources.

Projects are categorised as green when we have a high degree of confidence, based on publicly available information that this project aligns with the Climate Bonds Taxonomy.

Projects are categorised as potentially green when there is a strong possibility that these

are aligned with the Climate Bonds Taxonomy, but it is difficult to confirm alignment without going through the full and in-depth certification process. For example, the Water criteria under the Climate Bonds Standard require an in-depth assessment which is not possible to make with publicly available information.

Six sectors are covered in the list, including: low-carbon transport, renewable energy,

sustainable water management, sustainable waste management, green buildings and new infrastructure. The assessment of the 'greenness' of each project was based on the Climate Bonds Taxonomy (see back cover).

Please note that this is not an exhaustive list, and in order to include more diverse projects, project types, location and cost are considered.

Green Project						
Sector	Project name	Proponent	Location	Status	Cost	Greenness
 Transport	Shatin to Central rail link ¹⁹⁹	MTR Co., Ltd.	Hong Kong	Under construction	HKD99.1bn (USD12.79bn)	Green
	Sai Van LRT Bridge (connecting LRT Taipa line and the Macao Peninsula) ²⁰⁰	Macao SAR Construction and Development Office	Macao	Under construction	MOP11bn (USD1.38bn)	Green
	LRT Hengqin Line ²⁰¹	Macao SAR Construction and Development Office	Macao	Under construction	MOP3.5bn (USD438.6m)	Green
	Guangzhou Urban Rail Transit Line 18 Project ²⁰²	Guangzhou Metro Group Co., Ltd.	Guangzhou	Under construction	RMB49bn (USD7.5bn)	Green
	Shenzhen Metro Line 12 PPP Project ²⁰³	Shenzhen Metro Company Co., Ltd	Shenzhen	Planned	RMB9.96bn (USD1.5bn)	Green
	Shenzhen Airport to Daya Bay Intercity Railway ²⁰⁴	Shenzhen Metro Company Co., Ltd	Shenzhen	Under construction	RMB52.6bn (USD8bn)	Green
	Shenzhen-Shanwei high-speed railway ²⁰⁵	Shenzhen Metro Company Co., Ltd	Shenzhen, Huizhou	Under construction	RMB48.5bn (USD7.4bn)	Green
	Shenzhen Airport to Qianhai Section of Guangzhou-Dongguan-Shenzhen Intercity Railway ²⁰⁶	Shenzhen Metro Company Co., Ltd	Shenzhen, Guangzhou, Dongguan	Under construction	RMB11.9bn (USD1.8bn)	Green
	Shenzhen-Jiangmen Section of Shenmao Railway ²⁰⁷	China Railway Guangzhou Bureau Group Co., Ltd.	Shenzhen, Zhongshan, Jiangmen	Under construction	RMB52.1bn (USD7.99bn)	Green
	Shenzhen-Nanning Railway Jiangmen to Pearl River Delta Hub Airport Section ²⁰⁸	Provincial Railway Construction Investment Group Co., Ltd.	Jiangmen, Zhaoqing	Under construction	RMB18.6bn (USD2.9bn)	Green
	Foguan Intercity Guangzhou South Railway Station to Wanghong Section ²⁰⁹	Guangdong Pearl River Delta Intercity Rail Transit Co., Ltd.	Guangzhou, Dongguan	Completed	RMB12.9bn (USD1.98bn)	Green
	Guangzhou to Shanwei Railway ²¹⁰	China Railway Guangzhou Bureau Group Co., Ltd.	Guangzhou, Huizhou, Shanwei, Shenzhen	Under construction	RMB43bn (USD6.6bn)	Green
	Section from Foshan West Station to Guangzhou South Station on the Guangfo Ring Road ²¹¹	Guangdong Pearl River Delta Intercity Rail Transit Co., Ltd.	Guangzhou, Foshan	Under construction	RMB18bn (USD2.8bn)	Green
	PPP Reconstruction Project of Dongguan Rail Transit Line 1 Phase I Project ²¹²	Dongguan Municipal Development and Reform Bureau	Dongguan	Under construction	RMB64.74bn (USD9.9bn)	Green
Huangpu District Tram Line 1 (Changlingju-Luogang) PPP project ²¹³	Guangzhou Development District Financial Investment Construction Project Management Centre	Guangzhou	Under construction	RMB2.88bn (USD442m)	Green	

Green Project

Sector	Project name	Proponent	Location	Status	Cost	Greenness
Solar 	Guangzhou Juneng New Energy co., Ltd. Distributed Photovoltaic Power Generation Project²¹⁴	Guangzhou Juneng New Energy Co., Ltd.	Guangzhou	Completed	RMB35m (USD5.3m)	Green
	Beijing Enterprises Clean Energy Group (Guangdong) Zhongye Sewage Treatment Co., Ltd. 2.4MWp Distributed Photovoltaic Power Generation Project²¹⁵	Guangzhou Fuhuan New Energy Development Co., Ltd.	Guangzhou	Completed	RMB18.1m (USD2.8m)	Green
	Guangdong Yudean Zhaoqing Deqing Photovoltaic Poverty Alleviation Project²¹⁶	Guangdong Electric Power Development Co., Ltd.	Zhaoqing	Completed	RMB287.9m (USD44m)	Green
Wind 	Zhuhai Jinwan Offshore Wind Farm Project²¹⁷	Guangdong Yudean Zhuhai Offshore Wind Power Co., Ltd.	Zhuhai	Under construction	RMB5.74bn (USD880m)	Green
	CGN Huizhou Port No. 2 PA/PB Offshore Wind Farm Project²¹⁸	CGN New Energy (Huizhou) Co., Ltd.	Huizhou	Under construction	RMB13.26bn (USD2bn)	Green
	CGN Deqing Dadingshan Wind Farm²¹⁹	CGN New Energy Investment (Shenzhen) Co., Ltd. South China Branch	Zhaoqing	Under construction	RMB450m (USD69m)	Green
Sustainable Water Management 	Additional Sewage Rising Main and Rehabilitation of the Existing Sewage Rising Main between Tung Chung and Siu Ho Wan²²⁰	Environmental Protection Department of the HKSAR Government	Hong Kong	Under construction	HKD1.36bn (USD175m)	Potentially green
	Outlying islands Sewerage, Stage 2 – Upgrading of Cheung Chau Sewage Treatment and Disposal Facilities²²¹	HK SAR Drainage Services Department	Hong Kong	Under construction	HKD2.6bn (US335m)	Potentially green
	Tseung Kwan O sewerage for villages²²²	HK SAR Drainage Services Department	Hong Kong	Under construction	HKD228m (USD29m)	Potentially green
	Rehabilitation of underground stormwater drains stage 2²²³	HK SAR Drainage Services Department	Hong Kong	Under construction	HKD515m (USD66m)	Potentially green
	Pinggang-Guangchang Raw Water Supply Guarantee Project²²⁴	Zhuhai Water Holding Group	Macao, Zhuhai	Completed	RMB856m (USD131m)	Potentially green
	Water diversion and storage project of Qinglin Road in Shenzhen²²⁵	Shenzhen Water Affairs Bureau	Shenzhen	Planned	TBD	Potentially green
	Flood Control (Tide) Drainage Project in Baguang Area²²⁶	Shenzhen Water Affairs Bureau	Shenzhen	Planned	TBD	Potentially green

Green Project

Sector	Project name	Proponent	Location	Status	Cost	Greenness
Sustainable Water Management 	'Every village coverage' tap water project in Huidong County ²²⁷	Huidong County Water Affairs Bureau	Huizhou	Under construction	RMB448m (USD68.7m)	Potentially green
	Guangzhou Beijiang Water Diversion Project (Water Source Project) ²²⁸	Guangzhou Beijiangyuan Water Supply Co., Ltd.	Guangzhou	Under construction	RMB2.34bn (USD358.9m)	Potentially green
	Pollution Remediation Project for Guangzhou and Foshan Transboundary Rivers ²²⁹	Foshan City Government	Foshan	Under construction	RMB16.99bn (USD2.6bn)	Potentially green
	Black and odorous (not up to standard) water body improvement and upgrading project ²³⁰	Zhongshan City Agent Construction Project Management Office	Zhongshan	Under construction	RMB20.22bn (USD3.1bn)	Potentially green
	Sponge City Pilot PPP Project in the Western Central City (Jinwan District) ²³¹	Housing and Urban-Rural Development Bureau of Jinwan District, Zhuhai City	Zhuhai	Under construction	RMB1.7bn (USD260.7m)	Potentially green
	The second round of PPP projects for the construction of rural domestic sewage treatment facilities in Taishan City ²³²	Taishan Water Resources Bureau	Jiangmen	Under construction	RMB896m (USD137m)	Potentially green
	Improvement works for the Macao Peninsula Sewage Treatment Plant ²³³	Environmental Protection Bureau of Macao SAR	Macao	Under construction	MOP465.8m (USD58.4m)	Potentially green
	Flood Control Project from Fai Chi Kei to Ilha Verde ²³⁴	Land, Public Works and Transport Bureau of Macao SAR	Macao	Under construction	MOP26.1m (USD3.3m)	Potentially green
	Design, construction, operation and maintenance of temporary sewage treatment facilities near the outer port terminal	Environmental Protection Bureau of Macao SAR	Macao	Under construction	MOP99.9m (USD12.5m)	Potentially green
	New port sewage interception pipe design and construction contracting project ²³⁵	Land, Public Works and Transport Bureau of Macao SAR	Macao	Under construction	MOP336m (USD42m)	Potentially green
Sustainable Waste Management 	O-PARK1 ²³⁶	Environmental Protection Department of the HKSAR Government	Hong Kong	Completed	HKD1.59bn (USD205m)	Potentially green
	Mawan Urban Energy Ecological Park Project ²³⁷	Shenzhen Energy Environmental Protection Co., Ltd.	Shenzhen	Completed	RMB1.27bn (USD194.8m)	Potentially green
	Shenzhen East Power Plant Phase II Project ²³⁸	Shenzhen Energy Co., Ltd.	Shenzhen	Planned	TBD	Potentially green
	Zhengqi Construction Waste Comprehensive Utilisation Base Project in Pingshan District ²³⁹	Shenzhen Grand Industrial Zone Renewable Resources Co., Ltd.	Shenzhen	Planned	TBD	Potentially green

Green Project

Sector	Project name	Proponent	Location	Status	Cost	Greenness
Sustainable Waste Management 	Green Industrial Service Project of Dongguan Haixinsha Resource Comprehensive Utilisation Centre²⁴⁰	Dongguan Xindongxin Environmental Protection Investment Co., Ltd.	Dongguan	Under construction	RMB1.9bn (USD291.4m)	Potentially green
	Guangzhou Fourth Resources Thermal Power Plant Phase II Project and Supporting Facilities²⁴¹	Guangzhou Huantou Nansha Environmental Energy Co., Ltd.	Guangzhou	Under construction	RMB2.66bn (US408m)	Potentially green
	Guangzhou Fifth Resources Thermal Power Plant Phase II Project and Supporting Facilities²⁴²	Guangzhou Huacheng Environmental Protection Energy Co., Ltd.	Guangzhou	Under construction	RMB2.21bn (US339m)	Potentially green
	Green Industry Service Centre Project (Hazardous Waste treatment)²⁴³	Dongjiang Environmental Co., Ltd.	Zhuhai	Under construction	RMB450m (USD69m)	Potentially green
	Boluo County Domestic Waste Incineration Power Plant Expansion Project and Restaurant Kitchen Waste Co-processing Project²⁴⁴	Everbright Environmental Energy (Bolo) Co., Ltd.	Huizhou	Under construction	RMB556m (USD85m)	Potentially green
	Huadu Construction Waste Recycling and Comprehensive Utilisation Project²⁴⁵	Guangdong Xinruilong Ecological Building Material Co., Ltd.	Guangzhou	Completed	RMB120m (USD18.4m)	Potentially green
	PPP project of terminal classification and treatment of rural domestic waste in Huaiji County²⁴⁶	Housing and Urban-rural Planning and Construction Bureau of Huaiji County	Zhaoqing	Under construction	RMB246.16m (USD37.75m)	Potentially green
	Sihui Environmental Energy Thermal Power Plant Project²⁴⁷	Zhaoqing Boneng Renewable Resources Power Generation Co., Ltd.	Zhaoqing	Under construction	RMB714m (USD109.5m)	Potentially green
	Design and construction of the third phase expansion project of Macao Waste Incineration Centre²⁴⁸	Environmental Protection Bureau of Macao SAR	Macao	Under construction	MOP2.57bn (USD322m)	Potentially green
Green buildings 	Inland Revenue Tower in the Kai Tak Development²⁴⁹	Inland Revenue Department of the HKSAR Government	Hong Kong	Under construction	HKD3.6bn (US464.5m)	Green
	Government Data Centre Complex²⁵⁰	Architectural Services Department	Hong Kong	Under construction	HKD2.25bn (USD290.3m)	Green
	Joint-user Government Office Building in Cheung Sha Wan²⁵¹	Architectural Services Department	Hong Kong	Under construction	HKD2.28bn (US294.2m)	Green
	PPP project of underground comprehensive pipe gallery project in Pazhou West District²⁵²	Guangzhou Road Engineering Research Centre	Guangzhou	Under construction	RMB1.8bn (USD276m)	Green

Green Project

Sector	Project name	Proponent	Location	Status	Cost	Greenness
Green buildings 	Plot A (Self-numbering) 9# Building Plot of Guangzhou International Innovation City Phase I Project (GB/T50378-2014 Three-star)²⁵³	Guangzhou Bike Smart City Development and Construction Investment Co., Ltd.	Guangzhou	Under construction	RMB193.5m (USD29.7m)	Green
	Guangzhou Pengrun Cloud Project (GB/T50378-2014 Three-star)²⁵⁴	Guangzhou Pengkang Real Estate Development Co., Ltd., Gome Holding Group Guangzhou Co., Ltd.	Foshan	Under construction	RMB2.2bn (USD337.4m)	Green
	China State-owned Capital Venture Capital Building²⁵⁵	Shenzhen Investment Control Development Co., Ltd.	Shenzhen	Under construction	RMB3.53bn (USD541.4m)	Green
	Hongyi Building²⁵⁶	Shenzhen Hongyi Hengsheng Real Estate Co., Ltd.	Shenzhen	Completed	RMB920m (USD141.1m)	Green
	WeBank Building²⁵⁷	Shenzhen Qianhai WeBank Co., Ltd.	Shenzhen	Under construction	RMB3.79bn (USD581.3m)	Green
	China Resources Sungang Vientiane Plaza (residential and apartment part)²⁵⁸	Shenzhen Sungang China Resources Land Development Co., Ltd.	Shenzhen	Completed	RMB7.16bn (USD1.1bn)	Green
	The First Affiliated (Nansha) Hospital of Sun Yat-sen University International Healthcare Centre (GB/T50378-2014 Three-star)²⁵⁹	Guangzhou Nansha District Construction Centre	Guangzhou	Under construction	RMB4.8bn (USD736.2m)	Green
	Guangzhou Commercial Centre²⁶⁰	Guangzhou Industrial and Commercial Union Investment Co., Ltd.	Guangzhou	Under construction	RMB5bn (USD766.9m)	Green
New infrastructure 	Guangdong Telecom 5G/4G mobile network construction project²⁶¹	China Telecom Co., Ltd. Guangdong Branch	Guangdong Province	Planned	RMB5bn (USD766.87bn)	Potentially green
	Guangdong Tower Mobile Communication Infrastructure Project²⁶²	China Tower Co., Ltd. Guangdong Branch	Guangdong Province	Planned	RMB3.84bn (USD588.96m)	Potentially green
	Guangdong Telecom Rural Information Infrastructure Construction Natural Village Optical Network Coverage Project²⁶³	China Telecom Co., Ltd. Guangdong Branch	Guangdong Province	Planned	RMB80m (USD12.27m)	Potentially green
	Expansion of Guangzhou GAC's annual production capacity of 200,000 vehicles (new energy vehicles)²⁶⁴	GAC Toyota Motor Co., Ltd.	Guangzhou	Under construction	RMB6.34bn (USD972.4m)	Potentially green
	Jiangmen Umicore New Energy Vehicle Lithium Battery Material Project²⁶⁵	Umicore Chang Xin New Materials Co., Ltd.	Jiangmen	Under construction	RMB2.61bn (USD398.8m)	Potentially green
	Dongguan East Industrial Park, Guancheng Park, New Energy Auto Parts²⁶⁶	Dongguan Keihin Automobile EFI Equipment Co., Ltd.	Dongguan	Under construction	RMB1bn (USD153.4m)	Potentially green
	Guangdong Mobile Communication Infrastructure Project²⁶⁷	China Mobile Communications Group Guangdong Co., Ltd.	Guangdong Province	Under construction	RMB6bn (USD920.3m)	Potentially green

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Climate Bonds Taxonomy

The Climate Bonds Taxonomy identifies the assets and projects needed to deliver a low carbon economy and gives GHG emissions screening criteria consistent with the 2-degree global warming target set by the COP 21 Paris Agreement. More information is available at <https://www.climatebonds.net/standard/taxonomy>.



ENERGY	TRANSPORT	WATER	BUILDINGS	LAND USE & MARINE RESOURCES	INDUSTRY	WASTE	ICT
Solar	Private transport	Water monitoring	Residential	Agriculture	Cement production	Preparation	Broadband networks
Wind	Public passenger transport	Water storage	Commercial	Commercial Forestry	Steel, iron & aluminium production	Reuse	Telecommuting software and service
Geothermal	Freight rail	Water treatment	Products & systems for efficiency	Ecosystem conservation & restoration	Glass production	Recycling	Data hubs
Bioenergy	Aviation	Water distribution	Urban development	Fisheries & aquaculture	Chemical production	Biological treatment	Power management
Hydropower	Water-borne	Flood defence		Supply chain management	Fuel production	Waste to energy	
Marine Renewables		Nature-based solutions				Landfill	
Transmission & distribution						Radioactive waste management	
Storage							
Nuclear							

Certification Criteria approved
 Criteria under development
 Due to commence

10/2020



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Authors: Laqiqige Zhu, Ivy Lau
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