DATA CENTRES IN MAINLAND CHINA

FOUR POINTS TO PROCESS IN **2022**

Greater China Research

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Executive Summary

Mainland China's data centre market is evolving rapidly. As investors and developers invest/further invest, there are many themes, topics, and issues to consider. In our report we look at four key points and they are:

- The market;
- Government policy;
- Investment, and;
- Environmental sustainability.

The Market

At the beginning of 2021, cabinet stock in Mainland China touched 3.6 million, with the anticipation that this number will surpass 4 million by the end of the year/beginning of 2022.

The Beijing-Tianjin-Hebei region, the Yangtze River Delta region and the Pearl River Delta region continue to maintain strong data centre construction impetus, both in terms of the number of new cabinets and aggregate inventory.

Government Policy

One of the most important data centre industry-related policies released recently in Mainland China is "The Three-year Action Plan for New Data Centre Development (2021-2023)". The basic actions of the plan are:

- The optimisation of construction layout;
- The upgrading of network quality;
- The enhancement of computing power;
- The strengthening of the industrial chain;
- 'Green' and low-carbon development, and;
- Safety and reliability.

Investment

Domestic data centre financing conduits in Mainland China are varied. They are largely split into equity financing and debt financing, including public offering, rights issue, private placement, bond financing, bank loans and other instruments.

Given the appealing cap rate that data centre projects can offer, many investors of late have paid much attention to data centre properties in China. These investors have executed on investment deals via a number of methods, such as directly purchasing data centre property assets, forming a joint venture company, or utilising financing channels.

Data centres require large capital investment, and the trial of a domestic REITs market will beget new financing channels to listed companies.

The recent REITs documents jointly delivered by the China Securities Regulatory Commission and the National Development and Reform Commission (NDRC) pointed out that the ownership of REITs projects should be well-defined, and pertinent procedures, such as acceptance, land use, environmental assessment, planning, project investment management, operation, cash flow and investment returns, should be met as required.

Sustainability

In the face of global warming, Mainland China has propositioned the strategic goal of "reaching a carbon peak by 2030 and going carbon neutral by 2060." Data centres, on the other hand, transform electricity into computing power, and so with the swift growth of digital demand, data centres are progressively requiring a greater amount of electricity for centre operational purposes.

The dramatic acceleration of global data centre markets has raised concerns around the impact the sector has on the environment. With the extremely high consumption of power by data centres and the significant carbon footprint the sector generates, there is a need to strengthen sector-wide standards and commitments for sustainable data centre operations. Governments around the world are forcing the data centre sector towards 'greener' operations with new regulations, and even moratoriums.

In light of this, the National Development and Reform Commission, the Cyberspace Administration of China, the Ministry of Industry and Information Technology and the Energy Administration have jointly issued the "Guidance on Accelerating the Construction of the Collaborative Innovation System of Integrated Big Data Centre" and other documents. These policies aim to guide future data centre development in Mainland China along a sustainable 'green' path, whereby, among other aspects, new development:

- Is systematic, coordinated and orderly;
- Ensures energy-use efficiency, and;
- Utilises energy from renewable energy sources where possible.

Moreover, demand pressure for data centre carbon neutrality is also arising from user enterprises, as they try to achieve their yearly environment, social and governance (ESG) rating objectives.

Over the years, the data centre industry in Mainland China has looked at various energy-saving and 'green' technology initiatives. Some data centres in the country have been able to reduce their power usage effectiveness (PUE) value to 1.1 or below. In the long term, regarding the aspiration of going carbon neutral, energy efficiency and energy saving are just small steps in the whole journey to discover a true solution.

Moreover, carbon offsetting, carbon trading, carbon capture and other analogous initiatives are also somewhat limited when contemplating the overall objective. For a long-term total solution, the generation and use of renewable energy are the keys to unlocking and revealing the real 'green' solution.

Introduction

This report focuses on four major points to deliberate when investing in data centre projects in Mainland China.

The report begins by centring on the first point to consider — The data centre market in Mainland China — before looking at the second consideration point — Data centre-related government policy in the country.

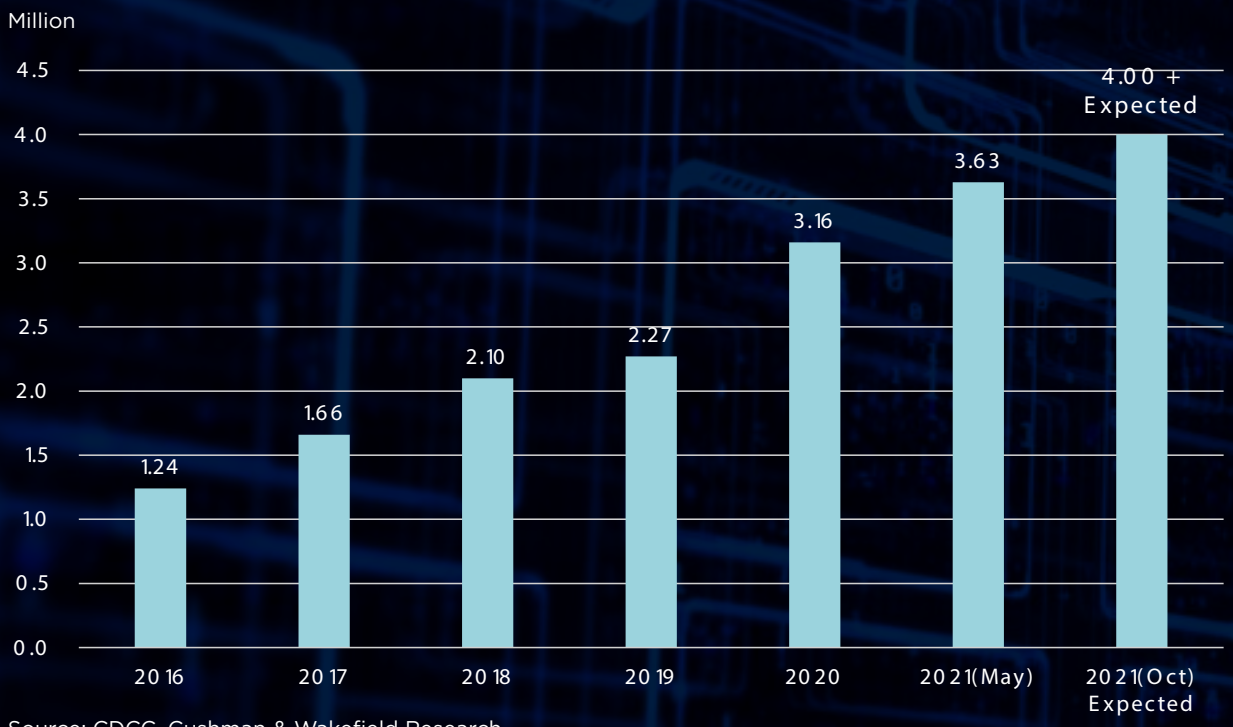
Data centre investment itself in Mainland China is the third consideration point to be examined, with the report finishing with the fourth point to consider — The topic of environmental sustainability in Mainland China.

The Four Points to Process

The Market

According to CDCC statistics, as of early 2021, cabinet stock in Mainland China reached 3.6 million, with the expectation that this indicator figure will exceed 4 million by the end of the year/beginning of 2022 (Figure 1).

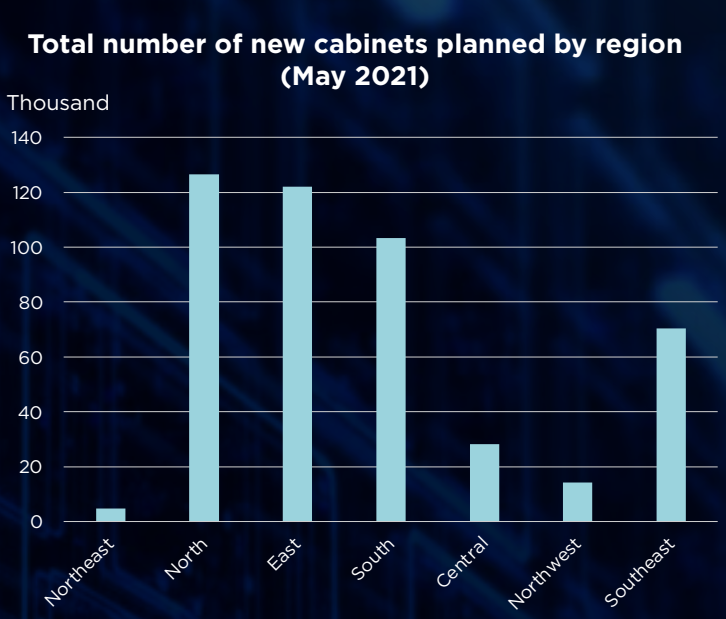
Figure 1:
Cabinet stock in Mainland China – Timeline (2016-Oct 2021)

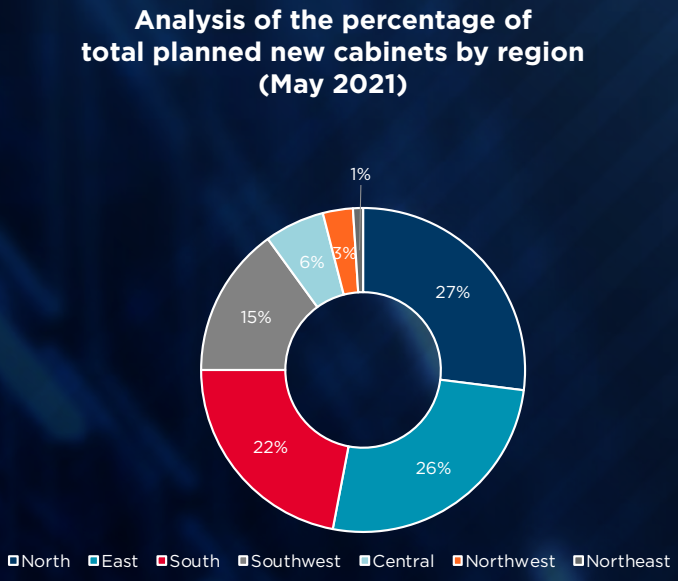


Source: CDCC, Cushman & Wakefield Research

As of 31 May 2021, the number of new cabinets planned in Mainland China was 469,300. From a regional distribution standpoint, North China accounts for 27%, East China 26% and South China 22%. These three regions lead the country with the total number of new planned cabinets in each region being over 100,000 (Figure 2).

Figure 2:
New cabinet supply planned in Mainland China – Regional distribution (H1 2021)

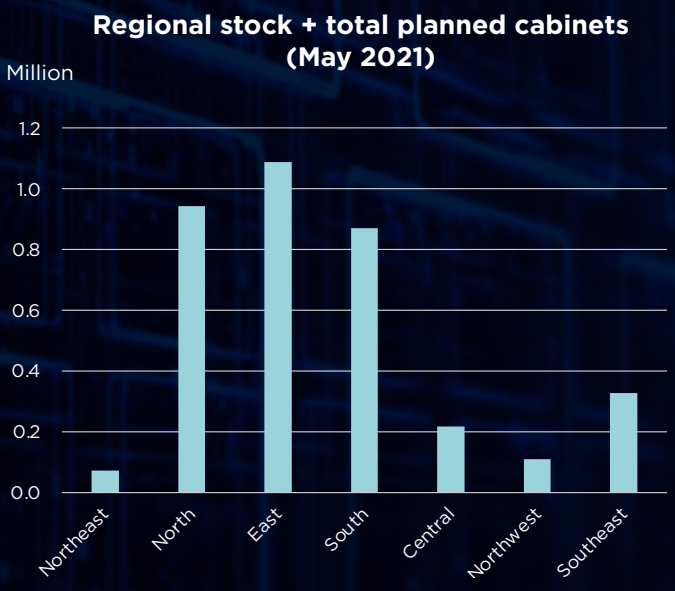


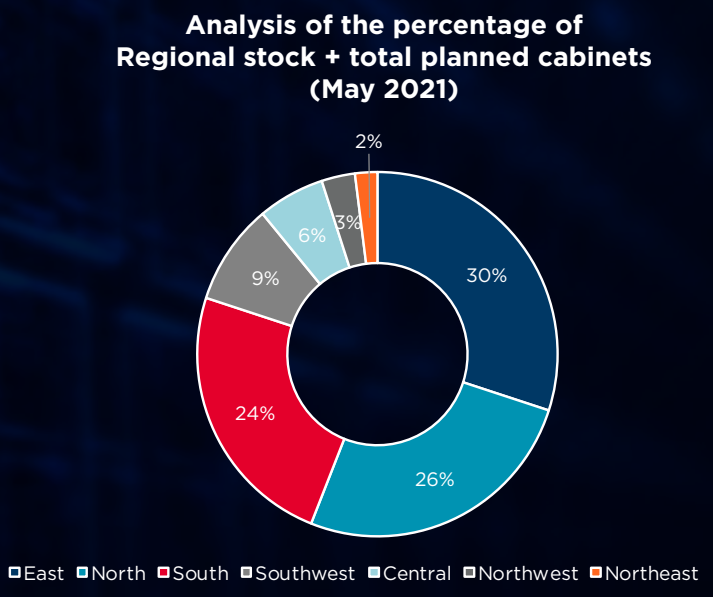


Source: CDCC, Cushman & Wakefield Research

When considering the current and planned stock of cabinets in each region, East China now exceeds 1 million, while North China and South China have reached over 0.9 million and 0.8 million, respectively. The regional distribution of data centres in Mainland China currently reflects the development of the total digital economy — some regions have a higher level of development than others (Figure 3).

Figure 3:
Cabinet stock in Mainland China – Regional distribution (H1 2021)

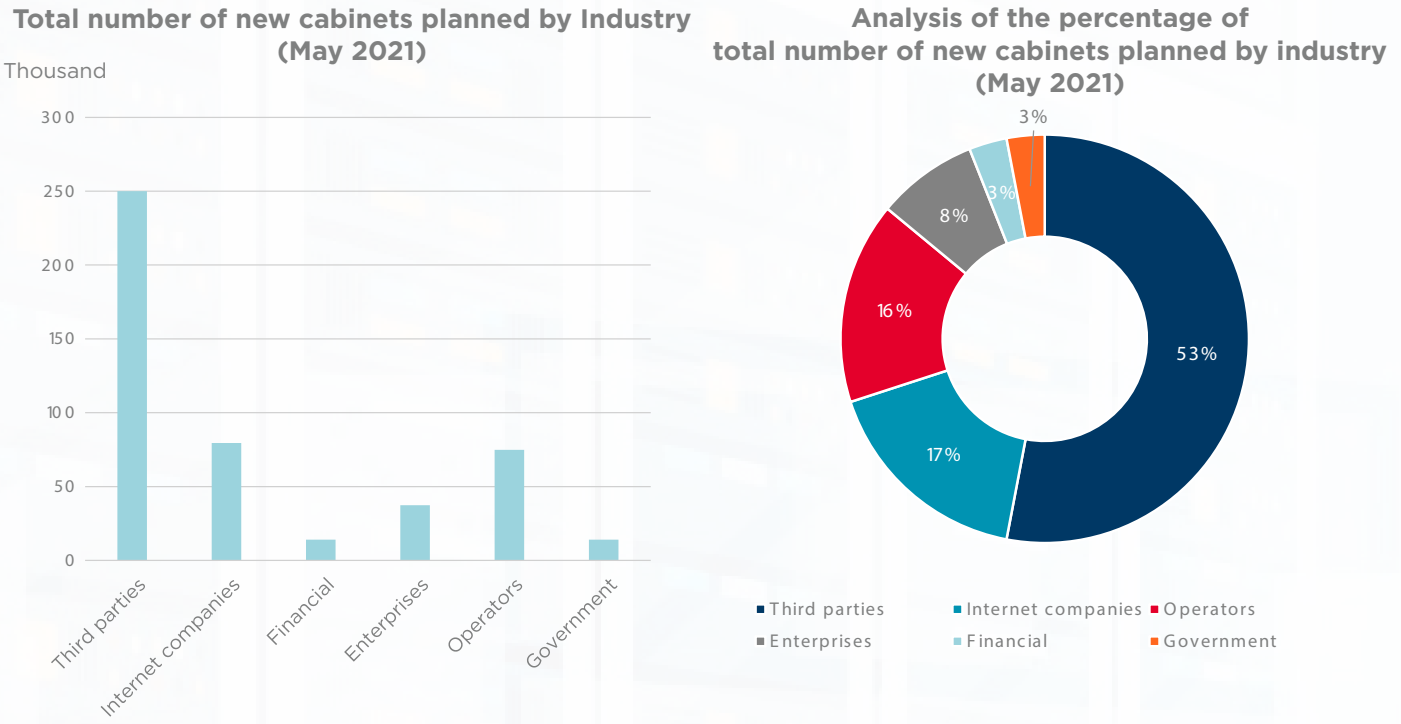




Source: CDCC, Cushman & Wakefield Research

In the first half of 2021, third-party data centre developers planned nearly 250,000 cabinets, accounting for up to 53% of the total supply. Third-party data centre development is expected to continue to play a major role in the market for the foreseeable future (Figure 4).

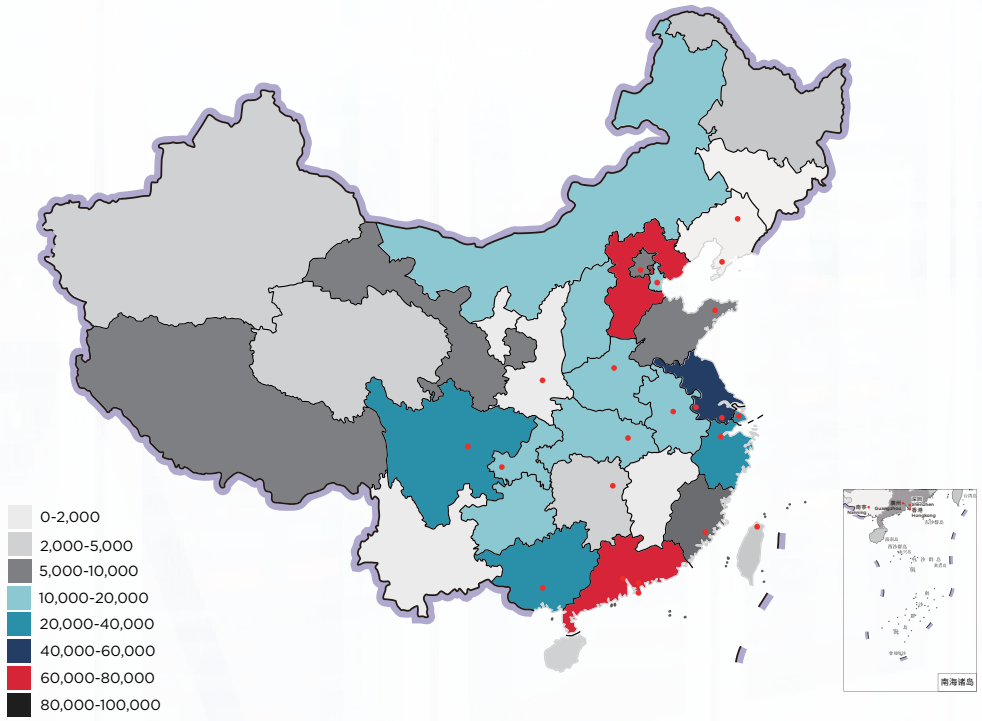
Figure 4:
New cabinet supply planned in Mainland China – Developer distribution (H1 2021)



Source: CDCC, Cushman & Wakefield Research

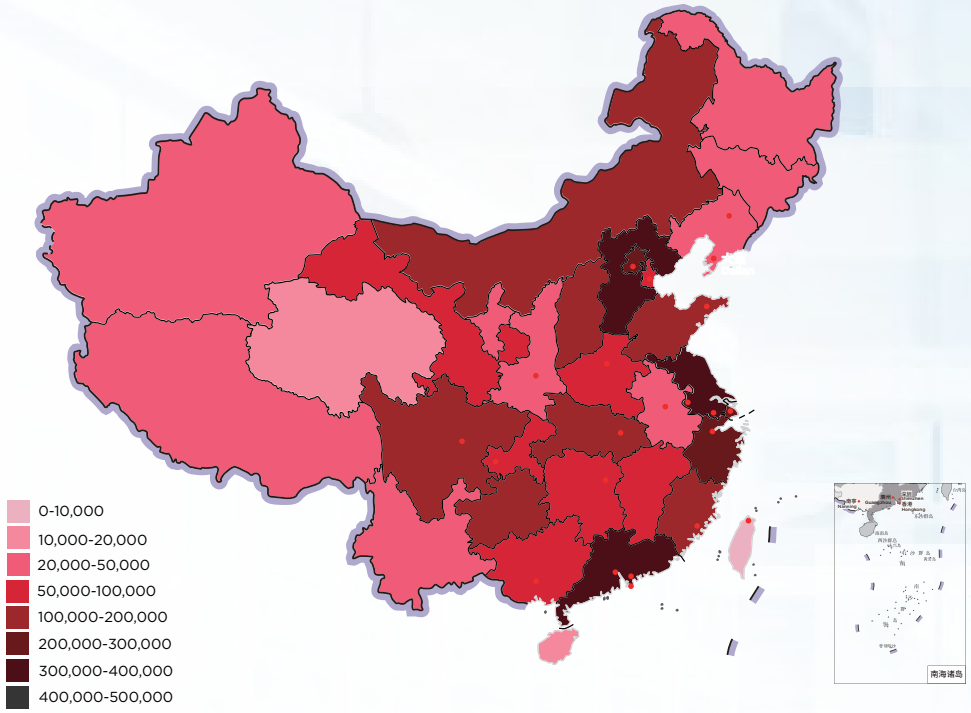
From CDCC heat maps, one can see that the Beijing-Tianjin-Hebei region, the Yangtze River Delta region and the Pearl River Delta region continue to maintain vigorous data centre construction momentum, both in terms of the number of new cabinets and cumulative inventory (Figure 5 and Figure 6).

Figure 5:
New cabinet supply in Mainland China – Distribution heatmap (Jan-May2021)



Source: CDCC, Cushman & Wakefield Research

Figure 6:
Cabinet stock in Mainland China – Distribution heatmap (May 2021)

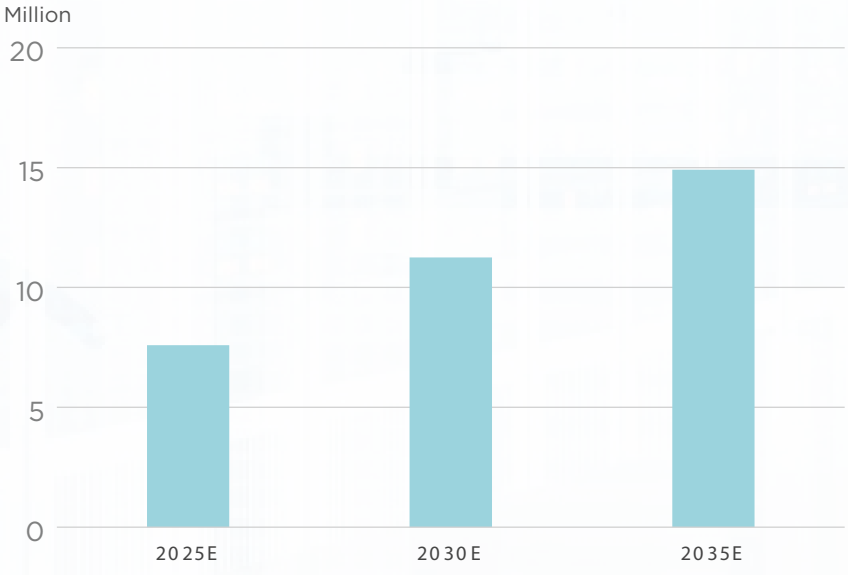


Source: CDCC, Cushman & Wakefield Research

Looking to the future, the rapid development of the digital economy in Mainland China is expected to bring about a surge in the amount of demand for cabinets. Rigid demand for these data services will only grow as large-scale data processing, storage, and transmission volume increase.

Under the double stimulation of digital economy demand dynamics and policy dividends, the market scale for data centres is expected to continue to expand steadily. Alongside this growth, it is anticipated that the total number of data centre cabinets in Mainland China will be close to 15 million by 2035 (Figure 7).

Figure 7:
Cabinet supply growth in Mainland China (2025-2035)



Source: Greenpeace: "Decarbonisation of Mainland China's Digital Infrastructure: Potential and Challenges for Data Centres and 5G Carbon Reduction", Cushman & Wakefield Research

Beijing

When sharpening the focus and looking at the market from a city-level perspective, one can see that Mainland China's first-tier cities have been the focus of much market activity over the past year.

Market Overview:

Throughout 2021, the construction of and demand for data centres in Beijing continued to remain robust. Additionally, according to policies issued by Beijing, two future development scenarios are open for existing data centres in the city. The first scenario is for existing energy-inefficient data centres to upgrade to more energy-efficient data centres, and the second scenario is for energy-efficient data centres that meet the energy use standards to be given a higher level of preference when it comes to development and operation. At the same time, data centre enterprises that use advanced 'green' energy-saving technologies and products to carry out energy-saving technological transformation can now apply for financial subsidies.

Ecosystem Development:

- In April 2021, the Beijing government released the "Beijing Data Centre Coordinated Development Implementation Plan." From 2021 to 2023, Beijing will restructure the data centre market by closing down outdated data centres, consolidating a number of scattered data centres, and renovating those high-power consumption and inefficient data centres, while building a number of new computational data centres, artificial intelligence arithmetic centres and edge computing data centres. The Beijing government has also divided all the districts into specific divisions for data centre development according to their needs. Additionally, the authorities are exploring the idea of data centres being connected to the Beijing Energy-Saving Monitoring Service Platform in order to strictly control energy consumption.
- In July 2021, the Beijing government also released the "Issuance of Certain Provisions on Further Strengthening the Energy Efficiency Review of Data Centre Projects". This policy aims to further improve the urban energy efficiency review of data centre projects, regulate and guide data centres from the beginning to improve energy efficiency and carbon efficiency, strengthen whole life-cycle energy efficiency management, achieve green development, and promote carbon emission reduction and carbon neutrality in the city.
- China Telecom's cloud calculation system, called Tianyi 3.0, based out of Beijing, can customise intelligent integrated communication solutions for the global business needs of enterprises and institutions. At present, the centre has attracted more than ten top customers from domestic and foreign business sectors, such as GE, Tencent, Jingdong, Iqiyi, and Qihu; and the number of contracted racks accounts for more than half of the total scale.

Recent Property Sales:

Table 1: Beijing and surrounding area recent property transactions (2020-2021)

Property	Size (sq m)	Sale Date	Sale Price (RMB)	Buyer	Seller
Beijing No.15 Data Centre	19,000	Sept 2020	3.80 Billion	Gloal Data Solutions Limited	CITIC Funds Manage-ment
Data centre portfolio (data centres in Beijing, Shanghai, Guangzhou, Foshan, and telecom data centres)	-	Oct 2021	1.65 Billion	Shenzhen Baoneng Chuang-zhan Ltd.	Dr. Peng Group

Source: Cushman & Wakefield Research

Major Construction Update:

Table 2: Beijing major construction update (2021)

Operator	District	Size (sq m)	Stage
Beijing Future Science Park Development Group	Changping District	13,389	Under construction
China Everbright Bank	Shijingshan District	100,000	Under construction

Source: Cushman & Wakefield Research

Shanghai

Market Overview:

Shanghai's data centres have continued to develop along with the growth of the digital economy, including digital technology associated with the 5G, artificial intelligence (AI) and cloud computing Industries. Many Internet enterprises have gathered in Shanghai, bringing strong demand for data centres in the city as these enterprises usually have a large amount of data which requires storage, exchange, and computing requirements. Moreover, as an international finance hub, Shanghai is also home to many headquarters of financial institutions. The digital transformation of the financial sector has also promoted data centre development in Shanghai.

Shanghai continues to support enterprises with long-term data centre operation practice to build and operate data centres. Shanghai is also aware of the need for sustainable and energy efficient data centres and has released policies related to the size and energy consumption of data centres to ensure data centres develop in a 'green' and energy efficient way. Alongside this move to be more sustainable, Shanghai has made significant progress in the construction and operation of advanced micro-modular data centres. Micro-modular data centres have a number of advantages, including energy use efficiency. as each centre can be configured to use energy independently — thus enabling centre management to effect centre maintenance and manage centre power usage more efficiently.

Ecosystem Development:

- China Telecom will invest RMB 18 billion to build Shanghai into a world-leading "5G + Optical Network" double gigabit demonstration city. In 2019, China Telecom installed 10 gigabit optical networks into commercial buildings and industrial parks in the city. What's more, Mainland China Telecom's 5G network now covers Shanghai's central urban areas and major towns. Based on Shanghai's leading "5G + Optical Network " dual gigabit network, China Telecom will make full use of new generation technologies to help make Shanghai a centre for industrial and service sector innovation.
- Shanghai plans to introduce the "Shanghai Data Regulations" to empower the digitalisation of the city and the digital economy development. Additionally, Shanghai will set up a data trading centre in Pudong and build an international data port in Lingang.
- In 2018, Shanghai began to promote the concept of energy efficiency with regard to data centre construction and operation. Under the plan "new data centre PUE is limited to less than 1.3."
- Meanwhile , the cities around Shanghai have stepped up data centre construction, with cities such as Kunshan, Wuxi, and Nantong now becoming important cities for Internet data centre (IDC) development around Shanghai.

Recent Property Sales:

Table 3: Shanghai and surrounding area recent property transactions (2020-2021)

Property	Size (sq m)	Sale Date	Sale Price (RMB)	Buyer	Seller
Minghang District Data Centre	75,000	Apr 2021	3.66 Billion	CapitaLand	AVIC Trust Co., Ltd
Data centre portfolio (data centres in Beijing, Shanghai, Guangzhou, Foshan, and telecom data centres)	-	Oct 2021	1.65 Billion	Shenzhen Baoneng Chuang-zhan Ltd.	Dr. Peng Group

Source: CDCC, Cushman & Wakefield Research

Major Construction Update:

Table 4: Shanghai major construction update (2021)

Operator	District	Size (sq m)	Stage
Huayu Engineering	Songjiang District	35,167	Under construction
Longfeng Shanghai Data Technology	Pudong New Area	65,074	Under construction
Alibaba Cloud	Jinshan District	162,000	Under construction

Note: Based on campus area
Source: CDCC, Cushman & Wakefield Research

Shenzhen

Market Overview:

Initiated by robust industry development, Shenzhen's data centre sector expanded early. Notable operators include China Telecom, Global Data Solutions and Dr Peng Group. Shenzhen is currently an important Big Data hub in Mainland China and thus an extremely active hub for data centres that collect, process, store and distribute this type of data with low latency. The generation and utilisation volume of Big Data is only set to increase and as such, the number of data centres needed to service this data is set to further expand.

At present, Big Data technology in Mainland China is continually innovating and evolving. AI and state-of-the-art machine learning are the next steps. Emerging industry verticals to use this technology include education, transportation, E-commerce, the Internet, supply chain and logistics, agriculture, manufacturing, sports, environmental meteorology, and energy. Companies, such as Huawei and others, are persistently pushing the technological boundaries. It is believed that the continuous progress in Big Data technological innovation by high-tech companies will also lead to a need for more data centre space not just nationally, but in and around Shenzhen as well.

Shenzhen is also encouraging the revamping of aged data centres with 'green', efficient technology. Data centre operators in the city are able to receive energy support packages which are dependent on PUE levels. Moreover, key energy consumption data centres are required to be monitored at the provincial level.

Finally, given land-use efficiency, Shenzhen is also exploring the idea of building data centres in underground spaces.

Recent Property Sales:

Table 5: Shenzhen and surrounding area recent property transactions (2020-2021)

Property	Size (sq m)	Sale Date	Sale Price (RMB)	Buyer	Seller
GDS SZ8 Data Centre	2,500	Q1 2021	90 Million	Global Data Solutions Limit-ed	-
Huizhou Tong-hu Smart City Data Centre	45,000	Q3 2020	1.5 Billion	Alpha Data Centre Fund - Keppel	Country Garden

Source: CDCC, Cushman & Wakefield Research

Ecosystem Development:

- Huawei Enterprise Cloud platform is an easy-to-use, highly reliable, and low-cost Big Data solution for Big Data application scenarios such as advertising marketing, E-commerce, and the Internet of Vehicles. The now established platform also helps user enterprises meet their ever-increasing data storage and analysis needs.
- Ping'an Technology's Big Data team is developing Big Data projects and setting up Big Data research laboratories which are looking into developing advanced Big Data analysis technology and modelling methods. The company is building Shenzhen's first financial data centre that achieved a PUE of 1.248 in response to the government's 'green' development initiative.

Major Construction Update:

Table 6: Shenzhen major construction update (2021)

Operator	District	Size (sq m)	Stage
Tencent	Guangming District	29,800	Under construction
Ping'an Insurance	Futian District	26,000	Under construction

Source: CDCC, Cushman & Wakefield Research

Guangzhou

Market Overview:

The data centres business in Guangzhou has been constantly expanding in recent years. The robust demand form the Internet industry and digital upgrading has driven growth in the city. Under the development of information technology and digital transformation, the retail and E-commerce industries have also boosted demand for data centres.

As one of the central cities in the Greater Bay Area, Guangzhou is also one of the preferred choices for data centre business location, with sufficient resources and facilities required for the construction of data centres. According to the three-year development plan for new infrastructure, Guangzhou is currently actively promoting intensive construction and carrying out the upgrading and transformation of aged data centres.

In the future, 'green' data centres with innovation capabilities, as well as small and medium-sized data centres with low latency, high added value, and an obvious role in the industry chain, will receive more support and attention.

Ecosystem Development:

- China Telecom is building a 5G cloud computing centre project in Conghua, Guangzhou. As the core project within the Mingzhu Intelligent Industrial Park, it is one of the four national data centres within China Telecom's national cloud network. The project plans to provide ultra-low latency data transmission and cloud services for the Greater Bay Area. It will provide Internet infrastructure support, such as data storage and transmission for the Guangzhou Artificial Intelligence and Digital Economy Experimental Zone. The implementation of autonomous vehicles, telemedicine and other new business formats that have strict requirements on transmission delay and speed will be accelerated. The development of emerging industries, such as blockchain, Big Data and AI will also be promoted.

Recent Property Sales:

Table 7: Guangzhou and surrounding area recent property transactions (2020-2021)

Property	Size (sq m)	Sale Date	Sale Price (RMB)	Buyer	Seller
Rooms 101-701, Block 5 Blue-sea Intelligence Valley	20,595	Jul 2021	635.90 Million	Keppel DC REIT	Guangdong Bluesea Data Development Company Limited
Data centre portfolio (data centres in Beijing, Shanghai, Guangzhou, Foshan, and telecom data centres)	-	Oct 2021	1.65 Billion	Shenzhen Baoneng Chuang-zhan Ltd.	Dr. Peng Group

Source: CDCC, Cushman & Wakefield Research

Major Construction Update:

Table 8: Guangzhou major construction update (2021)

Operator	District	Size (sq m)	Stage
China Telecom	Conghua District	420,000	Under construction
South Logistics	Zengcheng District	140,000	Under construction

Source: CDCC, Cushman & Wakefield Research

Back to the broader market picture, Mainland China's data centre industry has continued to receive national, provincial, and city-level attention. Influenced by the dual impact of new infrastructure development and carbon neutrality sentiment, a number of relevant industry policies have been issued and one of the major ones, the "Three-year Action Plan for New Data Centre Development (2021-2023)" and its potential impact, is considered in the next section of our report.

Government Policy

The Three-year Action Plan for New Data Centre Development (2021-2023)

In March 2020, the Standing Committee of the Political Bureau of the CPC Central Committee proposed "accelerating the progress of 5G network, data centre and other new infrastructure construction." Moreover, the 14th Five-Year Plan has outlined guidelines for the construction of new infrastructure in terms of modernisation, digitalisation, and sustainability. The strategic decision by the CPC Central Committee and the State Council on carbon peaking and carbon neutrality has placed higher requirements for the coordinated development of both a digitised and 'green' information and communication industry sector.

Currently, in some instances, the data centre industry in Mainland China still faces a number of issues, such as poor layout, insufficient computing power, insufficient energy utilisation and the utilisation of older technology. It has therefore been deemed urgent to upgrade the industry to reach an across-the-board high level of technology, computing power, energy efficiency and security. In this context, the Ministry of Industry and Information Technology issued the "Action Plan."

1. What are the basic actions of the Action Plan?

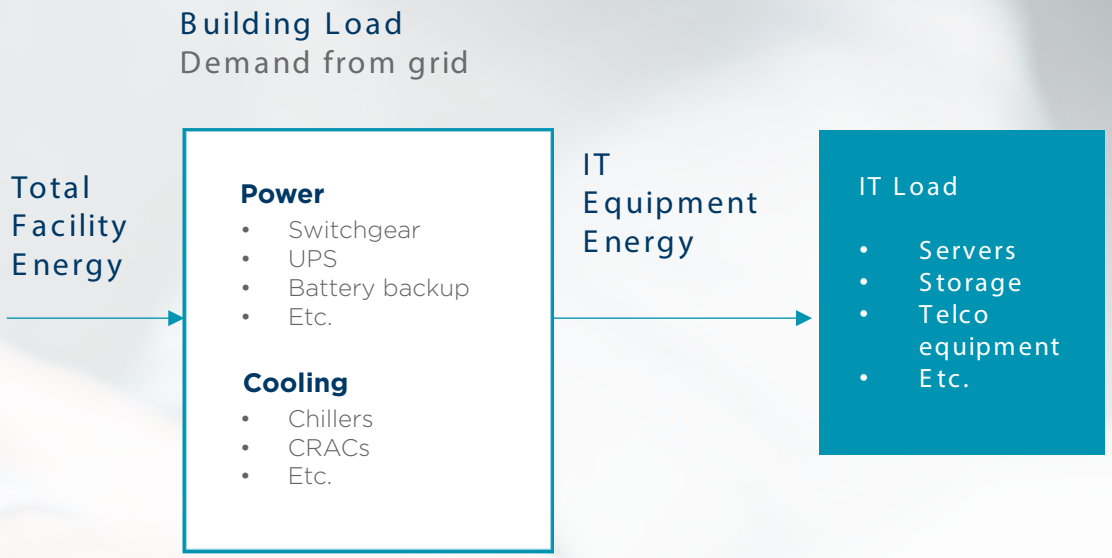
Six special actions were put forward, including:

- The optimisation of construction layout;
- The upgrading of network quality;
- The enhancement of computing power;
- The strengthening of the industrial chain;
- 'Green' and low-carbon development, and;
- Safety and reliability.

2. In the next three years, what are some of the specific industry goals?

It is planned that by the end of 2023, the national average utilisation rate for data centres will be increased to more than 60%. In terms of computational power scale, the total power scale is expected to exceed 200 quintillion floating-point operations per second (EFLOPS), with the proportion of high-performance computational power reaching 10%. In terms of energy efficiency, the PUE for newly built large data centres will be reduced to less than 1.3. In cooler regions, efforts will be made to reduce it to below 1.25 (Figure 8).

Figure 8:
PUE calculation and efficiency



PUE	Level of efficiency
1.5	Efficient
1.2	Very efficient

$$\text{PUE} = \frac{\text{Total Facility Energy}}{\text{IT Equipmeng Energy}}$$

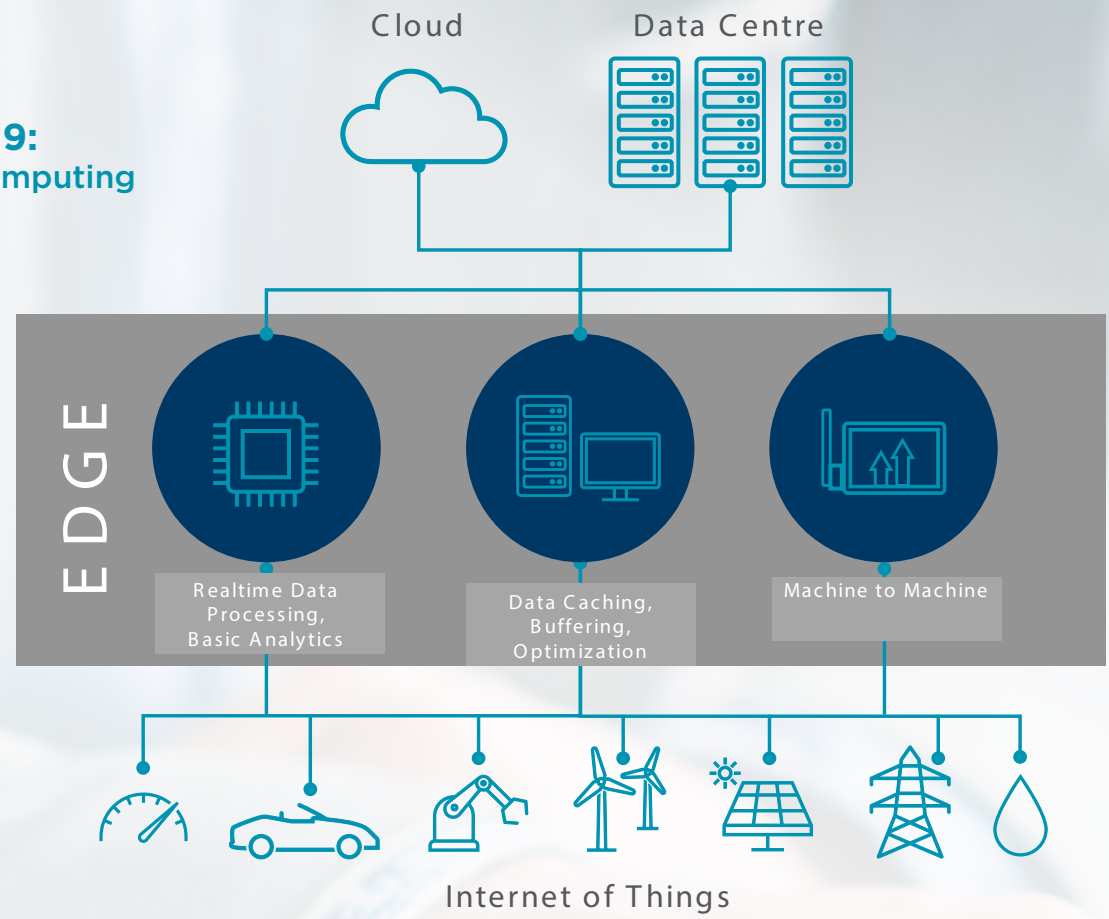
Source: 42u.com, Cushman & Wakefield Research

Finally, regarding network delay, the end-to-end network delay in the national hub node will be less than 20 milliseconds in principle.

3. In the next three years, how will data centre development be optimised?

- Firstly, national hubs will be promoted to accelerate the construction of new data centre clusters to meet the needs of different types of computing power across the country. The plan calls for large-scale computing to be deployed in the Beijing-Tianjin-Hebei area, the Yangtze River Delta area, the Guangdong-Hong Kong-Macao Greater Bay area, and the Chengdu-Chongqing area. Other national hubs will include Guizhou, Inner Mongolia, Gansu, and Ningxia;
- Secondly, new data centres will be built in each province to create local computing power services with local characteristics;
- Thirdly, edge data centre development will be accelerated and deployed to meet the demand from new service applications with very low time delay (Figure 9 and Table 9);

Figure 9:
Edge computing



Source: IEEE, Cushman & Wakefield Research

Table 9: Types of edge data centres

Type of edge		Data centre	Location	Number of DCs per 10m population	Latency (average)	Size
On premises edge		Enterprise site	Business	NA	2-5ms	1 rack max.
Network (mobile)	**Tower edge**	Tower	Nationwide	3000	10ms	2 racks max.
	Outer edge	Aggregation points	Town	150	30ms	2-6 racks
	Inner edge	Core	Major city	10	40ms	10+racks
Regional edge		Regional	Major city	100	50ms	100+racks
Not edge		Hyperscale	State/national	1	60+ms	5,000+racks

Source: STL Partners, Cushman & Wakefield Research

- Fourthly, older data centres will be improved in terms of energy efficiency and computing power supply capacity;
- Fifthly, promote data centre development internationally, particularly in "Belt and Road" countries, and;
- Sixthly, promote the coordinated development of both cloud and edge data centres.

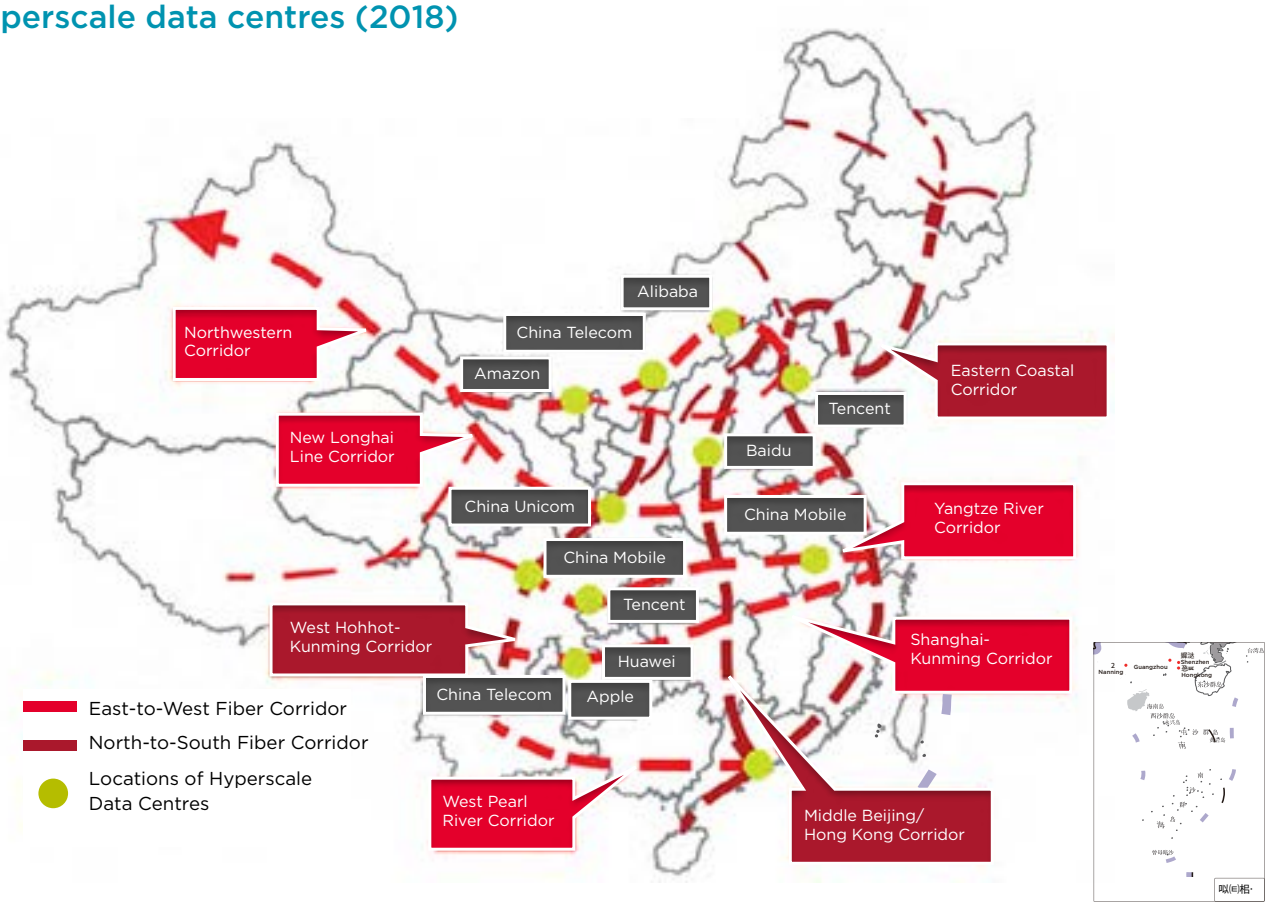
4. What are the particular considerations to encourage the collective development of new data centres and networks in the next three years?

The Action Plan incorporates four considerations, and they are:

- The optimisation of the layout of the national Internet network and the promotion of a balanced, efficient, and effective approach to overall data centre development in Mainland China (Figure 10);

Figure 10:

Map of Mainland China's backbone fibre network and locations of hyperscale data centres (2018)



Source: China Business Review, Cushman & Wakefield Research

- The effective development of new data centre clusters to promote cross-network, cross-regional, cross-enterprise data exchange;
- The promotion of network interconnection between edge data centres and new data centre clusters, and the promotion of coordinated development of cloud, of digital technology and of the network, and;
- The encouragement of the collaborative development of the digital network, through the establishment of a digital network linkage mechanism as well as the improvement in data centre network monitoring, data centre demand and supply dynamics and data centre network capacity.

5. How will the measurement of computing power be adjusted over the next three years?

The computing power of data centres has now become an important driving force for economic and social transformation. The traditional rack scale index as a measurement indicator of industry development is now not suitable as a measurement tool to show the level of industry development. The Action Plan for the first time calls for the introduction of a computing power index that uses EFLOPS to evaluate the quality of data centre development. By using this index, the aim is to enhance high quality development in computing power and to better promote the developmental quality and efficiency of data centres in Mainland China (Figure 11).

Figure 11:

The world's top supercomputers (November 2021)

Computational performance

Supercomputer	Organisation	Country	TeraFLOPS
Fugaku	Fujitsu/Riken		442,010.0
Summit	IBM		148,600.0
Sierra	IBM		94,640.0
Sunway TaihuLight	NRCPC		93,014.6

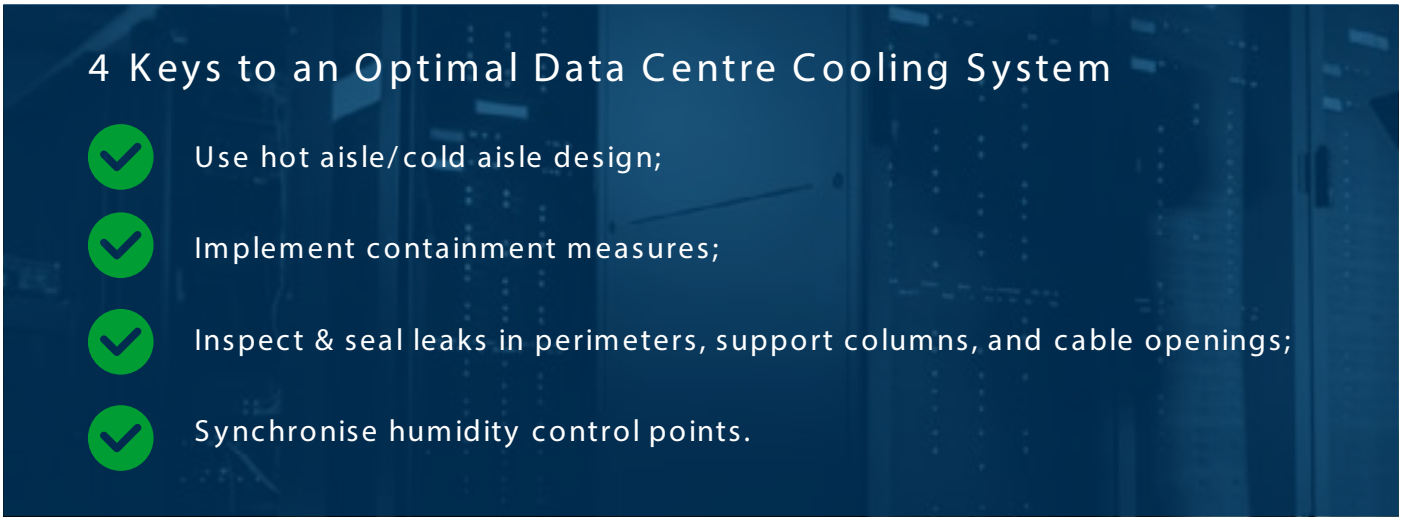
Source: Top500.org, Cushman & Wakefield Research

6. In the next three years, how will new data centres be steered towards a 'green' and low-carbon direction?

The Action Plan will encourage new data centres to go 'green', ensuring new development is efficient, clean, intensive, and circular from a construction, operation, and maintenance perspective. The Action Plan hopes to achieve this by:

- Encouraging enterprises to deepen new data centre 'green' design, construction, procurement and improve resource utilisation efficiency;
- Accelerating the application of advanced 'green' technology products, such as efficient IT equipment, refrigeration systems, power supply and distribution systems and auxiliary system technology products (Figure 12);

Figure 12:
Four points to ensure an optimal data centre cooling system



Source: China Business Review, Cushman & Wakefield Research

- Continuously improving the level of efficient clean energy utilisation and continuously conducting evaluations of 'green' and low carbon data centres;
- Optimising 'green' management capacity, and;
- Supporting and accelerating the integration and transformation of inefficient data centres.

7. In the next three years, how will the Action Plan be effectively implemented?

The Action Plan proposes five safeguards to ensure effective implementation of the plan:

- Firstly, it will strengthen related organisational leadership across-the-board throughout Mainland China;
- Secondly, it will look to accelerate personnel training within the industry, especially in relation to data centre design, operation, and maintenance;
- Thirdly, it will endeavour to deepen exchanges and cooperation, whether between academia or through international exchanges;
- Fourthly, it will strengthen data centre industry platform support to ensure coordinated development in Mainland China, and;
- Fifthly, it will promote industry investment from diversified sources, including real estate investment trusts (REITs) (Table 10).

Table 10: Biggest global data centre acquisitions (As of 16 November 2021)

BUYER/S	ENTITY	PRICE
KKR and Global Infrastructure Partners	CyrusOne	US$ 15 billion
American Tower	Coresite	US$ 10.1 billion
Blackstone	QTS	US$ 10 billion
Digital Realty	Interxio	US$ 8.4 billion
Jiangsu Shagang Group	Global Switch	US$ 8 billion (Approx.)
Digital Realty	DuPont Fabros Technology	US$ 7.6 billion
Equinix	Telecity	US$ 3.8 billion
Equinix	Verizon's data centres	US$ 3.6 billion
EQT Infrastructure	EdgeConneX	US$ 2.5 (Reported)
Medina Capital Management and BC Partners	CenturyLink's data centres	US$ 2.15 billion

Source: datacenterdynamics.com, Cushman & Wakefield Research

Investment

Domestic data centre financing channels in Mainland China are diversified. They are mainly divided into equity financing and debt financing, including public offering, rights issue, private placement, bond financing, bank loans and other means.

Different financing methods have their own advantages and disadvantages. With equity financing, there are a number of advantages, including that there is often little to no financial pressure to pay regularly. The financial risk is also generally smaller, but it will face the risk of loss of control to the equity investor, and the financing cost can sometimes be higher than debt financing.

As for debt financing, as with equity financing, there are a number of advantages, including often lower financing costs. However, it does also face the financial pressure of regular repayment of principal and interest, and financing risk is relatively greater.

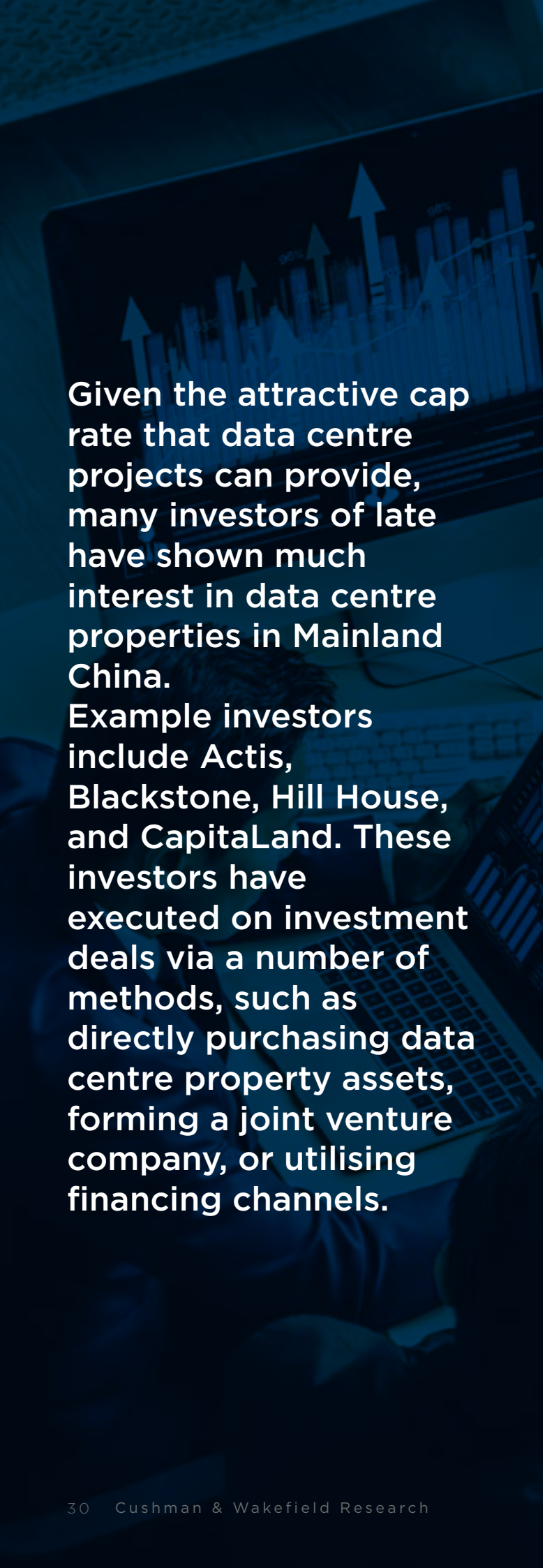
Under normal circumstances, enterprises in Mainland China will use both financing methods for data centre investment, using hybrid financing to cushion the impact on the capital structure (Table 11).

Table 11:

Debt and equity financing – Selected advantages and disadvantages

	DEBT FINANCING	EQUITY FINANCING
ADVANTAGES		
1	Keep full ownership	Less risk than debt
2	No obligations after paying debt	No paying back funds
3	Interest is tax deductible	Gain credibility through investor networks
4	Short- and long-term options	Investors don't expect immediate ROI
5	More cash on hand	Fixed payment for better budgeting
DISADVANTAGES		
1	Must pay back	Investor returns could be more than debt payments
2	Could cause cash flow issues	Investor gets more ownership
3	Usually need collateral	Must consult investor for decisions

Source: The Lodge Nature Review Tours, Cushman & Wakefield Research



Given the attractive cap rate that data centre projects can provide, many investors of late have shown much interest in data centre properties in Mainland China.
Example investors include Actis, Blackstone, Hill House, and CapitaLand. These investors have executed on investment deals via a number of methods, such as directly purchasing data centre property assets, forming a joint venture company, or utilising financing channels.

The following are recent investment deal examples:

1. Direct property asset purchase: In April of 2021, CapitaLand directly acquired its first hyperscale data centre property in Mainland China in Shanghai's Minhang district.
2. Joint venture: In 2019, Gaw Capital Partners formed a joint venture partnership with Centrin Data to acquire, develop and operate a portfolio of hyperscale IDC projects in Mainland China. In the same year, Global Data Solutions and GIC also formed a unique strategic partnership to develop and operate hyperscale domestic build-to-suit data centres.
3. Financing channels: In June 2021, Princeton Digital Group (PDG), backed by private equity firm Warburg Pincus, secured US$230 million debt refinancing from Mainland China Merchants Bank as part of a US$1 billion data centre investment expansion plan in Mainland China.

Cloud computing vendors are an important driving factor for the development of data centres in Mainland China. Companies involved in cloud computing are expected to continue to increase investment, including investment in large data centres in the county. Alibaba and Tencent are two representative companies in Mainland China that will drive data centre investment over the next few years:

- Alibaba: According to a Sina News report in 2019, Alibaba plans to invest around RMB 200 billion in data centres over the next three years, and;
- Tencent: According to a recent article by Xinhuanet, Tang Daosheng, President of Tencent Cloud and Intelligence Industry Group, announced that Tencent will invest RMB 500 billion yuan over the next five years.

As can be seen from both Alibaba's and Tencent's investments, data centres need large capital investment, and the trial of a domestic REITs market will bring new financing channels to listed companies (Figure 13).

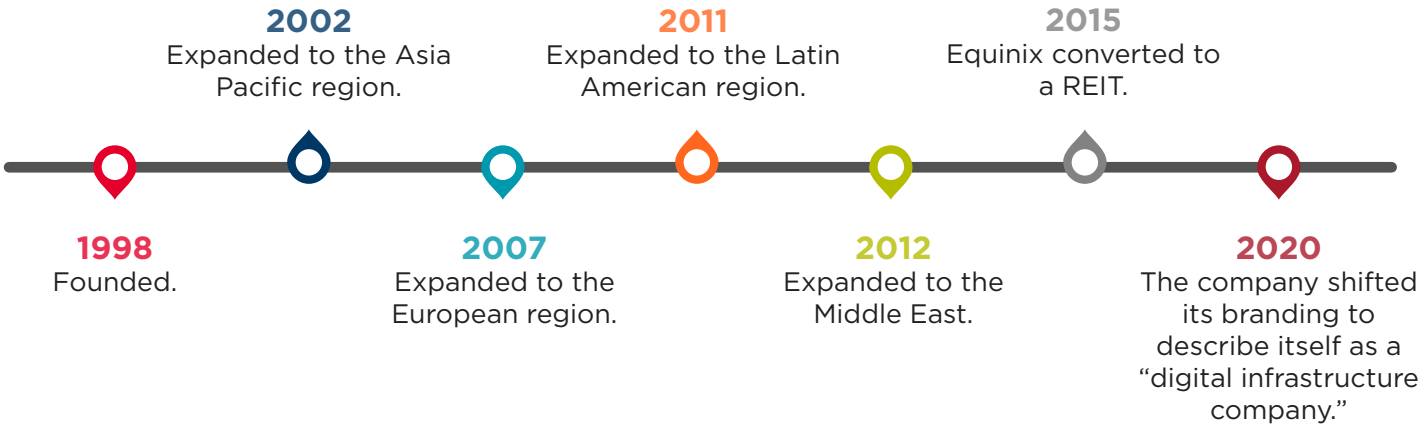
Figure 13: REIT investment mechanism

Source: Listen Money Matters, Cushman & Wakefield Research

The recent REITs documents jointly issued by the Mainland China Securities Regulatory Commission and the National Development and Reform Commission (NDRC) pointed out that the ownership of REITs projects should be clear, and relevant procedures, such as acceptance, land use, environmental assessment, planning, project investment management, operation, cash flow and investment returns, should be fulfilled as required.

Internationally, Equinix is a good example of a data centre operator which has converted to a REIT (Figure 14 and Case Study 1 in the Appendix).

Figure 14:
Equinix, Redwood City timeline



Source: Cushman & Wakefield Research

By converting to a REIT, Equinix has been able to acquire a number of business advantages:

- Firstly, Equinix had to and has to continue to ensure high yield, low risk characteristics to meet the needs of investors — which in turn has resulted in a high stock price.
- Secondly, there is the advantage of a lower tax burden. Equinix is able to avoid double taxation by exempting REITs from income tax on rental income and dividends from property sales.
- Thirdly, Equinix enjoys an enhanced financing capacity. Since 2015, Equinix's capital expenditure has grown rapidly, and its operating income has improved significantly.
- Finally, Equinix's asset structure has been optimised. Financing has been easier since transforming to a REIT, and the gearing ratio has steadily declined while the company has maintained rapid business expansion.

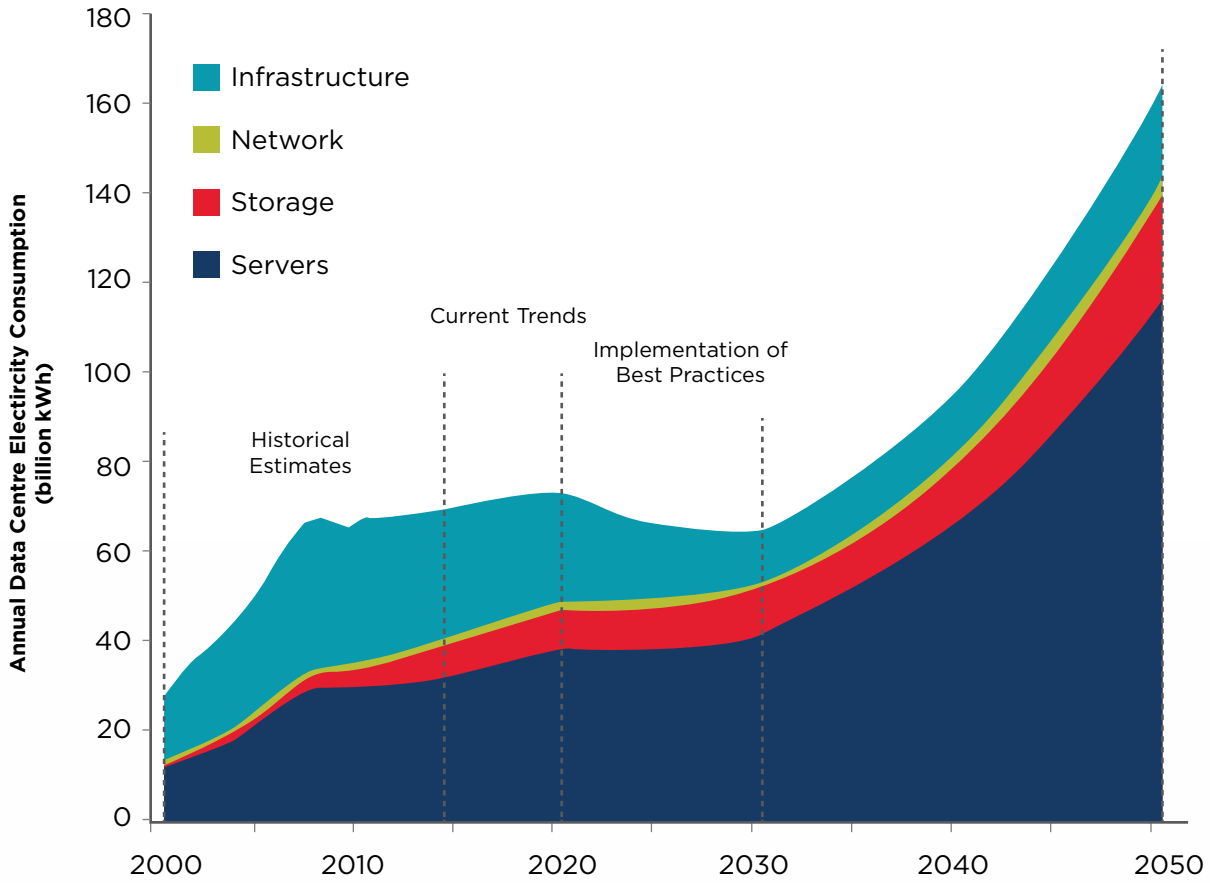
Ahead, as with any asset, all assets under a REIT, including data centre REIT assets, will increasingly be subject to scrutiny from an environmental sustainability perspective. Understanding how data centre development and operation impact environmental sustainability and finding impact mitigating solutions will be key to the industry in Mainland China and, these issues are discussed in the next chapter.

Sustainability

In the face of global warming, China has proposed the strategic goal of "reaching a carbon peak by 2030 and going carbon neutral by 2060."

Data centres, on the other hand, convert electricity into computing power, and so with the rapid growth of digital demand, data centres are increasingly demanding a greater amount of electricity for centre operational purposes. What's more, according to some statistics, the current global data centre electricity consumption now accounts for between 2% to 3% of the total electricity consumption and this proportion could well increase in the future, as seen for a data centre electricity consumption estimation example through to 2050 from the U.S. (Figure 15).

Figure 15:
U.S. data centre electricity consumption (2000-2050)

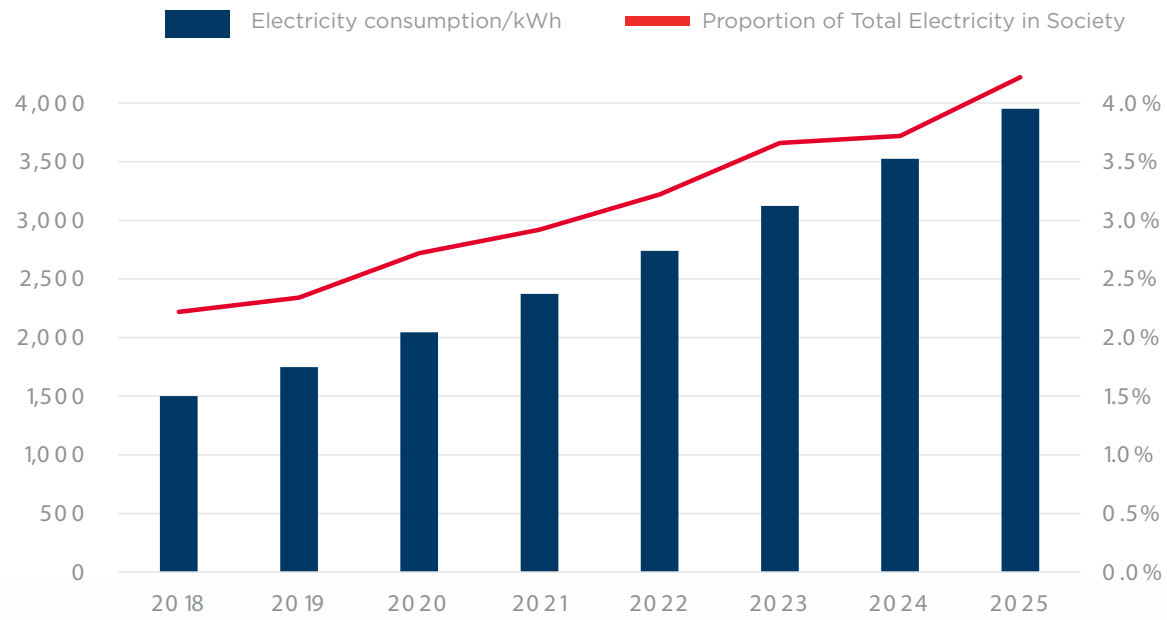


Source: U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, Cushman & Wakefield Research

When considering Mainland China specifically, according to statistics, the total power consumption of Mainland China's data centres, and that contributed by 5G, in 2020 exceeded 200 billion kilowatt hours, accounting for 2.7% of the total power consumption. Taken together, the total power consumption of Mainland China's data centres and that contributed by 5G will be 2.5 to 3 times that of 2020 by 2035, accounting for 5 to 7% of Mainland China's total power consumption (Figure 16).

Figure 16:

Mainland China data centre electricity consumption (2018-2025)



Source: IDC Quan, Cushman & Wakefield Research

The spectacular acceleration of global data centre markets has elevated trepidations around the impact the sector has on the environment. With the exceedingly high consumption of power by data centres and the substantial carbon footprint the sector produces, there is a need to fortify sector-wide standards and commitments for sustainable data centre operations. Governments around the world are pushing the data centre sector towards 'greener' operations with new regulations, and even moratoriums.

In light of this, as previously mentioned, the National Development and Reform Commission, the Cyberspace Administration of China, the Ministry of Industry and Information Technology and the Energy Administration have jointly issued the "Guidance on Accelerating the Construction of the Collaborative Innovation System of Integrated Big Data Centre" and other documents. These policies aim to steer future data centre development in Mainland China along a sustainable 'green' path, whereby, among other factors, new development:

- Is systematic, coordinated, and orderly;
- Ensures energy-use efficiency, and;
- Utilises energy from renewable energy sources where possible.

In addition, demand pressure for data centre carbon neutrality is also arising from user enterprises, as they try to fulfil their annual environment, social and governance (ESG) rating targets (Figure 17).

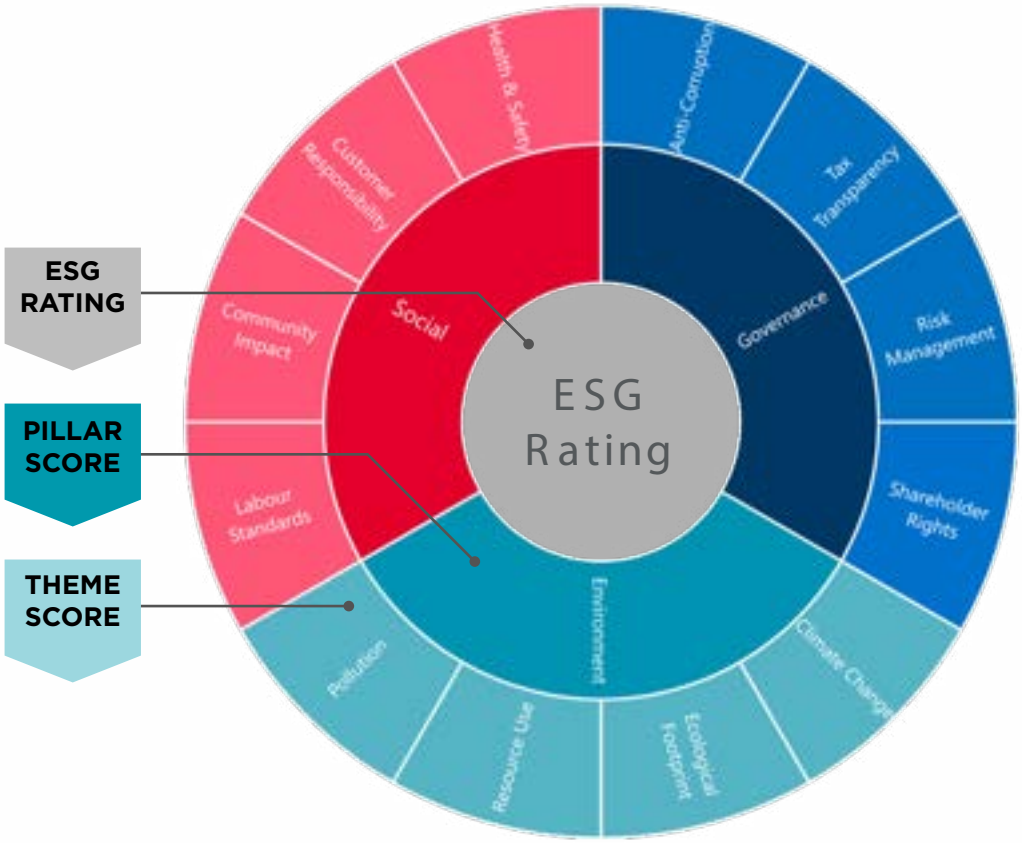
Figure 17:

An ESG rating example

ESG RATING
Calculated by cumulating total ESG performance

PILLAR SCORE
Cumulative score and risk calculated from themes

THEME SCORE
A score for issues in each ESG pillar e.g. Climate Change, which is calculated using critieria e.g. emissions per year



Source: medium.com, Cushman & Wakefield Research

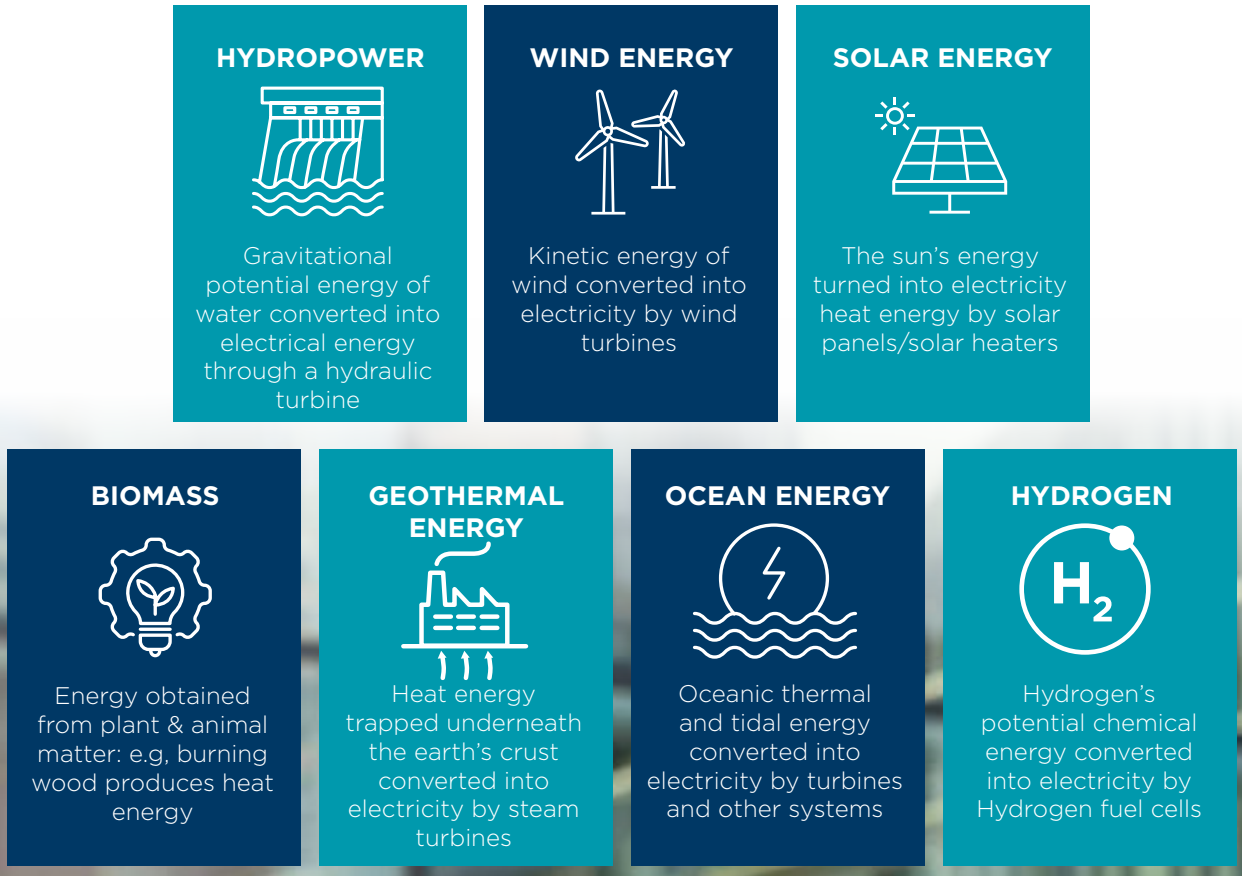
Over the years, the data centre industry in Mainland China has explored various energy-saving and 'green' technology initiatives. Some data centres in the country have been able to lessen their PUE value to 1.1 or below. In the long term, regarding the goal of going carbon neutral, energy efficiency and energy saving are just small steps in the overall journey to find a true solution. Additionally, carbon offsetting, carbon trading, carbon capture and other similar initiatives are also somewhat limited when considering the overall goal. For a long-term total solution, the generation and use of renewable energy are the keys to unlocking and revealing the real 'green' solution (Figure 18).

Having said this, however, with data centres in Mainland China, there is a bit of a dilemma when it comes to optimising workloads. On the one hand, Mainland China has a vast territory with many areas, particularly in its western regions, such as Sichuan, Xinjiang, Guizhou and Inner Mongolia, having the potential to provide sufficient power from wind, solar, water, heat, and other renewable energy sources. However, on the other hand, Mainland China is densely populated and has a large economy, which requires a large amount of energy in its eastern and coastal areas.

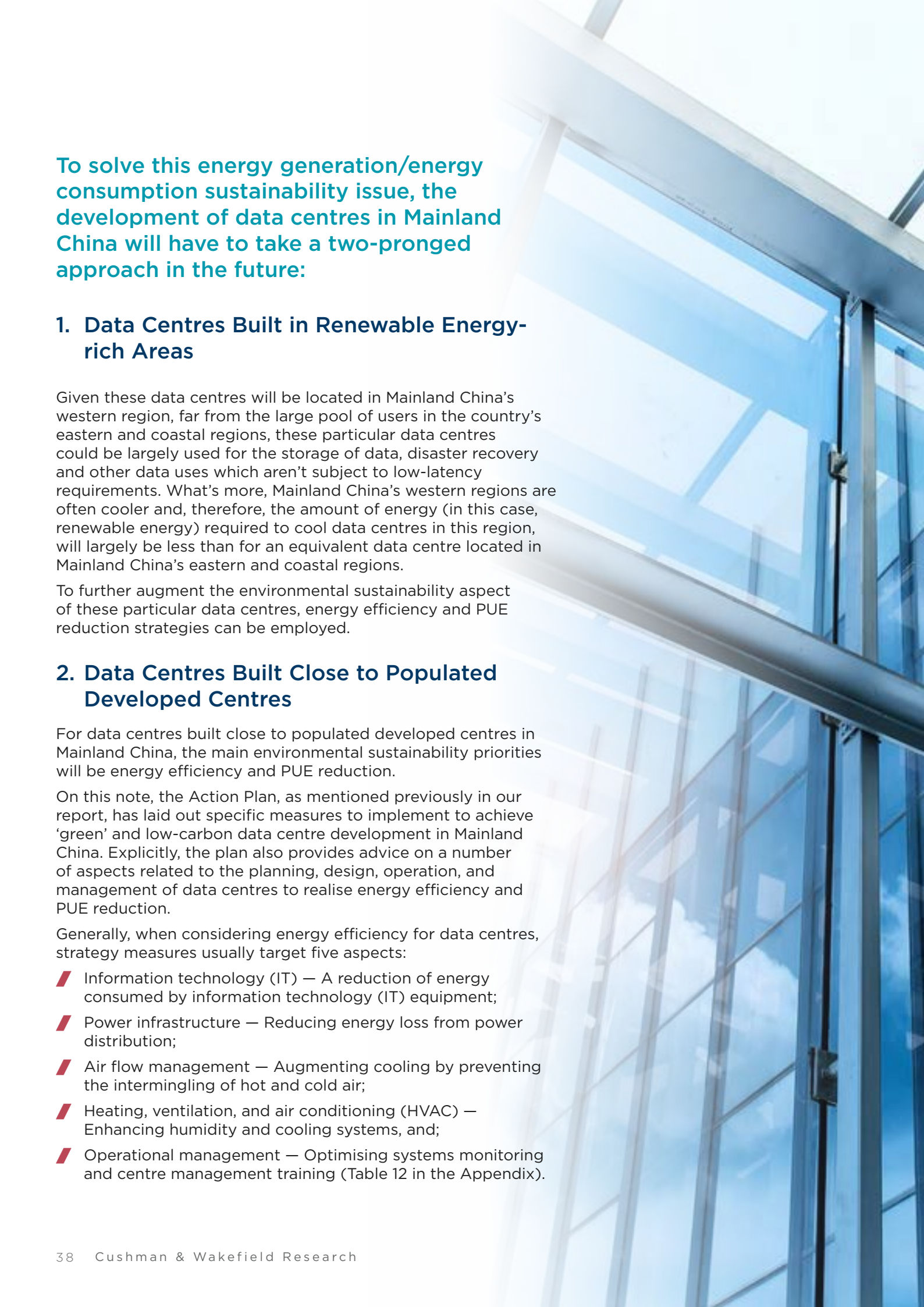
In the case of data centre development, demand and data transmission speed is important. Understanding this, it is natural for data centres to prefer to locate to a site close to a populated developed centre. Data centres, however, require a considerable amount of electricity and Mainland China's developed populated centres in its eastern and coastal regions lack many of the renewable energy resources, (found in its western regions), which will be increasingly needed in the future to power the data centres located in their jurisdictions.

Figure 18:

Sources of renewable energy



Source: Science Facts, Cushman & Wakefield Research



To solve this energy generation/energy consumption sustainability issue, the development of data centres in Mainland China will have to take a two-pronged approach in the future:

1. Data Centres Built in Renewable Energy-rich Areas

Given these data centres will be located in Mainland China's western region, far from the large pool of users in the country's eastern and coastal regions, these particular data centres could be largely used for the storage of data, disaster recovery and other data uses which aren't subject to low-latency requirements. What's more, Mainland China's western regions are often cooler and, therefore, the amount of energy (in this case, renewable energy) required to cool data centres in this region, will largely be less than for an equivalent data centre located in Mainland China's eastern and coastal regions.

To further augment the environmental sustainability aspect of these particular data centres, energy efficiency and PUE reduction strategies can be employed.

2. Data Centres Built Close to Populated Developed Centres

For data centres built close to populated developed centres in Mainland China, the main environmental sustainability priorities will be energy efficiency and PUE reduction.

On this note, the Action Plan, as mentioned previously in our report, has laid out specific measures to implement to achieve 'green' and low-carbon data centre development in Mainland China. Explicitly, the plan also provides advice on a number of aspects related to the planning, design, operation, and management of data centres to realise energy efficiency and PUE reduction.

Generally, when considering energy efficiency for data centres, strategy measures usually target five aspects:

- Information technology (IT) — A reduction of energy consumed by information technology (IT) equipment;
- Power infrastructure — Reducing energy loss from power distribution;
- Air flow management — Augmenting cooling by preventing the intermingling of hot and cold air;
- Heating, ventilation, and air conditioning (HVAC) — Enhancing humidity and cooling systems, and;
- Operational management — Optimising systems monitoring and centre management training (Table 12 in the Appendix).

Industry Moves

In Mainland China, well-known enterprises, including hyperscalers, have also been actively exploring 'green' energy efficient low carbon-emitting data centres. In this context, both upstream and downstream data centre enterprises have begun to take action and put forward their commitment to or goals for 'green' transformation.

January 2021: Tencent announced the launch of a carbon neutral programme, becoming one of the first Internet companies to do so.

March 2021: Ant Group announced that it would achieve net zero emissions by 2030 and put forward a specific implementation path with 100% renewable energy as the core.

April 2021: Qinhuai Data proposed the goal of achieving 100% renewable energy by 2030.

May 2021: Alibaba announced its "Zero Carbon Cloud" plan.

The goal of the plan is "to ensure that the overall efficiency is the highest it can be and PUE is the lowest it can be."

Currently, Ali Cloud has established five super data centres in Zhangbei in Hebei, Ulanqab in Inner Mongolia , Heyuan in Guangdong, Nantong in Jiangsu and Hangzhou in Zhejiang. Of note, Ali Cloud's:

- **Zhangbei Data Centre** — has a PUE of 1.25;
- **Wulanchabu Data Centre** — utilises renewable energy which is generated from both wind and solar sources;
- **Heyuan Data Centre** — is the first 'green' data centre in Mainland China to harness lake water for cooling;
- **The Nantong Data Centre** — is actively promoting new energy consumption, and finally;
- **Hangzhou Data Centre** — is continually striving to achieve one of the lowest PUE scores in Mainland China.

May 2021: @Hub proposed the goal of achieving 100% renewable energy for all new generation hyperscale data centres within its operational scope by 2030.

June 2021: Baidu announced a carbon neutral plan to "achieve carbon neutrality in group operations by 2030."

July 2021: Aofei Data announced that the company received the carbon neutrality certificate issued by the Mainland China National Accreditation Service for Conformity Assessment (CNAS). The company's Guangzhou Jinfa Data Centre, Langfang Cloud Data Centre and the company's other self-built data centres obtained carbon neutrality certification.

September 2021: GDS's Chengdu No.1 and Shanghai No.3 data centre projects passed the first DC-Tech "Zero Carbon" data centre grade evaluation.

Key Takeaways

The Market

- At the beginning of 2021, cabinet stock in Mainland China touched 3.6 million.
- This number is expected to surpass 4 million by the end of the year/beginning of 2022.
- The Beijing-Tianjin-Hebei region, the Yangtze River Delta region and the Pearl River Delta region continue to maintain strong data centre construction impetus.

Government Policy

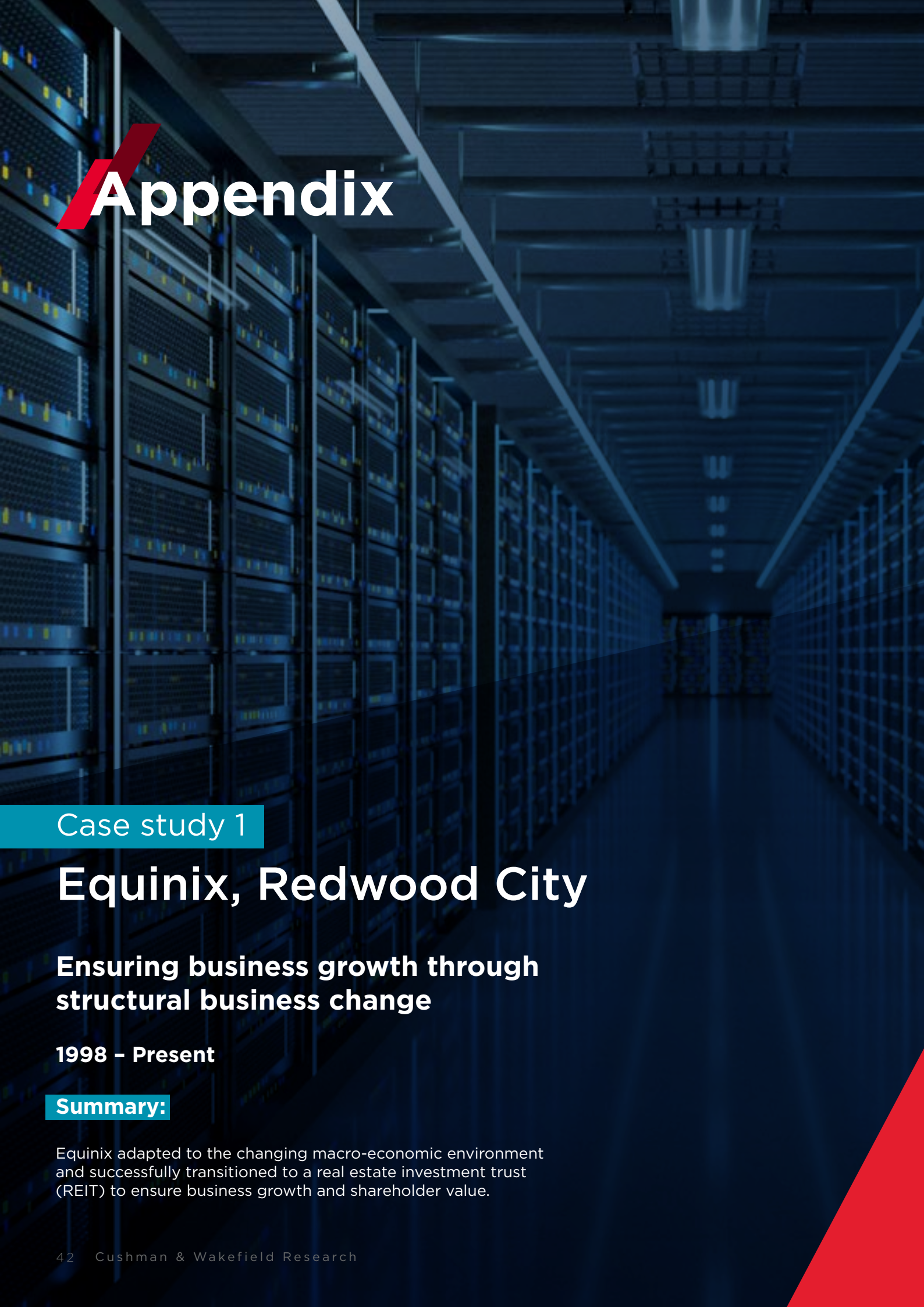
- One of the most important data centre industry-related policies released recently in Mainland China is "The Three-year Action Plan for New Data Centre Development (2021-2023)".

Investment

- Domestic data centre financing conduits are largely split into equity financing and debt financing, including public offering, rights issue, private placement, bond financing, bank loans and other instruments.
- Data centres require large capital investment, and the trial of a domestic REITs market will beget new financing channels to listed companies.

Environmental Sustainability

- Recent policies in Mainland China aim to guide future data centre development in Mainland China along a sustainable 'green' path, whereby, among other aspects, new development:
  - Is systematic, coordinated, and orderly;
  - Ensures energy-use efficiency, and;
  - Utilises energy from renewable energy sources where possible.
- Moreover, demand pressure for data centre carbon neutrality is also arising from user enterprises, as they try to achieve their yearly environment, social and governance (ESG) rating objectives.
- Mainland China's data centre market is rapidly transforming. By thoroughly accessing the market, government policy, the investment dynamics, and factors associated with sustainability, both investors and developers will be in a stronger position to make the right decisions when it comes to their data centre property investment in the region.



Appendix

Case study 1

Equinix, Redwood City

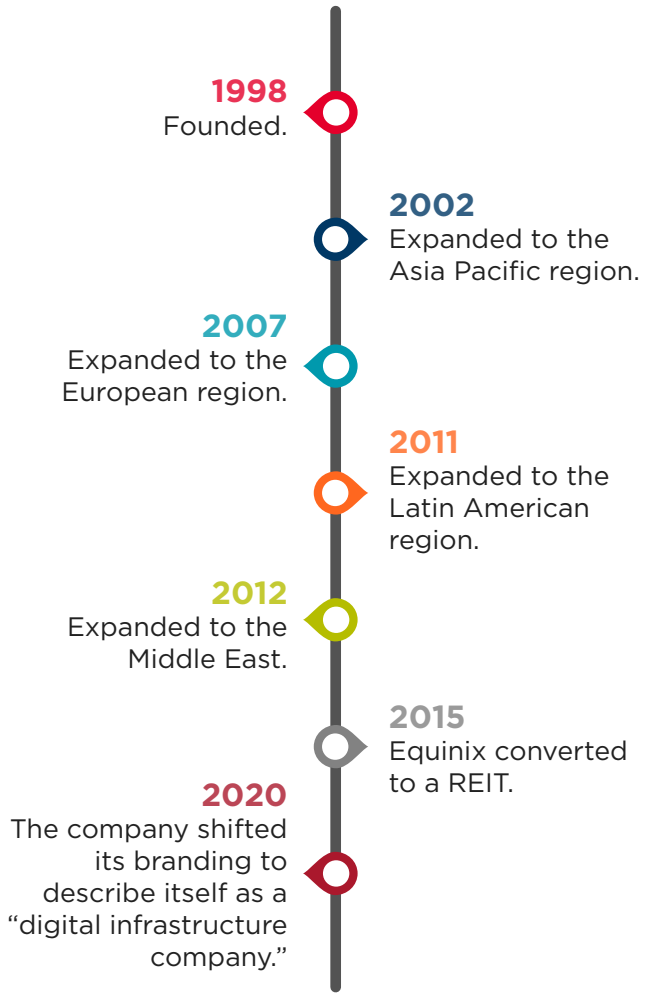
Ensuring business growth through structural business change

1998 – Present

Summary:

Equinix adapted to the changing macro-economic environment and successfully transitioned to a real estate investment trust (REIT) to ensure business growth and shareholder value.

Timeline of major events/milestones reached:



Overview:

- Equinix, Inc. is an American multinational corporation with its global headquarters located in Redwood City, California.
- The company's business focus is centred on Internet connection and data centres.
- Equinix is a leader in global colocation data centre market share.
- The company has 220 data centres in 26 countries on five continents.

Impact:

- In 2015, Equinix successfully converted to a real estate investment trust (REIT) to gain tax advantages and add shareholder value.

How it was done:

- Equinix was established in 1998.
- The organisation promoted its data centre platform as a neutral place where competing networks could connect and share data traffic.
- The business made the most of the "network effect", through which each new customer would widen the attraction of its platform.
- Equinix enlarged its business footprint to the Asia-Pacific region in 2002 and to Europe in 2007.
- This expansion was followed by Latin America in 2011 and the Middle East in 2012.
- In September 2020, the company modified its branding to define itself as a "digital infrastructure company".

Results:

- As a result of the business conversion, Equinix was able to successfully transition its business structure to that of a REIT.

Key takeaways:

- By converting to a REIT, Equinix has been able to acquire a number of business advantages:
- Firstly, Equinix had to and has to continue to ensure high yield, low risk characteristics to meet the needs of investors – which in turn has resulted in a high stock price.
- Secondly, there is the advantage of a lower tax burden. Equinix is able to avoid double taxation by exempting REITs from income tax on rental income and dividends from property sales.
- Thirdly, Equinix enjoys an enhanced financing capacity. Since 2015, Equinix's capital expenditure has grown rapidly, and its operating income has improved significantly.
- Finally, Equinix's asset structure has been optimised. Financing has been easier since transforming to a REIT, and the gearing ratio has steadily declined while the company has maintained rapid business expansion.

Table 12: General energy efficiency strategy measures for data centres

Aspects	Energy Efficiency Measures	Strategies
IT	Apply efficient data storage procedures and consolidate under-used servers	• Utilise tools and technologies, such as duplication software, to store data efficiently, and; • Consolidate and eliminate superfluous hardware.
	Initiate server power management features	• Today, many servers have built-in energy saving features. However, to work, they need to be activated.
Power Infrastructure	Lessen energy losses from power distribution units (PDUs) and uninterrupted power supply (UPS) systems	• Seek out and incorporate and operate smart, efficient PDUs and energy-efficient UPS systems.
Air Flow Management	Ensure cooling effectiveness by managing air flow	• Implement measures, such as floor grommets, diffusers, curtains, perspex panels and blanking panels to make sure cold air does not mix with hot exhaust air.
	Design and install a hot aisle/cold aisle layout	• When laid out in rows, the fronts of server racks should be positioned so that they face each other. Furthermore, the backs of server racks should also be positioned to face each other. This will ensure an optimal air flow management hot (exhaust) aisle/cold aisle layout is realised in the centre
HVAC	Think about using a water-side economiser and/or an air-side economiser	• Utilise a cooling tower as an alternative to a mechanical chiller to provide chilled water for cooling, and/or; • Cool the data centre at almost no cost by utilising outside air.

Aspects	Energy Efficiency Measures	Strategies
HVAC	Fit in-rack/in-row cooling	• These systems carry cold air nearer to (or straight to) the servers.
	Make humidification modifications	• IT equipment can on the whole bear a wide range in humidity. If needing to add humidity, utilise energy-saving misters, foggers, etc.
	Use sensors and devices to coordinate cooling capacity and airflow with IT loads	• Sensors and devices can recognise outside temperature and humidity levels, indoor temperature and humidity levels, cooling tower water temperature levels (if a cooling tower installed and utilised) and IT loads at any given time and then accordingly automatically adjust the energy used by the HVAC system to cool the centre, thereby ensuring energy-saving efficiency.
Operational Management	Compare the data centre's energy efficiency	• Benchmark the project to similar facilities around the region.
	Offer energy-saving/energy-efficiency awareness training	• By providing regular training, the centre's management staff will be aware of the latest technology, techniques, systems, methodologies, and processes associated with energy saving and energy efficiency at any given time.

Source: Cushman & Wakefield Research

Table 13: Recent data centre-related policies

Department	Date	Policy
MIIT, The Bureau of Energy, The National Development and Reform Commission, The Cyberspace Administration of China	23 Dec 2020	Guidelines on accelerating the establishment of a national collaborative innovation system for integrated Big Data centres
	24 May 2021	Implementation plan for a computing power hub for a collaborative innovation system for a national integrated Big Data centre
	8 Dec 2021	Implementation plan to promote green and high-quality development of new infrastructure, such as data centres and 5G
MIIT	16 Nov 2021	The development plan for the information and communication industry during the 14th Five-Year Plan period
	3 Dec 2021	The green industrial development plan for the 14th Five-Year Plan period
The State Administration for Market Regulation (Standardisation Administration)	14 Oct 2021	Energy efficiency limits and energy efficiency levels for data centres

Province/Municipality	Date	Policy
Beijing	27 Apr 2021	Implementation plan for the coordinated development of data centres in Beijing (2021-2023)
	27 Jun 2021	The notice on further strengthening the energy conservation examination of data centre projects
Shanghai	7 Apr 2021	The notice on matters related to the overall planning and construction of data centres in Shanghai in 2021
	8 Apr 2021	Shanghai data centre construction guidelines (2021 edition)
Guangdong	27 Apr 2021	The notice from the Energy Bureau of Guangdong Province on clarifying relevant requirements for data centre energy consumption in Guangdong Province

Source: Cushman & Wakefield Research

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To better serve our clients, our Greater China Research Team has established Centres of Excellence in various focus areas, such as Capital Markets, Office, Industrial and Retail. Shaun leads the Research Centre of Excellence for Greater China Data Centre Research in Greater China. If you have any queries related to Data Centre Research in Greater China, please contact Shaun Brodie.

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