



COPENHAGEN CENTRE
ON ENERGY EFFICIENCY
SEforALL EE HUB



ITU Dialogue on Sustainable Digital Transformation in Asia and the Pacific

Liquid Cooling for Sustainable Digital Infrastructure Development in China

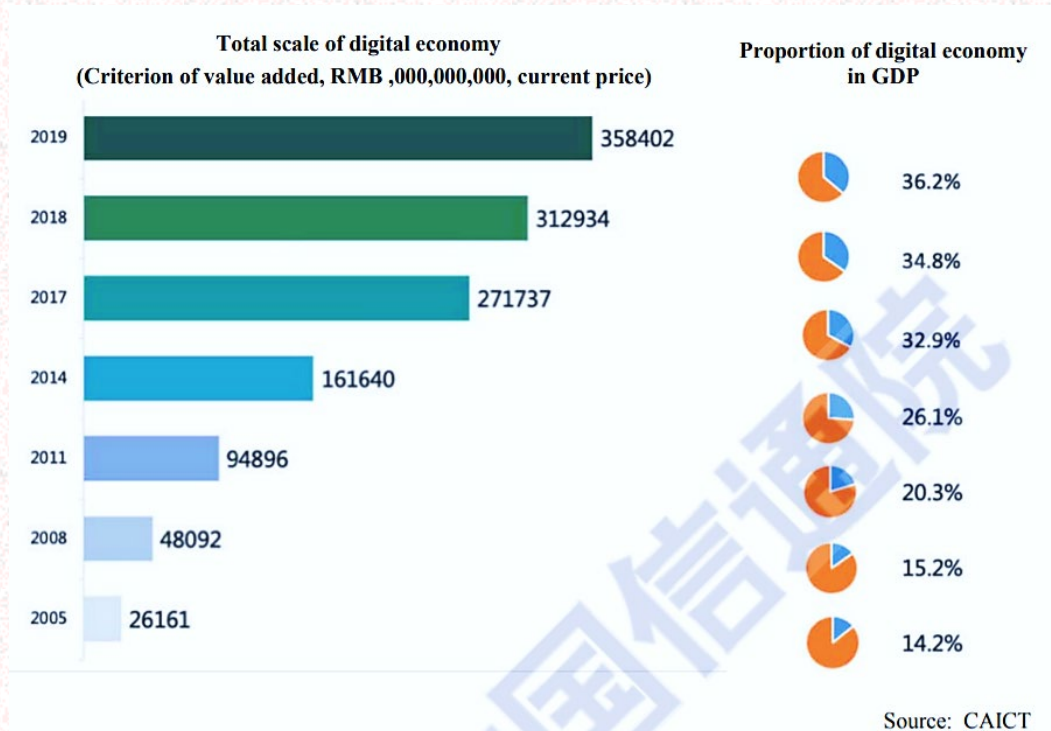
Xiao Wang 王潇

UNEP DTU Partnership, Copenhagen Centre on Energy Efficiency

19th October, 2021

How big is China's digital economy?

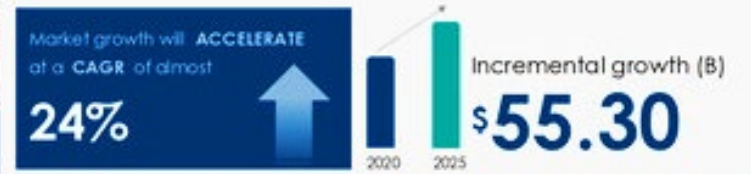
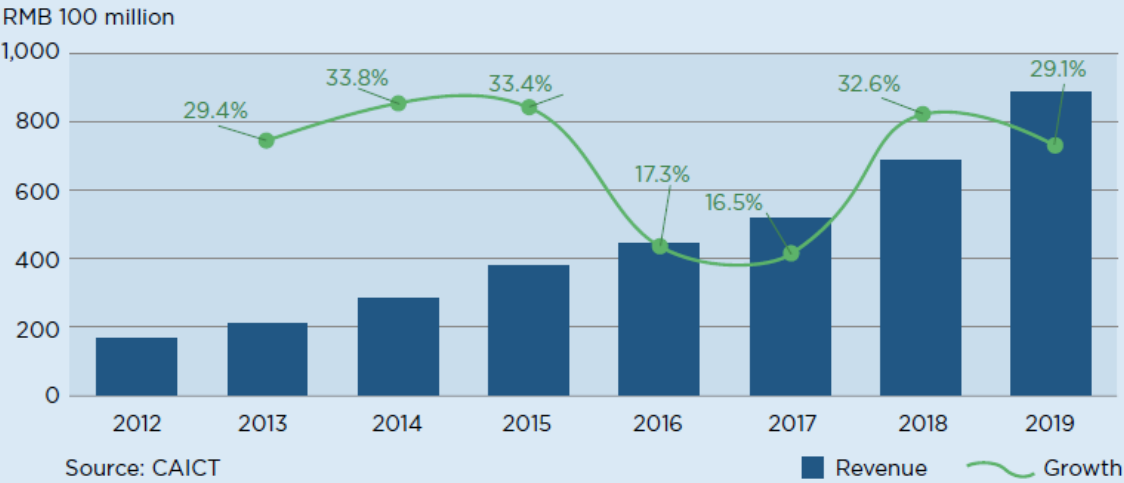
China has built the world's largest optical fiber and 4G and 5G mobile broadband networks, with the number of 5G terminal connections exceeding 365 million.



China's digital economy kept a high growth rate of 9.7 percent in 2020 amid the pandemic and global economic downturn.

China Data Centre Development

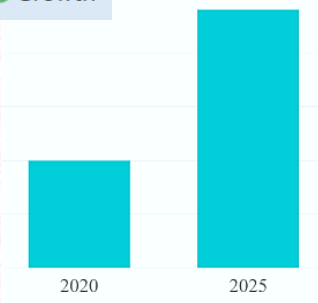
Figure 1. 2012-2019 IDC revenue and growth in China



The market is **FRAGMENTED**
with several players occupying the market

center-market_Market Summary

Study Period:	2018 - 2026
Base Year:	2020
CAGR:	19.2%



Source : Mordor Intelligence

Alibaba Group

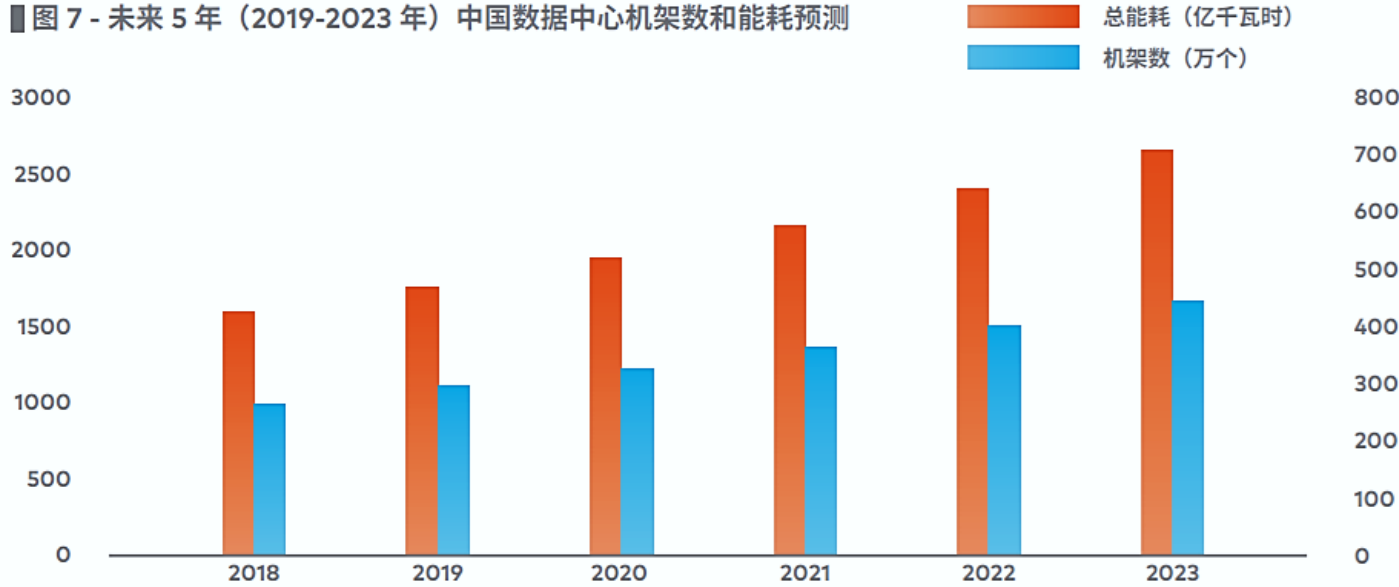
中金数据系统
CENTRIN DATA SYSTEMS

中国移动
China Mobile

China unicom 中国联通

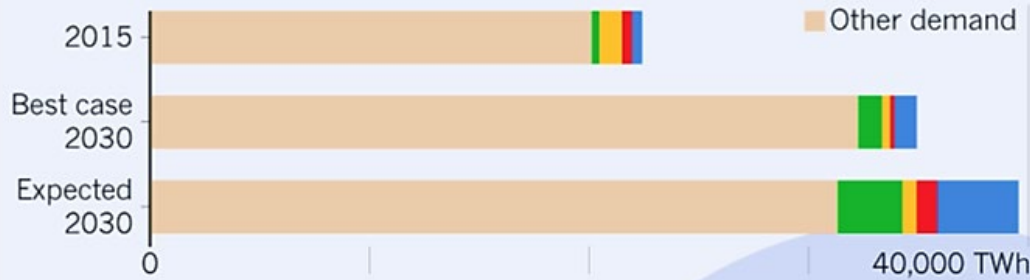
中国电信
CHINA TELECOM

图 7 - 未来 5 年 (2019-2023 年) 中国数据中心机架数和能耗预测



Source: Greenpeace and North China Electric Power University

Global electricity demand



Source: Andrae/Nature.com

ENERGY SCALE

Global electricity demand

20,000 TWh

Electricity use by ICT

2,000 TWh

Data-centre electricity demand

200 TWh

Bitcoin use by mid-2018

20 TWh

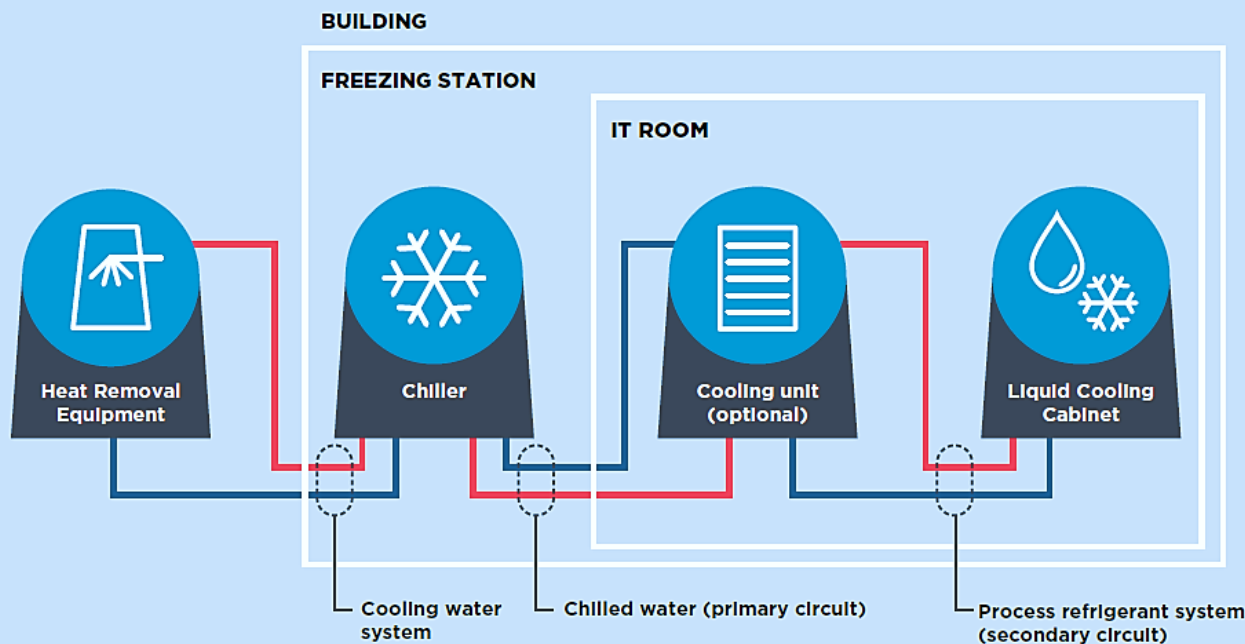
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Figures are approximate.

Sources: IEA/A. Andrae/Ref. 6

Liquid cooling as a mitigation solution

Figure 2. Liquid cooling general circuit



Source: C2E2 data centre brief

In the data-centre field, mainframe computers have used this technology since the 1960s.

A liquid circuit in which the cooling liquid exchanges heat with the components.

Liquid cooling provide effective heat dissipation, reduce energy consumption, improve energy efficiency and reduce noise pollution.

At present, liquid-cooling solutions mainly use one of three technical routes: cold-plate liquid cooling, immersion liquid cooling and spray liquid cooling.

China Liquid Cooling Case Study

Figure 4. Alibaba Winter Olympics Cloud Data Centre (source: Alibaba)



A single-phase immersion liquid-cooling server cluster in its 2MW power capacity.

As the per-unit computing capacity is increased more than tenfold.

In terms of physical space, the immersion liquid-cooling solution can save 75% of the surface occupied by IT equipment.

Taking southern China as an example, compared with the PUE1.5 air-cooled data centre, the energy consumption of a liquid-cooled data centre of the same size can be reduced by more than 35%. In other words, when 100,000 servers are running, about 235 million kWh of electricity and 200,000 tons of carbon dioxide emissions can be saved each year.

Thank you!

<https://c2e2.unepdtu.org/sustainable-datacentres-and-ict/>

DATA CENTRE BRIEF SERIES FEBRUARY 2020

BRIEF 1 Environmental sustainability of data centres: A need for a multi-impact and life cycle approach

KEY MESSAGES

- The concerns over energy use of data centres and associated impacts on climate change have aimed efforts to reduce data centres' energy demand during operations.
- The focus on reducing climate change related impacts arising from data centres' operations can overlook relevant environmental impacts from other life cycle stages, including raw material extraction, equipment manufacturing, data centre construction, end of life of equipment and data centre buildings.
- To support the design of truly sustainable data centres, more comprehensive environmental sustainability assessments, encompassing the entire life cycle and focusing on a broad spectrum of environmental problems, are needed.
- This issue brief uses examples to showcase the substantial environmental impacts of data centres stemming from other life cycle stages than their operation and calls for the use of Life Cycle Assessment (LCA) to assess and address such impacts.

DATA CENTRE BRIEF SERIES JULY 2020

BRIEF 2 Data Centres: Digitalisation Powerhouse and Energy Efficiency Potential

KEY MESSAGES

- The digitalisation of the economy worldwide and technological innovations such as artificial intelligence (AI), Internet-of-things (IoT) and blockchain are driving exponential growth in the demand for data centres' services.
- Data centres use approximately 200 TWh of electricity annually, corresponding to roughly 1% of global electricity demand.
- To match the rapid growth in the energy use of data centres, it is key that the future demand for data centres' services will be met by energy-efficient data centres and that their uptake of renewable energy is accelerated.
- Policy-makers should establish robust mechanisms to collect data and publish statistics on the energy use of data centres, similarly to what has been done for other energy-intensive sectors.

DATA CENTRE BRIEF SERIES SEPTEMBER 2020

BRIEF 3 Reducing the energy use of video gaming: energy efficiency and gamification

KEY MESSAGES

- Video gaming is an increasingly popular leisure activity worldwide, but it has environmental impacts due to the energy used during climate change and resource issues over the entire life-cycle of the gaming devices.
- Among electric equipment in households, gaming devices are gradually becoming more relevant in terms of their overall energy use.
- Playing video games on newer generation game consoles uses significantly less energy than playing on computers, when the unit energy consumption of the equipment is considered.
- Playing video games in the cloud, known as cloud gaming, can draw as much as a three-fold increase in energy use compared to local gaming.
- The energy used in gaming should be integrated into end-use energy demand forecasts and routinely updated with demographic data and technology preferences, which can change quickly.
- Improved consumer information and the quantification of energy information are recommended strategies that can have a direct effect on behavior change.

DATA CENTRE BRIEF SERIES JANUARY 2021

BRIEF 4 Innovative Data-Centre Cooling Technologies in China - Liquid Cooling Solution

KEY MESSAGES

- The increased need to dissipate heat caused by the increased power consumption of IT equipment in data centres calls for energy-efficient cooling solutions. Liquid cooling, with its efficient heat distribution and high energy-saving characteristics, is becoming greatly preferred in China and is soaring with successful business cases steadily on the market.
- Liquid cooling still faces many challenges in the development process. There is an urgent need to promote the development of technology and industry by strengthening industry guidance, standardizing the evaluation system, and improving the industrial ecosystem, among other measures.
- This brief showcases the Alibaba and Tencent data centres' advanced liquid-cooling systems. Of the top leading Chinese internet companies, Alibaba has achieved large-scale deployment of liquid cooling technology.

Digital Climate Emergency Series

Zero Carbon Emissions in Digitalization

03 March 2020

DANISH DATA CENTER INDUSTRY

Digital Climate Emergency Series

Beyond Energy Efficiency - Life Cycle Based Data Centre Sustainability

02 July 2020

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