Concept image of a green data centre

Towards a greener and more sustainable data centre

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We live in an increasingly digitalised world where data and Information Technology (IT) powers the 4th Industrial Revolution. The COVID-19 pandemic has accelerated digital transformation in many industries and societies. Powering this digital economy are data centres (DCs). DCs are buildings packed with servers, forming the backbone of the internet. DCs play a hidden role in the shadows but serve as a critical resource in modern society. The importance of DCs cannot be understated, as they provide us with streaming entertainment such as Netflix or Spotify, a way to connect with our friends via social media and to work, through platforms such as Zoom. However, these conveniences and digitalisation come with a hidden cost too.

According to the International Energy Agency [1], DCs and data transmission networks account for about 1% of global electricity use. In Singapore, DCs account for 7% of the nation's total electricity consumption. [2] To moderate growth and encourage a more sustainable and energy-efficient DC sector, the government issued a temporary pause on the development of new DCs. [3] This has since been lifted in 2022. [4]

Energy utilisation will only increase with the boom in streaming and emerging digital technologies such as Artificial Intelligence, Blockchain, 5G and the Internet of Things (IoT) putting ever more pressure on DCs and supporting infrastructure. Action should therefore be taken now to ensure that even as we develop new technologies, special attention should be paid to how much impact such IT services have on the environment and how we can move forward in a more sustainable manner.

To move towards a greener and more sustainable DC, I urge stakeholders to improve the efficiency of DCs in four areas namely, server hardware, software, physical infrastructure, and government policy.

Firstly, on server hardware, manufacturers must invest in cutting edge research & development so as to improve the energy efficiency of newer generations of semiconductors and chips. One example is the thermal limits being relaxed over the years as better equipment is released. [5] This means that servers do not require as much cooling and therefore saving energy.

Running on top of hardware is software. No matter how efficient your hardware is, if software developers write poor and inefficient code, this can result in exponentially expensive computation. This will result in widespread inefficiency if they run on the operating systems we use daily, such as the Windows or Mac Operating System.

The physical infrastructure that houses the servers should not be overlooked too. This includes the lighting, cooling and security systems. Lighting efficiency can be improved by replacing Liquid Crystal Display (LCD) with Light Emitting Diode (LED) lights. Research [6] has also shown that designing proper room layouts to optimise airflow for cooling can result in energy savings. Possible ideas for the future may even include installing green walls on the side of buildings, to beautify the DCs and keep it cooler. [7]

Moving on to our last focus area, I want to urge governments to adopt a proactive stance to invest for our future, today. Government and the policies it develops can play a huge role in providing a conducive environment for cutting edge research and development work to take place. Governments also have the power to pause land sales to nudge DCs to adopt best practices. They can also incentivise developers and tech giants to do more research through tax breaks or grants for research.

In Singapore, there is a certification scheme, the BCA-IMDA Green Mark for Data Centres Scheme. The scheme aims to recognise DC operators' performance efficiencies in areas such as energy, water and the environment. [8] Such certifications not only recognise the efforts put in by companies, but also sets a benchmark and a way to quantify DC efficiencies.

Such efforts may have paid off. DCs in Singapore generally performed better in Power Usage Effectiveness than others in the Asia-Pacific Region by around 5 - 10%. [9] Moreover, some of the newer DCs have efficiency levels similar to US and Europe, despite Singapore's warmer tropical climate. (Tropical climate requires more cooling) [10]

To achieve improvements in the 4 domains as described above, we need to take bold actions now to reduce emissions from DCs. DCs and the information age will continue to grow exponentially, and this is something we cannot stop. However, we can achieve a greener and more sustainable DC with a nexus between academia, industry and government, pushing the frontier of what's possible, each playing its part for a greener IT environment.

References

1. Data centres & networks - Fuels & Technologies. (n.d.). IEA. Retrieved September 13, 2022, from https://www.iea.org/fuels-and-technologies/data-centres-networks

2. *MCI response to PQ on Data on Current and Expected 2021 Total Carbon Emissions by Data Centres in Singapore and Efforts to Reduce Emissions for Data Centres*. (n.d.-b). Base. Retrieved September 13, 2022, from https://www.mci.gov.sg/pressroom/news-and-stories/pressroom/2021/7/mci-response-to-pq-on-data-on-current-and-expected-2021-total-carbon-emissions-by-data-centres-in-singapore-and-efforts-to-reduce-emissions-for-data-centres?pagesize=24&type=Events%2CForum+Replies%2CNews%2CParliament+QAs%2CPress+Releases%2CSocial+Media%2CSpeeches%2CStories&category=Cyber+Security%2CDesign%2CDigital+Readiness%2CGovernment+Technology%2CInfocomm+Media%2CLibraries%2CPersonal+Data%2CPublic+Comms&page=21_24

3. *Written reply to PQ on new data centres*. (n.d.). MTI. Retrieved September 13, 2022, from https://www.mti.gov.sg/Newsroom/Parliamentary-Replies/2021/01/Written-reply-to-PQ-on-new-data-centres

4. *Launch of pilot Data Centre - Call for Application ("DC-CFA") to support sustainable growth of DCs*. (n.d.). Infocomm Media Development Authority. Retrieved September 13, 2022, from https://www.imda.gov.sg/news-and-events/Media-Room/Media-Releases/2022/Launch-of-pilot-Data-Centre---Call-for-Application-to-support-Sustainable-Growth-of-DCs

5. Soldati, A., Martirano, L., & Ramakrishna, S. (2021, May 28). Strategies for Improving the Sustainability of Data Centers via Energy Mix, Energy Conservation, and Circular Energy. *Sustainability*, *13*(11), 12. https://doi.org/10.3390/su13116114
   Reference citation: 86, 87

6. Soldati, A., Martirano, L., & Ramakrishna, S. (2021, May 28). Strategies for Improving the Sustainability of Data Centers via Energy Mix, Energy Conservation, and Circular Energy. *Sustainability*, *13*(11), 12. https://doi.org/10.3390/su13116114
   Reference citation: 83-85, 47

7. Dahanayake, K. C. (2017, October 20). *Comparing reduction of building cooling load through green roofs and green walls by EnergyPlus simulations*. SpringerLink. Retrieved September 13, 2022, from https://link.springer.com/article/10.1007/s12273-017-0415-7?error=cookies_not_supported&code=3522d240-dedd-4fb1-b821-9d335187815e

8. *BCA-IMDA Green Mark for Data Centres Scheme*. (n.d.). Infocomm Media Development Authority. Retrieved September 13, 2022, from https://www.imda.gov.sg/programme-listing/bca-imda-green-mark-for-data-centres-scheme

9. *MCI response to PQ on Data on Current and Expected 2021 Total Carbon Emissions by Data Centres in Singapore and Efforts to Reduce Emissions for Data Centres*. (n.d.). Base. Retrieved September 13, 2022, from https://www.mci.gov.sg/pressroom/news-and-stories/pressroom/2021/7/mci-response-to-pq-on-data-on-current-and-expected-2021-total-carbon-emissions-by-data-centres-in-singapore-and-efforts-to-reduce-emissions-for-data-centres?pagesize=24&type=Events%2CForum+Replies%2CNews%2CParliament+QAs%2CPress+Releases%2CSocial+Media%2CSpeeches%2CStories&category=Cyber+Security%2CDesign%2CDigital+Readiness%2CGovernment+Technology%2CInfocomm+Media%2CLibraries%2CPersonal+Data%2CPublic+Comms&page=21_24

10. Andy Lawrence, Executive Director of Research, Uptime Institute. (2021, May 4). *Which regions have the most energy efficient data centers?* Uptime Institute Blog. Retrieved September 13, 2022, from https://journal.uptimeinstitute.com/datacenter-energy-efficiency-by-region/