Enabling data centre sustainability is a key part of fighting the global climate crisis

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The COP26 summit presented a stark picture for the world: drastic action must be taken to fight climate change or else we risk irreversible damage to the planet. Amid this backdrop has been the tremendous development of the internet and technology over the past 20 years, which has fuelled the increased use of data centres to support the digital demand from both consumers and enterprises.

Many people do not realise that these data centres are becoming increasingly large consumers of both electricity and water. The continued growth of the digital economy and development of new technologies means that there is a need to balance this unabated demand for digital infrastructure against managing sustainability concerns. Governments and regulators must take a more hands-on role to address these issues, and there is a significant opportunity for innovators within the data centre value chain that can reduce the environmental footprint.

Data centres have a large environmental footprint

Data centres are the backbone of the digital economy because they facilitate the running of servers that process and store the vast quantities of data that are being generated and accessed by users worldwide. As IT workloads have continued to grow to support the increasing digitalisation of consumer and enterprise behaviour, so has the electricity consumption of data centres. Some examples are as follows.

- **Ireland.** Data centres currently account for 11% of the total demand for electricity in the country; forecasts suggest that this could grow to 25% by 2030.[1]
- **Singapore.** Data centres accounted for 7% of the country's total electricity consumption in 2020.[2]
- **China.** More electricity was consumed by internet data centres in China in 2018 than in the whole of Malaysia.[3]

IT workloads will continue to grow at a rapid pace thanks to the increasing take-up of cloud computing. In addition, new use cases such as cloud gaming and metaverses have the potential to accelerate IT workload growth further due to their heavy compute and storage needs. As renewable energy is not yet widely used by data centres, these massive IT workloads can have a large negative impact in terms of carbon footprint. For example, only 2 out of 22 Chinese tech companies in a particular study reported relying on renewable energy for

1 Reuters (2021), *Ireland faces energy shortfalls as data centres gobble up supply*. Available at: https://www.reuters.com/article/ireland-power-idUSL8N2QV2HR.

2 CNA (2021), *Singapore puts 'temporary pause' on new data centres: Why and what it means for the industry*. Available at: https://www.channelnewsasia.com/business/new-data-centres-singapore-temporary-pause-climate-change-1355246.

3 Greenpeace (2021), *Clean Cloud 2021 Tracking Renewable Energy Use in China's Tech Industry*. Available at: https://www.greenpeace.org/static/planet4-eastasia-stateless/2021/04/03a3ce1a-clean-cloud-english-briefing.pdf.

more than 3% of their needs, and as such, many are therefore indirectly contributing to greenhouse gas emissions.[3]

The water consumption of data centres is another often-overlooked aspect; water is often used to cool the servers and prevent critical IT equipment from over-heating. For example, Google's water withdrawal in 2019 reached 5.1 billion gallons; this is more than double that in 2016.[4] Growing IT workloads will lead to increased server cooling requirements and can thus cause water usage to rise further.

Governments are starting to take action

Governments worldwide are now recognising the detrimental impact that data centres can have on environmental sustainability. Indeed, some (such as those in Singapore and the Netherlands) are imposing moratoriums to pause the growth in the number of new data centres. However, such moratoriums are more of a temporary quick fix than a long-term solution to the problem. Additional measures are required to ensure the sustainability of data centres and are starting to be introduced as shown in Figure 1.

Figure 1: Government initiatives to reduce the environmental impact of data centres

Initiative	Description
Power usage effectiveness (PUE) requirements	China's Action Plan for the Development of New Data Centres (2021–2023) states that newly built large-scale data centres must have a PUE of 1.30 or below.[5]
Renewable energy requirements	The Beijing City government introduced new rules in 2021 that require new data centres to incrementally increase the renewable share of energy used by 10% each year to reach 100% by 2030.[6]
Use of recycled water	The EU's Code of Conduct for Data Centre Energy Efficiency includes a recommendation that data centres use recycled water (such as rain water) for cooling in order to reduce the consumption of potable water.[7]
Developing new cooling technologies	The government in Singapore has jointly funded the formation of a Sustainable Tropical Data Centre Testbed (STDCT) together with Facebook (now known as Meta). This will test and develop novel cooling techniques that will be used in Singapore.[8]

Source: Analysys Mason, 2021

Regulation related to data centres has often focused more on ensuring data privacy and security, but the significant environmental impact that data centres can have means that more hands-on approaches, such as those listed above, are required.

4 Google (2020), *Environmental Report 2020*. Available at: https://www.gstatic.com/gumdrop/sustainability/google-2020-environmental-report.pdf.

5 MIIT (2021), *Notice of the Ministry of Industry and Information Technology on Issuing the "Three-year Action Plan for the Development of New Data Centers (2021-2023)"*. Available at: https://www.miit.gov.cn/jgsj/txs/wjfb/art/2021/art_12cc04dc9daf4d57a7038811a57383b6.html.

6 Beijing Municipal Commission of Development and Reform (2015), *Introduction to the Functions of the Beijing Municipal Commission of Development & Reform.* Available at: http://fgw.beijing.gov.cn/fgwzwgk/zcgk/bwgfxwj/202107/t20210727_2449512.htm.

7 European Commission (2021), 2021 Best Practice Guidelines for the EU Code of Conduct on Data Centre Energy Efficiency. Available at: https://e3p.jrc.ec.europa.eu/sites/default/files/documents/publications/jrc123653_jrc119571_2021_best_practice_guidelines_final_v1_1.pdf.

8 CNA (2021), *NUS, NTU set up S$23 million programme to test cooling solutions for data centres in the tropics*. Available at: https://www.channelnewsasia.com/singapore/stdct-nus-ntu-test-cooling-solutions-data-centres-sustainability-1966666.

Companies with innovative data centre cooling technology can use this as an opportunity to gain ground

Concerns about the environmental impact of data centres present an opportunity for new innovations in data centre cooling that can reduce electricity and water usage. Some of these technologies are starting to be employed by major hyperscalers, many of which have established 'net zero' aims. Examples of these new technologies include the following.

- **Indirect evaporative cooling.** Meta's upcoming data centre in Singapore will use indirect evaporative cooling technology. The company claims that this can reduce the peak water usage by over 20% and can enable a PUE of 1.19.[9]

- **Immersion cooling.** Directly immersing servers in a non-conductive liquid can enable very low PUEs of less than 1.10. This technique is being increasing explored by hyperscalers. For example, Microsoft has identified immersion cooling as a key initiative to support its sustainability goals, and its tests reveal that it can also boost performance and thus facilitate more-advanced workloads.[10]

- **Direct-to-chip cooling.** This involves pumping chilled liquid to a cold plate that cools the server chip directly. Google has used this technology at its data centres that have its advanced Tensor Processing Unit (TPU) chips.[11]

Players within the data centre value chain that can offer such innovative technologies have a strong opportunity to gain ground by addressing the sustainability concerns of both governments and major users of data centres. These players include data centre co-location providers and hardware providers; those that have advanced proprietary technology are likely to have the greatest potential to benefit from this opportunity and thus improve the environmental sustainability of the industry.

Conclusion

The large environmental footprint that data centres currently have requires action to be taken to support the sustainability of our planet. The reliance on the internet and the digital economy is set to accelerate, so failing to act now will have drastic implications for our future generations. Governments will need to take on a more hands-on approach towards addressing these concerns and this can also present an opportunity for industry players with innovative cooling approaches.

Analysys Mason has conducted multiple projects in the data centre space worldwide, including market studies, due diligence exercises and helping regulators to develop their data centre policies. For further information, please contact Jay Lee (Manager) or Lim Chuan Wei (Partner).

9 Facebook Engineering (2019), *Rethinking data center design for Singapore*. Available at: https://engineering.fb.com/2019/01/14/data-center-engineering/singapore-data-center/.

10 Microsoft (2021), *Supporting our customers on the path to net zero: The Microsoft cloud and decarbonization*. Available at: https://blogs.microsoft.com/blog/2021/10/27/supporting-our-customers-on-the-path-to-net-zero-the-microsoft-cloud-and-decarbonization/.

11 Keppel Capital (2020), *Data Centres Not Just Hype.* Available at: https://www.kepcapital.com/en/file/newsroom/research-publications-and-presentations/2020/july/keppel-capital-watch-data-centres-not-just-hype-140720.pdf.