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Hong Kong Data Centres

The Right Supply for Rising Demand



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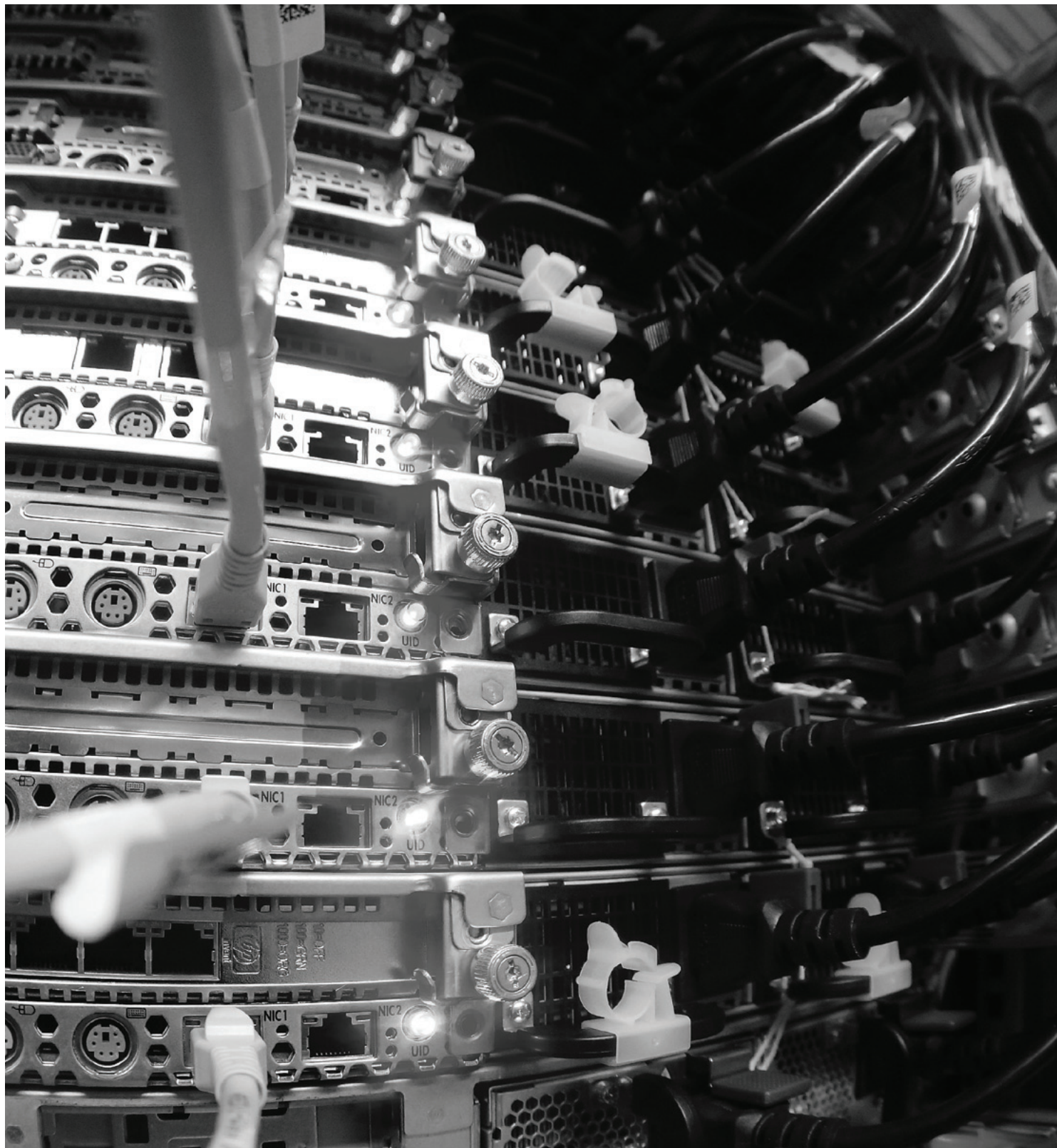
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- 05** **Investment Summary**
- 07** **The Data Centre Market in Hong Kong**
 - Where Does the Demand Come From?
- 09** **Data Centre Supply in Hong Kong**
 - Major Data Centre Operators in Hong Kong
 - Sources of Data Centre Supply
 - How's the Supply Situation in the Next 2-3 Years?
- 16** **The Tseung Kwan O Data-Centre Cluster**
 - Practitioners' Views on the Site
 - New Submarine Cable Connecting Tseung Kwan O
- 19** **Supply-Demand and Pricing Analysis**
 - Demand = 85% of Supply in 2018...
 - Existing Data-Centre Pricing Stable; Discounts at New Data Centres
 - More Mega-Scale Supply?
- 22** **Overview of Data Centre Operations in Hong Kong**
 - Hong Kong Is One of the Region's Ideal Locations
- 27** **Brief Introduction to Data Centres in China**
 - Key Players of the Data-Centre Market in China
 - Licensing in China
- 30** **Major Listed Data Centre Operators in Hong Kong and China**
- 33** **Conclusion**



Investment Summary

We interviewed more than 10 leading data centre operators (including telecommunications companies as well as listed and non-listed carrier-neutral data centre operators) which collectively account for about half of the market share in Hong Kong. We have learnt industry practitioners' views on the outlook for the industry as well as future demand, based on their project pipeline and conversations with their existing and potential customers. We also spoke to a government agency and information security services provider to understand the market dynamics and latest industry developments. We are positive on the outlook for Hong Kong's data-centre sector, and expect the market to grow at 15% per year over the next 3-5 years. We also analysed the supply-demand situation and have concluded that new supply over the next few years will be healthily absorbed.

Hong Kong is set to be one of the major data-centre hubs in Asia. It is a gateway through which Chinese Internet and multi-media content providers as well as telecom operators can connect to the rest of the world. The city is one of the few locations in Asia that have (i) a safe environment sheltered from natural disasters, (ii) a reliable and stable supply of electricity, and (iii) advanced telecom infrastructure.

The demand for data centres in Hong Kong used to come from the banking and financial sector. Recently, new demand has come from multi-media content providers such as Letv that host digital content, as well as Internet players such as online-entertainment giant Tencent. The demand is also fuelled by the rising adoption of cloud technology by business enterprises. Industry practitioners also shared with us that Chinese telecom operators are also expanding their footprint into Hong Kong to serve multi-national customers.

Overall data-centre supply in Hong Kong is constrained by the limited supply of land in the territory. There are mainly two sources of data-centre supply in Hong Kong, namely (i) old industrial buildings that have been converted for that purpose and (ii) greenfield data-centre projects. Additional supply from conversion of old industrial buildings is usually slow to come to the market due to the limited number of sites with suitable data-centre specifications available in the market. As for greenfield projects, the next auctions of data-centre sites put out by the government – in Tseung Kwan O – will be in 2018-2019.

According to the Innovation and Technology Bureau (ITB) of the Hong Kong government, data-centre capacity will increase by 32% to 7.1 million square feet (sq ft) in terms of Gross Floor Area (GFA) by the end of 2017 from 5.4 million sq ft at the end of 2015, thanks to the completion of a number of government-supported greenfield projects. In particular, the new data-centre facility by SUNeVision will add GFA of 730,000 sq ft. We forecast capacity utilisation of 82% and 80% in 2016 and 2017, respectively, in Hong Kong, which is satisfactory. We expect it to reach 85% in 2018.

Data centre operators generally think that the pricing for existing facilities should be stable in the next few years. Customers are very sticky and consider quality a priority. The switching cost and risks of operation disruption are simply too high. As for newly-

launched facilities, it is a common strategy of data-centre operators to focus on acquiring selected anchor customers by offering price discounts. Firstly, this will attract other potential customers for cross-connect benefits, which will in turn boost profitability in the long term. Second, this will shorten the time to fill available capacity, and therefore, the payback period as well. Thereafter, the price per GFA will gradually normalise with increasing utilisation. All in all, we do not expect the new supply in 2016 and 2017 to result in significant price pressure on existing data centres.

The key market players in Hong Kong include (i) local telecom operators such as PCCW and HGC GlobalCentre Limited (Hutchison Telecom); (ii) local carrier-neutral data-centre operators such as SUNeVision, Grand Ming, Telehouse HK CCC (HKCOLO), and Citic Telecom; (iii) international data-centre operators such as NTT communications, Pacnet (Telstra), Global Switch, and Equinix (iv) Chinese telecom operators such as China Mobile, China Telecom, and China Unicom. The top two players in terms of GFA are NTT Communications and SUNeVision.

We believe that leading data-centre operators with land sites or premises for capacity expansion will benefit from the industry's robust growth in the next few years. SUNeVision, currently having 14% market share, will double its capacity by the end of 2017 upon the completion of its greenfield facility in Tseung Kwan O and expansion of its data centre in Shatin. Thereafter, it will become the largest data centre operator in Hong Kong. It is one of the few pure data centre stocks listed in Hong Kong. ❌

Hong Kong is set to be one of the major data-centre hubs in Asia

The Data Centre Market in Hong Kong

We interviewed more than 10 leading operators (including telecom companies, as well as listed and non-listed carrier-neutral data-centre operators) which jointly account for about half of the market share in Hong Kong. We have learnt industry practitioners' view on the outlook for the industry, as well as future demand, based on their project pipelines and conversations with their existing and potential customers. We also spoke to a government agency and information security services provider to understand the market dynamics and latest industry developments. Based on our survey, Hong Kong's data-centre market is expected to grow at 15% per year for the coming 3-5 years. This is consistent with Frost & Sullivan's earlier forecast of 15% per year for 2013-2019¹.

Where Does the Demand Come From?

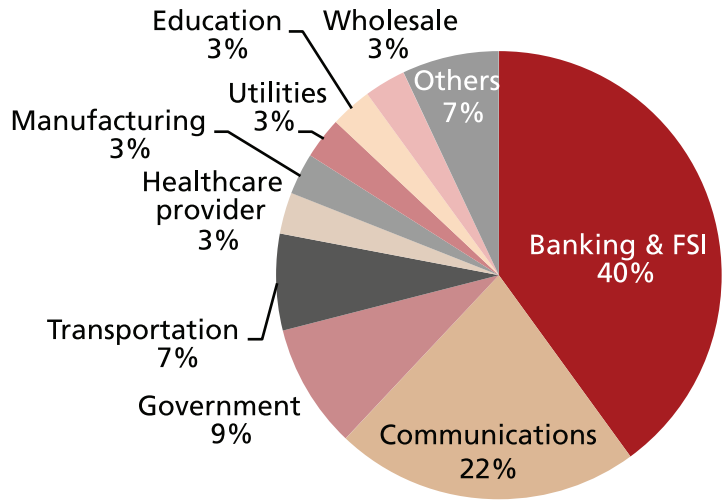
Hong Kong is a gateway connecting China and the rest of the world. Multi-national corporations, international telecom operators, and Internet companies set up their servers in Hong Kong to serve mainland Chinese Internet users. Hong Kong is also a springboard for Chinese Internet companies (such as Tencent) and multi-media content providers (such as Youku and Letv), as well as telecom operators to expand to the rest of the world. As such, the city is well placed benefit from the rising demand from China, compared to other data-centre clusters in Southeast Asia.

According to technology research firm Gartner, the banking and financial services institutions, communications, government, and transportation sectors were estimated to account for 40%, 22%, 9%, and 7% of data-centre spending in 2014, respectively. The demand for data centres in Hong Kong used to come from the banking and financial sector. In recent years, demand has come from multi-media content providers such as Letv, which host digital content, as well as Internet players such as Tencent. The demand is also fuelled by rising digitalisation and the adoption of cloud technology by business enterprises. Industry practitioners shared with us that Chinese telecom operators are also expanding their footprint into Hong Kong to serve multi-national customers. Some believe that the demand from the multi-media, Internet, cloud, and IT sectors could account for as much as 30-40% of the data-centre market in the next 3-5 years.

The proliferation of over-the-top (OTT) multi-media content providers such as TVB and Letv in Hong Kong is a key driver of demand for storage space and transmission bandwidth. Moreover, the quality (resolution) of the video content has partly been upgraded from High Definition (HD) to Ultra-High Definition (4K). 4K videos take up as much as six times the storage space that HD videos do. Research firm IDC estimates that the data created by digitalisation worldwide will increase from 9.3 Zettabyte (ZB) in 2015 to 44ZB in 2020², representing a compound annual growth rate (CAGR) of 36.5%, with 48% contributed by media content.

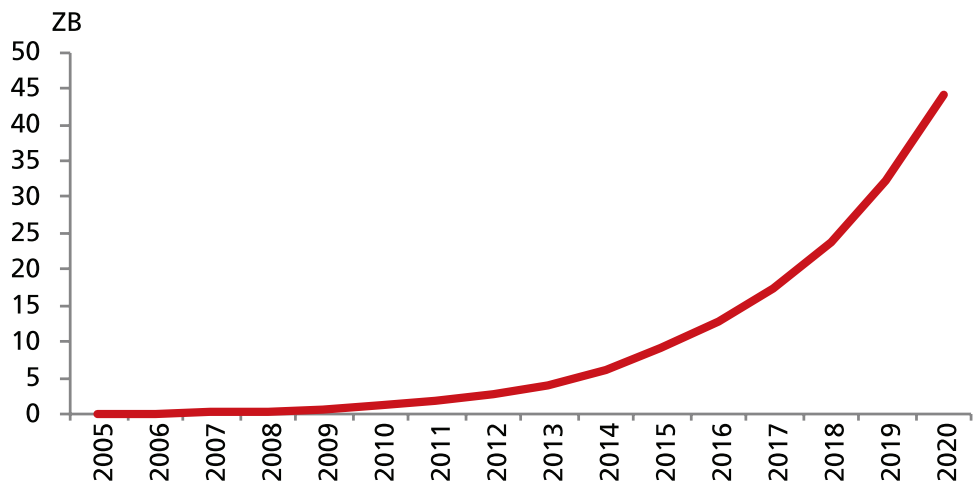
The multi-media, Internet, cloud, and IT sectors could account for as much as 30-40% of the data-centre market in the next 3-5 years

Diagram 1. Breakdown of spending by data centre end-users in Hong Kong (2014)



Source: Gartner, DBS Vickers

Diagram 2. Data created by digitalisation globally (2005-2020)



Source: IDC

We expect bigger enterprises which are currently maintaining their own IT infrastructure in commercial buildings to outsource to third-party data centres to cut down on expensive rental and maintenance costs. Gradually, smaller enterprises will follow suit. We also see upgrading from tenants that will move to newer, fancier sites when the new facilities are ready.

For example, the Hong Kong government is planning to build a new data centre with GFA of about 133,000 sq ft in Cheung Sha Wan to cope with the increasing need for data storage and replace some outdated facilities. Currently, the government has 25 data centres operated by 15 bureaus and departments totalling about 178,000 sq ft and 2,300 racks. Additionally, it has rented 420 racks from third-party data centre operators³. ❌

Data Centre Supply in Hong Kong

Total data-centre supply in Hong Kong at the end of 2015 was approximately 5.4 million sq ft, according to Hong Kong's ITB. Major data centres are located in Tseung Kwan O Industrial Estate, Tai Po Industrial Estate, as well as industrial areas in suburbs such as Shatin, Tsuen Wan, Kwai Chung, Chai Wan, and Wong Chuk Hang. Based on our interviews with various data centre operators in Hong Kong, the current utilisation rate stands at around 80%, which they believe to be healthy. For the remaining 20%, some space is new (and hence, idle) and some, reserved for existing tenants' future expansion.

In this report and in our analysis, we use GFA in square feet to describe data-centre capacity as this information is most commonly disclosed by data centre operators. Other capacity measures include Raised Floor Area (RFA), number of racks and power output (in Watt [W]). For example, for a tier-3+ data centre, 1 square foot of RFA is approximately equivalent to 2 sq ft of GFA. We also estimate that one rack occupies GFA of about 90-100 sq ft. Total power output (KW) is the product of Kilovolt-Ampere (kVA) per rack, power factor (typically 0.8 for data centre) and number of racks.

Major Data Centre Operators in Hong Kong

Key market players in Hong Kong include

1. local telecom operators such as PCCW and HGC GlobalCentre Limited (Hutchison Telecom);
2. local carrier-neutral data-centre operators such as SUNeVision, Grand Ming, Telehouse HK CCC (HKCOLO), and Citic Telecom;
3. international data-centre operators such as NTT Communications, Pacnet (Telstra), Global Switch, and Equinix;
4. Chinese telecom operators such China Mobile, China Telecom, and China Unicom.

The top two players are NTT Communications and SUNeVision in terms of GFA. We expect SUNeVision to become the largest data-centre operator in Hong Kong after the completion of its Tseung Kwan O data centre and expansion of its Shatin facility. China Unicom and Global Switch are setting up their data centres in Tseung Kwan O Industrial Estate.

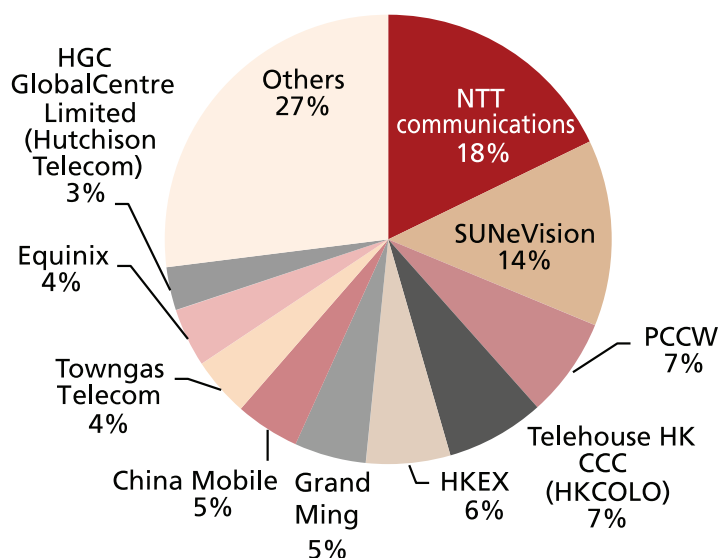
Diagram 3. Major data-centre operators in Hong Kong

Major data centre operator	Capacity (sq.ft.)	Market share
NTT communications	992,464	18.4%
SUNeVision	750,000	13.9%
PCCW	400,000	7.4%
Telehouse HK CCC (HKCOLO)*	396,000	7.3%
HKEX	337,987	6.3%
Grand Ming	287,972	5.3%
China Mobile	258,334	4.8%
Towngas telecom	236,806	4.4%
Equinix	236,000	4.4%
Digital Realty & Savvis~	193,750	3.6%
HGC GlobalCentre Limited (Hutchison Telecom)#	175,000	3.2%
Super Effort	170,000	3.1%
Citic Telecom	135,000	2.5%
Pacnet (Telstra)^	60,278	1.1%
New World Telecom	50,000	0.9%
China Telecom	27,000	0.5%
IBM	15,000	0.3%
Others	677,803	12.6%

* Telehouse HK CCC: a JV formed by HKCOLO and KDDI
~ Savvis: acquired by Century Link
^ Pacnet: under Telstra

HGC GlobalCentre Limited: a JV formed by Hutchison Telecom and Cheung Kong (Holdings) Limited
Source: Companies, DBS Vickers

Diagram 4. Market share by capacity in Hong Kong (2015)



Source: Companies, DBS Vickers

Diagram 5. Major data-centre clusters in Hong Kong (2016)



Source: Office of the Government Chief Information Officer of HK Government

Sources of Data Centre Supply

The Hong Kong government wants to foster and strengthen Hong Kong's position as the prime location for data centres in Asia Pacific, especially for top-tier data centres (Tier 3+). ITB was set up to provide services to developers and investors on related matters. The supply of data centre in Hong Kong mainly comes from (i) industrial buildings that have been converted, and (ii) greenfield projects.

1. Conversion of industrial buildings

The government provides policy support to develop the industry. Industrial buildings aged 15 years or above and located in zones specified for industrial, commercial or other

specified uses (business) use are eligible for a waiver of fees if part of the space was converted into data centres. The application procedure was streamlined by the Lands Department⁴ to facilitate the setting up of data centres on the premises. Note that the conversion is subject to a set of strict specifications such as network connection, floor space, and electricity supply for the operation of data centres.

The conversion work usually takes around 1-2 years. This means that supply comes to the market very slowly, due to the limited number of sites with suitable data-centre specifications available in the market. Traditional industrial areas such as Kwai Chung, Tsuen Wan, and Chai Wan are usually where this kind of data centres are found.

2. Greenfield projects

Major sources of land supply for the construction of data centres are (i) industrial estates managed by The Hong Kong Science and Technology Parks Corporation (HKSTPC), (ii) dedicated land parcels for the construction of top-tier data centres planned by the government, and (iii) sites or premises available in the open market.

Building a data centre from the ground up takes around 3-5 years. But the space can be maximised for housing data-centre equipment. The supply of data-centre capacity through greenfield projects is quite inelastic due to the long development cycle. Thanks to the government's support, greenfield projects in industrial estates and dedicated land lots often enjoy lower land costs. This makes investments more attractive.

How's the Supply Situation in the Next 2-3 Years?

Total data-centre capacity in Hong Kong stood at approximately 5.4 million sq ft in terms of GFA at the end of 2015. ITB expects this capacity to increase by about 32% to 7.1 million sq ft by the end of 2017, mainly due to the completion of several greenfield data centres in Tseung Kwan O, and conversion of some industrial buildings.

1. About 470,000 sq ft from conversion of industrial buildings

The government has received 28 applications, as at the end of August 2016, for converting parts of existing industrial buildings under the aforementioned concession scheme. There were 13 applications, equivalent to an aggregated data-centre capacity of 728,000 sq ft being approved and executed, according to ITB. We estimate that 470,000 sq ft of new capacity will be added in 2016-2017.

SUNeVision is planning to add 260,000 sq ft by expanding its existing data centre in Shatin⁵. We understand that there are 2-3 conversion projects to be launched soon. Citic Telecom has proposed to expand its data centre in Citic Telecom Tower (CTT) to add capacity of 300,000 sq ft in 2018-2019.

Building a data centre from the ground up takes around 3-5 years. But the space can be maximised for housing data-centre equipment

Telecom operators such as PCCW and Hutchison Telecom also have premises available for capacity expansion. We expect 500,000-600,000 sq ft of capacity to be added per year from 2018 to 2020.

2 (i) About 775,000 sq ft from greenfield projects in Tseung Kwan O Industrial Estate

China Unicom is building a data centre in the Tseung Kwan O Industrial Estate which will commence operations upon the completion of its first phase in 2016. The project will add supply of 400,000 sq ft to the market. We also expect Global Switch, a leading global data-centre operator, to complete its data centre with GFA of 375,000 sq ft in Tseung Kwan O Industrial Estate in the coming two years.

2 (ii) About 470,000 sq ft from dedicated land lots in Tseung Kwan O and another 1 million sq ft coming to the market in 2022-2023

There are three land parcels in Tseung Kwan O allocated by the government for data-centre development. SUNeVision successfully bid for one of the parcels during the auction in October 2013. The company will add supply of 470,000 sq ft after the completion of its Mega Plus data centre on the site.

The government now has two dedicated land parcels with GFA of about 500,000 sq ft each in Tseung Kwan O for auction in 2018-2019. Given that greenfield projects take around 3-5 years to complete, the supply will come into the market in 2022-2023. ❌

Diagram 6. Major data-centre supply in Hong Kong (2016-2017)

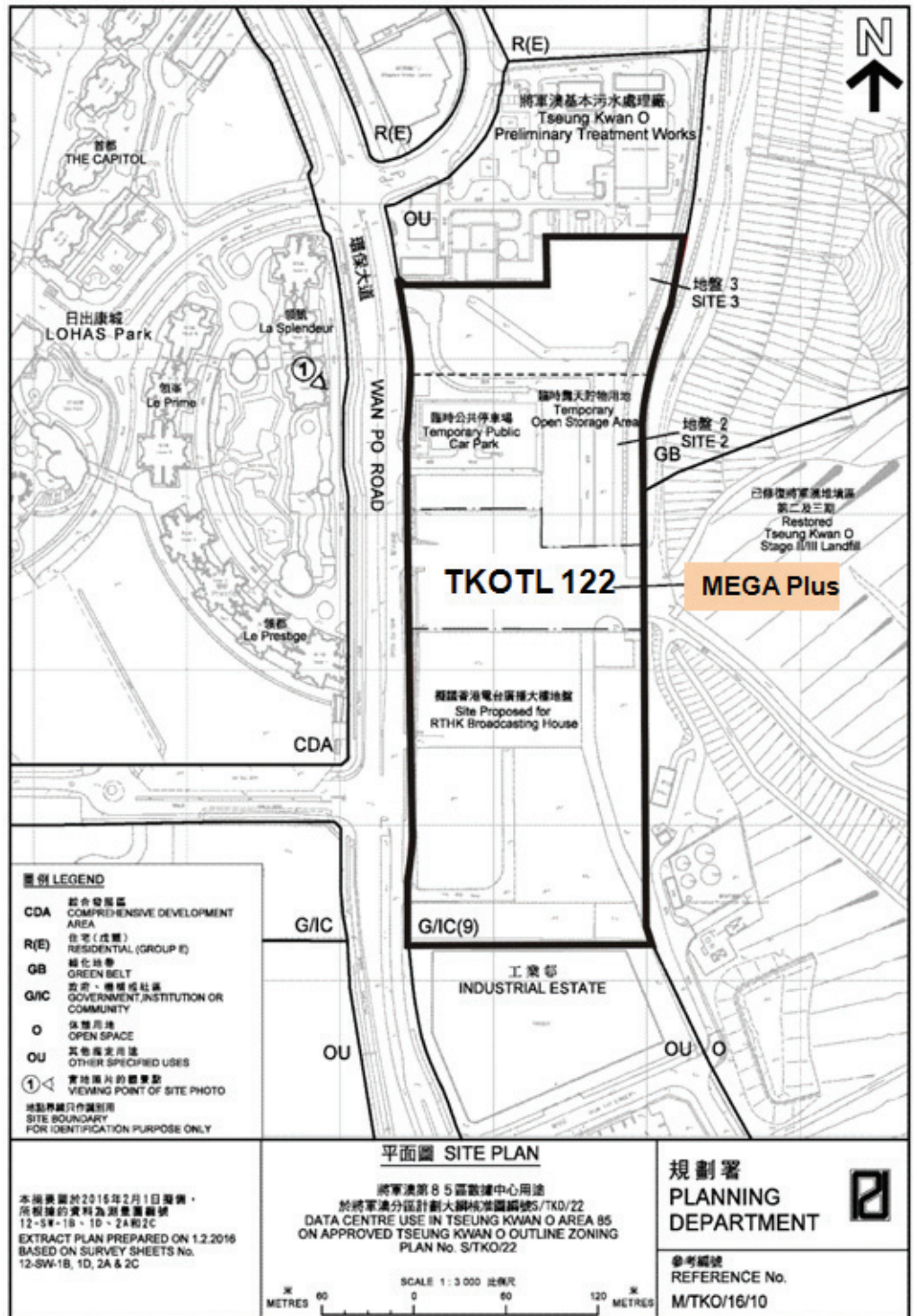
Data centre operator	Data centre area (sq.ft.)	Location
SUNeVision	260,000	Shatin
SUNeVision	470,000	Tseung Kwan O
China Unicom	400,000	Tseung Kwan O
Global Switch	375,000	Tseung Kwan O

Diagram 7. Land allocated for data centres by Hong Kong government

Land parcel	Site 1	Site 2	Site 3
Location	Wan Po Road, Tseung Kwan O		
Site area (sq.ft.)	110,869	116,521	116,521
Plot ratio	4.3	4.5	4.5
GFA (sq.ft.)	473,616	524,346	524,346
Status	Bidder by SUNeVision	Expected to put up for auction in 2018-2019	Expected to put up for auction in 2018-2019

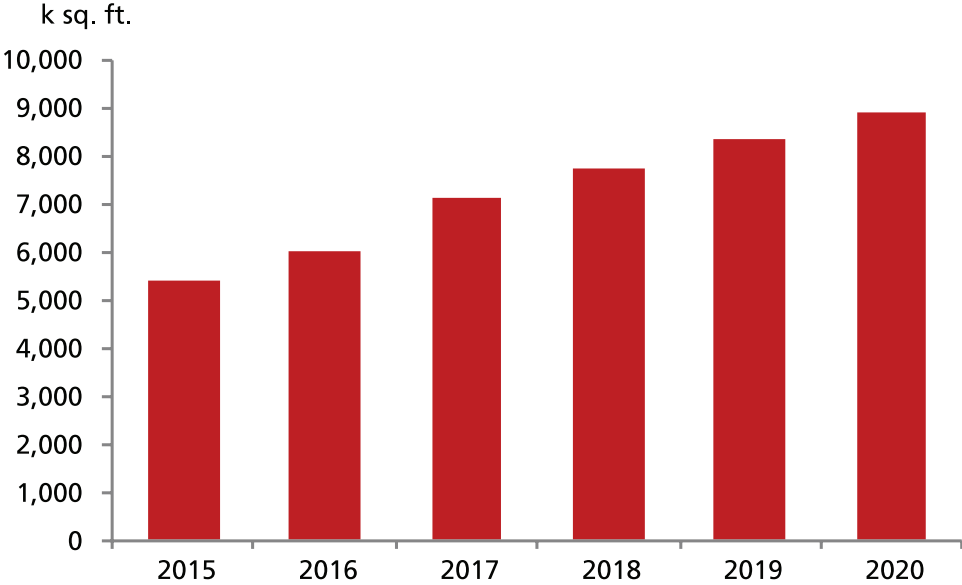
Sources: Companies, DBS Vickers

Diagram 8. Locations of land allocated for data centres by the Hong Kong government



Source: Office of the Government Chief Information Officer of HK Government

Diagram 9. Projected data-centre supply in Hong Kong (2015-2020)



Source: Companies, DBS Vickers

The Tseung Kwan O Data-Centre Cluster

Tseung Kwan O is home to 10 high-tier data centres: HSBC, Hong Kong Exchange, Telehouse HK CCC (HKCOLO), Pacnet (Telstra), NTT Communications, China Mobile, Towngas Telecom, Digital Realty Trust & Savvis, Global Switch, and China Unicom. IBM's Tier 3+ data centre is located in the Telehouse HK CCC building, which houses one of the most important data-centre clusters in Asia. The data centres in Tseung Kwan O occupy about 3 million sq ft of GFA, representing about 60% of Hong Kong's total data-centre capacity.

Practitioners' Views on the Site

Advantages: Tseung Kwan O is becoming a key area for the supply and development of data centres in Hong Kong due to the availability of land supply (compared to other parts of Hong Kong). The site definitely has advantages such as a stable electricity supply and advanced telecom infrastructure.

Diagram 10. Data centres at Tseung Kwan O Industrial Estate



Source: Hong Kong Science and Technology Parks Corporation, DBS Vickers

Diagram 11. Major data-centre supply in Hong Kong (2016-2017)

Data centre operator	GFA (sq.ft.)	Status
NTT communications	750,000	in operation
HSBC	500,000	in operation
China Unicom	398,265	Expected to complete phase 1 in July 2016
Telehouse HK CCC (HKCOLO)	396,000	in operation
Global Switch	375,000	under construction
HKEX	337,987	in operation
China Mobile	258,334	in operation
Towngas telecom	236,806	in operation
Digital Realty & Savvis	193,750	in operation
Pacnet (Telstra)	53,820	in operation

Source: Companies, DBS Vickers

Disadvantages: At the same time, we have also learnt about some shortcomings of the site:

1. Rats from the landfill site? Tseung Kwan O's original name was Junk Bay as it had been a landfill site since 1978. We learnt that rats from the landfill site do at times sneak into the data centres and damage the cabling systems. The proximity to the landfill site poses a risk to the operational stability of the data centres and increases their maintenance costs.
2. Single-way connection. Tseung Kwan O is connected to urban areas mainly through Tseung Kwan O Tunnel. This makes the data centre vulnerable to isolation in the event of any tunnel blockage. Moreover, we understand that fibre connection is also paved along the tunnel. The single-way connection is not ideal.
3. Sub-letting constraints⁶. Data-centre tenants in Tseung Kwan O Industrial Estate are not allowed to station their staff at the data centres due to the sub-letting prohibition set out by HKSTPC. Industry practitioners shared with us that some data centre users prefer to have their own IT or security staff stationed at the data centres to maintain network security and stability. As common practice, data centre operators often allow customers to use part of the data centre as office space on a temporary or as-needed basis, which could be considered value-added services. However, the current sub-letting constraints in Tseung Kwan O Industrial Estate pose practical inconvenience to the operators.

New Submarine Cable Connecting Tseung Kwan O

We learnt that a domestic submarine cable will be built by Superloop, a leading telecom infrastructure provider, to connect the Tseung Kwan O site to Chai Wan. This will increase the attractiveness of data centres in Tseung Kwan O as it will resolve the shortcoming of the single-way fibre connection along Tseung Kwan O Tunnel.

Established in 2014, Superloop is an independent provider of connectivity services in the Asia Pacific region. The company plans to build a fibre ring connecting 30 high-end commercial buildings and major data-centre clusters in Hong Kong. It has obtained the relevant approvals and begun network construction in 2016.

In particular, TKO Express (Tseung Kwan O Express) will be a domestic submarine cable in the fibre ring connecting data centres in Tseung Kwan O and Chai Wan. TKO Express has a completion timeline of 12-15 months. We expect the data centres in Tseung Kwan O to benefit from the construction of the fibre ring, which offers an alternative network connection. ❌

*New data-centre supply in the past few years
has been very limited*

Supply-Demand and Pricing Analysis

New data-centre supply in the past few years has been very limited. Thanks to the government's support, data-centre capacity will increase by 32% to 7.1 million sq ft in terms of GFA by the end of 2017 from 5.4 million sq ft at the end of 2015, according to ITB. Meanwhile, some people are concerned about potential over-supply. We believe that the supply-demand situation is a critical factor for the sector's outlook over the medium term. Therefore, we have analysed the supply-demand situation for the next few years. We have also studied the market dynamics during previous launches of new facilities, based on our interviews with data-centre operators. We conclude that the new supply over the next few years will be healthily absorbed by demand. Overall pricing should remain stable.

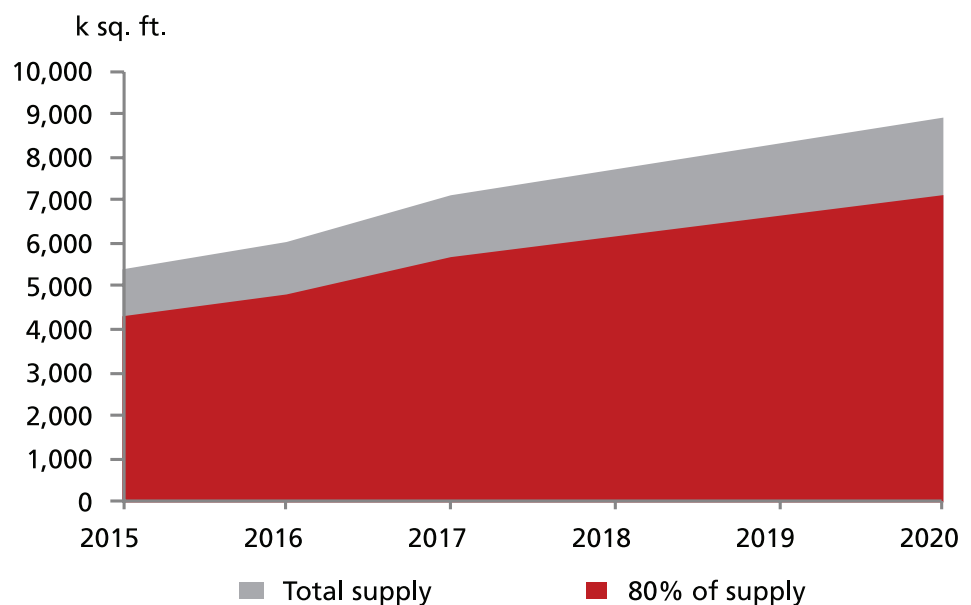
We conclude that the new supply over the next few years will be healthily absorbed by demand

Demand = 85% of Supply in 2018...

As mentioned earlier, total data-centre supply in Hong Kong was approximately 5.4 million sq ft as at the end of 2015. Based on our interviews with operators, 2015's utilisation rate stood at about 80%, i.e. 4.3 million sq ft of space was utilised, considered a satisfactory level for the industry. For the remaining 20%, some is newly established capacity and some is capacity locked in by existing tenants.

New data-centre supply will increase the capacity by about 32% to 7.1 million sq ft by the end of 2017. We assume 80% as the normal utilisation rate. Accordingly, an actual utilised capacity of 5.7 million sq ft (80% of 7.1 million sq ft) is considered an indicator that new capacity is being absorbed.

Diagram 12. Data centre supply at 80% utilisation in Hong Kong (2015-2020)

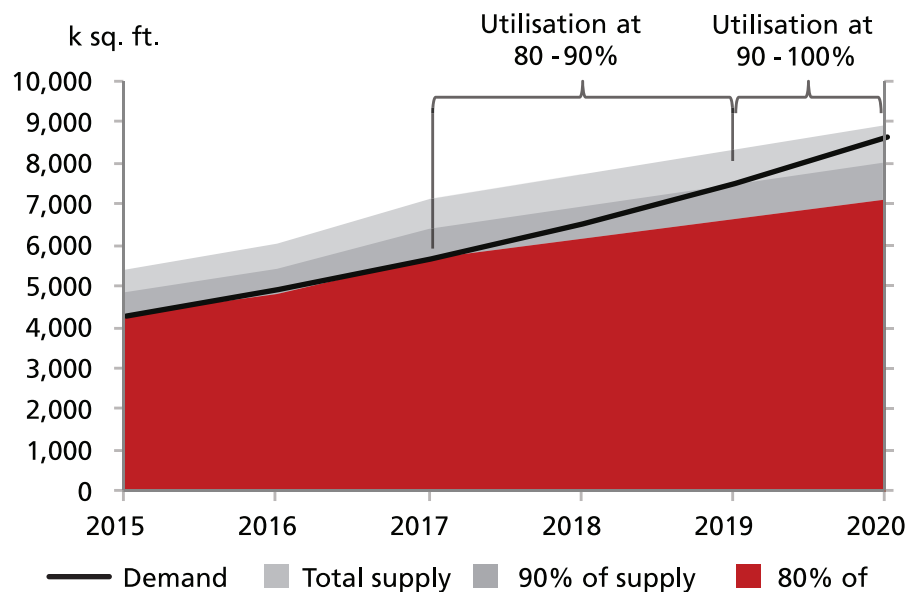


Source: Office of the Government Chief Information Officer of HK Government, Companies, DBS Vickers

Demand for data centres is expected to grow at about 15% per year for the coming 3-5 years, which suggests demand of 5.7 million sq ft and 6.6 million sq ft by the end of 2017 and 2018, respectively. The demand in 2017 represents, more or less, utilisation of 80%. The projected demand of 6.6 million sq ft for 2018 represents utilisation of 85% of our projected capacity of 7.7 million sq ft in 2018. Thus, we believe that the new supply in 2016 and 2017 will be healthily absorbed by the end of 2018. Overall utilisation will reach a more optimal level of 90% in 2019, and 100% before 2020.

Any new data facility generally takes around 3-5 years to ramp up capacity to an optimal utilisation rate of around 80-90%. It takes a few months for operators to negotiate contract terms and help customers move into the facilities. We expect to see temporary lower utilisation whenever new supply comes into the market due to this business lead time. We forecast the industry's capacity utilisation in 2016 and 2017 to remain satisfactory at 80%, which should not result in significant price pressure.

Diagram 13. Data centre supply and demand in Hong Kong (2015-2020)



Source: Office of the Government Chief Information Officer of HK Government, Companies, DBS Vickers

Existing Data-Centre Pricing Stable; Discounts at New Data Centres

Existing facilities. Management of data-centre operators shared with us that the pricing for existing facilities should be stable. Customers usually don't switch service providers and are motivated by quality of service. Switching costs and risks of operation disruption are

simply too high. In some cases, they need to be at a specific location due to accessibility and the need for geographical diversification of electricity supply and connectivity. For example, there could be over-supply in Tseung Kwan O for a short period of time, while other areas are still facing shortages (in particular, on Hong Kong Island). During 2012-2015, the total supply of data-centre space in Hong Kong in terms of GFA increased by 69% from 3.2 million sq ft in 2012 to 5.4 million sq ft. Over the same period, SUNeVision registered an inflation-adjusted price increase of 3-4%. This shows that pricing can be maintained with quality service and location, even as new data centres are launched.

New facilities. Operators usually focus on acquiring selected anchor customers by offering discounts. The rationale is that firstly, this will attract other potential users in the future for cross-connect benefits, which will in turn benefit overall pricing and occupancy in the long term. Secondly, this will shorten the time needed to fill the space and therefore, the payback period. We understand that leading players with strong customer networks will pre-sell their capacity to existing and new customers before completing the new facility, in order to further shorten the payback period. Thereafter, the price per GFA will gradually normalise.

Moreover, while we are using GFA for capacity and pricing analysis, we mentioned earlier that power supply is also a key pricing factor. The unit used to measure power density per rack is kVA. Most existing data centres support power provision of 1.5kVA-3kVA per rack. More advanced facilities support up as much as 24 kVA per rack. We believe that new facilities in greenfield sites usually allow higher power supply, which is positive to overall pricing on a per-GFA basis.

More Mega-Scale Supply?

Industry players shared with us that Hong Kong has probably lost some business (e.g. that of Google) to other cities (e.g. Singapore) in the past few years because the city lacks huge data centres. For example, we mentioned earlier that new demand in recent years has come from multi-media content providers such as Letv, as well as Internet players such as Tencent. Such tenants with huge demand prefer sizeable single-location facilities for easier management to multiple locations with small capacities. Due to tight supply in the past few years, the city lacked large facilities. The Hong Kong government is therefore now supporting the launch of mega sites for the sector's long-term development.

Note that the government still has two dedicated land parcels with GFA of about 500,000 sq ft each in Tseung Kwan O for auction in 2018-2019. We believe that the supply will come into the market in 2022-2023. Before that, we expect steady supply of about 500,000-600,000 sq ft per year from conversion to help meet the demand in 2018-2020. In the longer term, land supply in Hong Kong will remain limited; we believe that over-supply in the data-centre market looks unlikely. ❌

We believe that over-supply in the data-centre market looks unlikely

Overview of Data-Centre Operations in Hong Kong

Hong Kong Is One of the Region's Ideal Locations

Hong Kong is set to be one of the major data-centre hubs in Asia. The city is one of the few locations in Asia that have (i) a safe environment sheltered from natural disasters, (ii) a stable and reliable electricity supply, and (iii) advanced telecom infrastructure.

1. A safe environment sheltered from natural disasters. Hong Kong is away from plate boundaries and the Ring of Fire. The city is safe from natural catastrophes such as earthquakes and volcanic eruptions. Risks from tropical cyclones have been effectively mitigated, thanks to the weather warning and drainage systems.
2. A stable electricity supply. In Hong Kong, CLP Holdings supplies electricity to Kowloon and the New Territories, including Lantau Island, Cheung Chau, and most outlying islands, while Hong Kong Electric is responsible for Hong Kong Island and Lamma Island. Both companies' supply reliability is nearly perfect. The two electricity companies have enough capacity to provide emergency support to each other in the event of generator failure.
3. Advanced telecom infrastructure. Hong Kong has one of the world's most developed telecom networks, boasting the second-fastest average peak wire-line Internet connection speed of 105.2 megabits per second (Mbps) in the world. Hong Kong has 25 local fixed-network operators, with the biggest ones being Hong Kong Telecom, Hutchison Telecom, and TraxComm (under MTR Corp). Carrier-neutral data-centre operators use two or more broadband service providers for their data centres. In Hong Kong, over 70% of external telecom capacity is provided by submarine cables, with overland cables and satellite links accounting for the rest. The territory has seven submarine-cable landing stations (two at Tseung Kwan O, two at Tong Fuk, and one each at Deep Water Bay, Chung Hom Kok, and Cape D'Aguiar) and is connected to nine regional and transpacific submarine-cable systems. Hong Kong has links with the overland-cable networks of all four telecom operators in the mainland.

Data centres primarily serve the function of housing storage of electronic data and telecom systems. Operators generally provide power backup, redundant data communications connections, temperature and humidity control, as well as facility security. Leasing fees (or rental income) is a major source of revenue. The business model, to some extent, is similar to that of a property landlord.

The data-centre business is a capital-intensive one. The internal rate of return increases as operators offer more value-added services (on top of space or rack leasing). The returns of data centres providing wholesale co-location services in Hong Kong are 1-2 percentage points higher than that of commercial property leasing.

Diagram 14. Locations of cable-landing stations in Hong Kong



Source: Office of the Communications Authority⁷

Diagram 15. Wholesale co-location versus retail co-location

Whole co-location	Retail co-location
<ul style="list-style-type: none"> Lease a larger space to one or a few clients Contracts tend to be longer term Cater to cloud providers, retail co-location companies, and larger corporations Services include physical security (entrance control), uninterrupted power supply (UPS), and air-conditioning Example: Grand Ming 	<ul style="list-style-type: none"> Lease individual racks Services include physical security (entrance control), uninterrupted power supply (UPS), air conditioning, telecom services, and proximity services Examples: SUNeVision and Hutchison Telecom

Pricing

Pricing of data centre services (per GFA or per rack) depends on a number of factors, such as additional services (on top of space or rack leasing), the standard of the data centre (based on

tiers), and power supply, etc. For example, the monthly rent for a rack equipped with 2kVA power supply and basic co-location services is around US\$1,000-\$1,500.

For electricity supply, the costs are sometimes included in the 'all-in' rental and sometimes separately billed, depending on actual usage (with a mark-up of 0-3% administration fee). For Internet connectivity, the cost is sometimes included in the 'all-in' rental for smaller tenants. Larger tenants may directly negotiate with telecom operators. Other value-added services include data migration and project management.

Contract period

The contract period for wholesale co-location services can be as long as 5-20 years, with contract terms and pricing re-negotiated every 5 or 10 years. For retail co-location services, the contract period is shorter and varies from one to five years, depending on the size of the tenants and contract terms. Normally, the contract period for smaller tenants with less bargaining power is 1-3 years. Larger tenants with greater bargaining power prefer longer contract periods to lock in the pricing and some may even lock in some capacity for future expansion.

Customer retention

The customer retention rate for the data-centre business is high. Customers don't switch service providers often and are motivated by quality. Switching costs and risks of operation disruption are simply too high. Migrating servers from one data centre to another could interrupt operations and cause loss of data. Therefore, data-centre operators are usually able to raise prices by 10-20% upon contract renewal. Industry practitioners shared with us that to get customers to switch service providers, they would have to offer a discount of 30%.

Tenant mix

The tenant mix is important to operators' overall profitability. A good balance of household and commercial data traffic could optimise bandwidth cost. Data centre operators use peak data traffic as a basis to provide connectivity bandwidth. However, there will inevitably be moments when the bandwidth is idle, i.e. under-utilisation of bandwidth resources at certain periods of time. Commercial data traffic is high during office hours but low at night. Conversely, household data traffic is low during office hours but high during the night. A good balance of tenant mix (such as financial institutions and multi-media content providers) could therefore improve overall bandwidth utilisation and, in turn, overall profitability.

An anchor customer base is an asset to data-centre operators. Firstly, data exchange between tenants could be done within the data centre by directly connecting the respective servers. This will save connectivity costs for both tenants and data-centre operators. Secondly, the direct and fast connection to designated content (e.g. content hosted by Tencent) is beneficial to certain

The customer retention rate for the business is high...Switching costs and risks of operation disruption are simply too high

specific tenants (e.g. those that frequently retrieve Tencent's content). This will improve overall customer stickiness. Another example is brokerage firms, which have a very big incentive to have the Hong Kong Stock Exchange as their neighbour at a data centre as that will shorten the latency time and save on connectivity costs.

Capital expenditure

The costs of building data centres are mainly (i) land or properties which are subject to market conditions, and (ii) data-centre equipment which depends on the standards and service. The cost of land and properties in Hong Kong Island is generally higher than that in Kowloon or New Territories. The cost of land and properties in industrial estates is lower than that in the open market.

For the construction of a Tier-3 data centre, the estimated capital expenditure is around HK\$2,000-3,000 per sq ft (or HK\$200,000-HK\$300,000 per rack), excluding land and property costs. A Tier-4 data centre will cost about 30% more.

Tier standards

Data centres are classified into four tier standards based on their serviceability levels and building requirements. According to Uptime Institute, one of the mostly commonly quoted institutions for data-centre tier standards):

- a Tier-1 data centre has the lowest availability of 99.67% with basic site infrastructure;
- a Tier-2 data centre has availability of 99.75% with redundant site infrastructure;
- a Tier-3 data centre has availability of 99.98% with concurrently maintainable site infrastructure; and
- a Tier-4 data centre has availability of 99.99% with fault-tolerant site infrastructure including electrical power storage and distribution facilities. All operating units have to be duplicated, including power supply, backup generator, cooling equipment, etc.

Energy efficiency

A data centre consumes as much as 10-15 times the electricity used by a 320-unit residential building. The power is used for computing and cooling⁸. There are strict requirements on the temperature (between 18-27°C) and relative humidity (at 40-60%) for data centres⁹.

To measure the efficiency of a data centre, the PUE ratio is commonly used. It is defined as (total energy entering the data centre) / (energy used by the IT equipment inside the data centre).

Energy used for anything other than powering IT equipment is mainly for cooling and lighting. A low PUE represents high efficiency. If all the electricity is used for computation, the PUE is 1.0. The profitability for data-centre operators with lower PUE numbers should be higher. In Hong Kong, the PUE numbers are estimated to be around 1.6-1.8. It is more difficult for data-centre operators in Hong Kong to lower their PUE figures as the city lacks natural cooling resources such as wind and renewable energy.

In some countries or cities, natural cooling becomes a cost advantage for data-centre operation. In China, Guizhou, data-centre operators make use of rock caverns to house servers. The rock cavern naturally absorbs and carries away heat, eliminating the need to use energy for cooling. In Sweden, a company called Rockan opened a data centre in the rock caverns of mountainous Atvidaberg in Sweden. The space was first built in the 1960s for military usage as a radar control centre. The data centre is encapsulated by Nordic granite, one of the hardest materials on earth, to provide extra security. The rock is good at absorbing heat and has high thermal conductivity, reducing electricity costs needed for chilling. The data centre can house 500 racks without additional cooling and the maximum number of racks that can be installed is 1,150.

Hong Kong has a hilly geology, providing abundant rock caverns for the development of data centres and this has been discussed in recent years. According to the Hong Kong government's Civil Engineering and Development Department, developing rock caverns could provide 3,500 hectares (or 377 million sq ft) of buildable land¹⁰. However, environmental impact, ownership issues, economic feasibility, and town planning all have to be studied before the idea can become reality. ❌

A data centre consumes as much as 10-15 times the electricity used by a 320-unit residential building

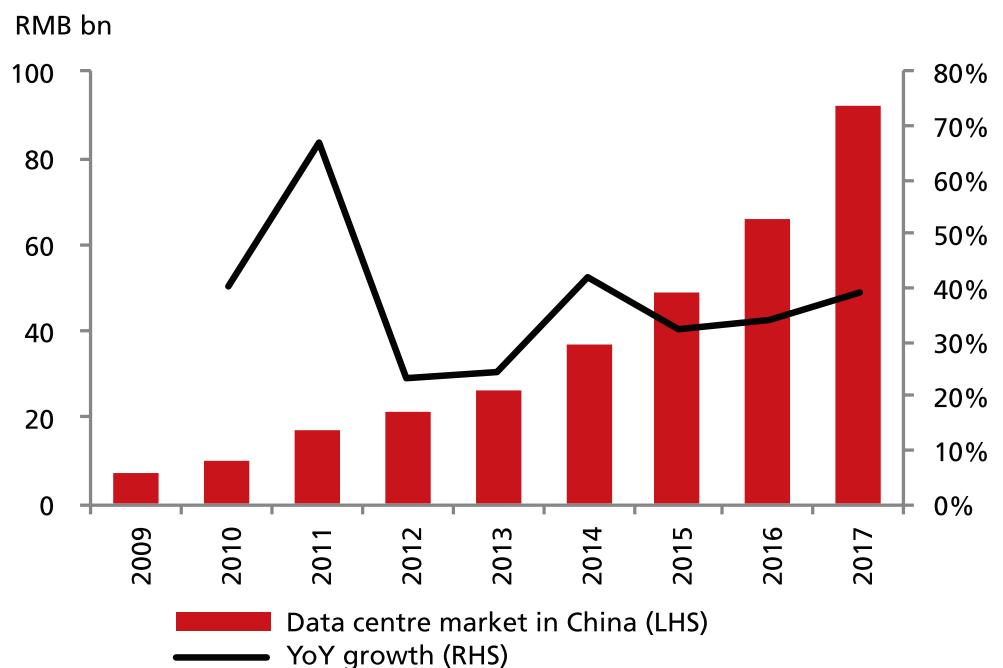
Brief Introduction to Data Centres in China

China's data-centre market has been growing strongly in the past few years. Given the geographical proximity and economic relationship between Hong Kong and China, China's data-centre market will in the future interact with Hong Kong's. We have therefore done some research on China's data-centre market.

The data-centre market in China had grown at a CAGR of 39% from 7.3 billion yuan in 2009 to 37.2 billion yuan in 2014, according to China IDC Quan. It is estimated to grow at a CAGR of 35% to 91.9 billion yuan from 2015-2017, mainly driven by rising adoption of cloud technology by business enterprises, increasing number of connected devices such as mobile terminals, and the proliferation of multi-media content on the Internet.

China's Ministry of Industry and Information Technology has issued a series of guidelines on the macro layout and distribution of the country's data-centre industry, highlighting its strategy of developing Information and communication technology (ICT) consumption as a key economic driver.

Diagram 16. The data-centre market in China (2009-2017)



Source: Companies, DBS Vickers

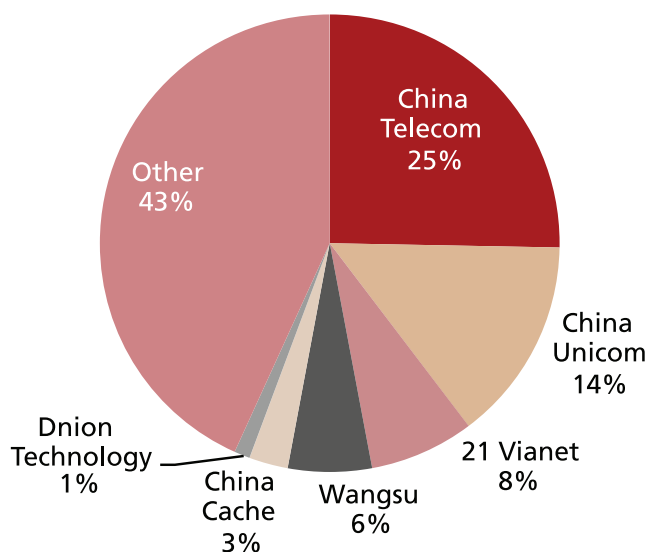
Key Players of the Data-Centre Market in China

Major data-centre players in China include telecom operators, namely China Telecom and China Unicom, as well as 21 Vianet. Telecom operators leverage their communication networks to

expand into the data-centre business as part of the enterprise solution to their customers. China Telecom had 155,000 cabinets at the end of 2015 and targets to add 150,000 cabinets in Guizhou and Inner Mongolia. China Unicom has around 68,000 racks and targets to have 320,000 racks¹¹.

Internet companies often build data centres for their cloud storage, and they also host cloud data for external customers. Aliyun, the largest cloud player in China, has data centres in Hangzhou, Qingdao, Beijing, Shenzhen, and Hong Kong. Tencent has Q-Cloud, which targets the online game market to support game publishers. Its data centres are located in Tianjin, Shanghai, and Guangzhou. Some Content Delivery Network (CDN) service providers such as China Cache and Wangsu (China NetCentre) also build data centres. Other names include (service provider) GDS, Dnion Technology, Sinnet and Dr. Pang.

Diagram 17. The data-centre market by revenue in China (2015)



Source: Companies, DBS Vickers

Guizhou on the Cloud

In China, Guizhou has been selected as one of the key cities for data-centre development. Guizhou on the Cloud is a platform established by the local government to pool and share resources and to promote development of Big Data. Guizhou aims to make itself one of the national centres of Big Data in the next few years.

In 2014, three Chinese telecom operators invested an aggregate of 13 billion yuan to construct their data centres there. The facilities will house hundreds of thousands of cabinets and millions of servers in the area. In the same year, Foxconn invested 220 million

yuan to build a green-tunnel data centre in a rock cavern – which connects three mountains – to create a natural wind tunnel. The wind blowing through the tunnel naturally cools data-centre equipment. It is estimated to save 18 million yuan¹² in electricity per annum. The power usage effectiveness – a metric used to determine a data centre’s energy efficiency – of that data centre was 1.08¹³.

Diagram 18. Foxconn’s data centre in Guizhou, China



Source: Apple Daily

Licensing in China

Since June 2012, China has resumed issuing licenses to companies that want to provide data-centre services. Eligible corporations should apply publicly for a licence.

In terms of capital, foreign enterprises (excluding those from Hong Kong and Macau) are not allowed to set up or apply for a data-centre business licence. For investments from Hong Kong and Macau, the proportion of capital from Hong Kong or Macau should not exceed 50% of total equity. In other words, foreign investors must establish joint ventures with domestic companies if they want to set up a data centre in China. ❌

Major Listed Data Centre Operators in Hong Kong and China

In Hong Kong, SUNeVision and Grand Ming are the major listed data-centre stocks. For SUNeVision, 80% of its total revenue comes from its data-centre business while Grand Ming's equivalent is 60-70%. PCCW also has a data-centre business but the earnings contribution is small. About 10-15% of Citic Telecom's revenue comes from its data-centre and cloud-related businesses. Hutchison Telecom operates a data-centre business through a joint venture with Cheung Kong (Holdings).

In China, 21Vianet is the major carrier-neutral data-centre company. Telecom operators, namely China Telecom and China Unicom have data-centre businesses but the revenue contributions remained insignificant vis-à-vis their respective group revenues.

SUNeVision is one of the leading data-centre operators in Hong Kong, with a capacity of 750,000 sq ft in terms of GFA and 14% market share. It is carrier-neutral, although it has a sister company – mobile operator SmarTone – and both are owned by Sun Hung Kai Properties. SUNeVision offers basic co-location services, managed hosting services as well as network connectivity within its facilities between customers. It owns four data centres in Hong Kong, with one more flagship data centre under construction (in Tseung Kwan O). The geographic locations are strategically well diversified.

Grand Ming started its high-tier data-centre business in 2007, after the completion of iTech Tower 1 with GFA of 190,000 sq ft. Construction of its second data centre – iTech Tower 2 with raised floor areas similar to that of iTech Tower 1 – was completed in December 2015. It is also looking for a new location to construct its third data centre.

PCCW is the largest telecom operator in Hong Kong – through its major subsidiary Hong Kong Telecom – with integrated operations comprising mobile and fixed-line businesses serving both the residential and enterprise segments. Its data-centre business is run under PCCW Solutions – a local leader of data-centre services – with an estimated capacity of 400,000 sq ft. Building on its unparalleled network obtained through its telecom carrier business, it can provide dedicated lines to customers.

Hutchison Telecom is a leading integrated telecom operator in Hong Kong. The company operates mobile and fixed-line businesses serving both the residential and enterprise segments. The company's data-centre business is operated under HGC GlobalCentre Limited, a joint venture with Cheung Kong (Holdings). Its Shatin data centre is for internal use; its Cavendish data centre in Aberdeen, and its Watson Data Centre in Kwai Chung have total GFA of 175,000 sq ft (or 1,870 racks).

Citic Telecom provides data-centre services in Hong Kong and China, and the data business currently accounts for 10-15% of the group's earnings. The company was initially engaged in the leased line, virtual private network, and cloud computing businesses, but later expanded into the data-centre business to provide a one-stop solution to its

customers. The company has two data centres in Hong Kong: (i) CTT data centre at Kwai Chung with estimated GFA of about 72,000 sq ft (or 800 racks), and (ii) Ap Lai Chau data centre (ALP) with estimated GFA of about 63,000 sq ft (or 700 racks)¹⁴. Citic Telecom has proposed to acquire the remaining area of CTT for HK\$850 million for the expansion of its data centre in the building from 800 racks to 4,000 racks. The data centre currently has a utilisation rate of more than 90%. For the new capacity, the company has already signed a letter of intent with a strategic partner to cover 20% of the rack space; it is in advanced discussions with a potential partner on another 20% of the rack space. We expect the expansion of the data centre at CTT to take around 1.5 years and be completed in phases after 2017. It also has 500 racks in Shanghai and 300 racks in Macau.

China Telecom's data-centre revenue was 12.5 billion yuan in 2015, a jump of about 28% y-o-y. It had about 385 data centres in China nationwide, hosting 70% of domestic Internet content. There were about 155,000 cabinets in service by the end of 2015. The data centre in Inner Mongolia commenced operations in 2014, while the one in Guizhou began in August 2015. According to the current plan, the data centres can accommodate 150,000 cabinets and 2.4 million servers.

China Unicom's data centre revenue was 6.7 billion yuan in 2015, up 33% y-o-y. Currently, the company owns 12 national-level cloud data centres and over 300 local data centres. China Unicom's data-centre "machine room" area is 5.3 million sq ft and it has around 68,000 racks in operation. It targets to have 320,000 racks in the medium term¹⁵. The company invested about 5.9 billion yuan in the data centre and cloud technology in 2015.

21Vianet is a leading carrier-neutral data centre operator in China. It had 23,600 cabinets in operation and generated 3.6 billion yuan in revenue (+26% y-o-y) in 2015. Around 68% of the cabinets are owned by the company while the remaining are rented from telecom operators. ❌



Conclusion

We have analysed the supply-demand conditions as well as the pricing dynamics of Hong Kong's data-centre market for the next few years. We conclude that the new supply in 2016 and 2017 will be healthily absorbed by the demand growth. We believe that leading data-centre operators with suitable sites or premises for capacity expansion will benefit from the industry's strong growth in the next few years. ❌

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