Green Data Centres: Pathway to Sustainable Digitalisation *

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In the last decade digitalisation in the economy has increased manifold in India and so has the need for data centres which are the basic building blocks for a digital economy. With the data centre industry getting infrastructure status, ongoing digitalisation and in view of the requirement of data localisation, the industry is expected to grow at a rapid pace in the coming years. In view of the significant increase in greenhouse gas emissions, which is expected from the above expansion, the data centre industry also needs to increasingly focus on 'environmental sustainability'.

Introduction

The past decade has seen tremendous growth in the digital infrastructure space in the country, both public and private. In the last two years, the pandemic has also created the need for a digitally oriented economy. The scale and quantum of data generated coupled with increasing focus on localisation of data, has added momentum to the storage of data generated in the country. Further, with the acceleration in digital businesses, including banking and fintech, healthtech, Edtech, e-commerce, telemedicine *etc.,* the resultant generation of a large quantum of data is expected to increase the demand for data centres. With the announcement of inclusion of data centres in the harmonised list of infrastructure in the Union Budget 2022-2023, and further including data centres with a minimum capacity of 5 MW of IT load in the harmonised list[1] and states like Tamil Nadu, Telangana, Uttar Pradesh, Maharashtra, West Bengal and Karnataka coming out with a state-specific policy for data centres, this business segment is expected to get easier access to institutional credit at lower rates, attract foreign investments in time to come.

Given the above developments and keeping in view the growth in the data centre business so far, a key concern would be the impact these data centres would have on the environment. Data centres are huge power guzzlers[2] and require an uninterrupted power supply for maintaining stability of operations, even during power fluctuations and outages to eliminate unavailability or loss of data. Data centre facilities also need deployment of electronic and electrical equipment (EEE) which eventually leads to the generation of electronic waste or e-waste. Hence, there is a need to put in place a mechanism which can measure, monitor and mitigate the adverse impacts that the data centres have on the environment.

This article, therefore, makes an attempt to discuss the need for greening data centres of banks and financial institutions and benefits thereof, keeping in view India's commitment at the COP26 summit on scaling up the use of renewable energy[3].

2. Importance of Data Centres for Banks and Financial Institutions

Data centres are the basic building blocks of a digital economy. A data centre is a physical facility that organisations use to host their critical Information Technology (IT) applications, supporting network and security operations. Everything that happens over the internet, is routed back and forth to a backend data centre which hosts the IT infrastructure for storing and processing online transactions. These facilities consume an enormous amount of power and must run round the clock for operating the servers and maintaining an optimal temperature in the data centre through heavy duty air conditioning systems. With banks and financial institutions increasingly leveraging the use of IT solutions in their core business operations,

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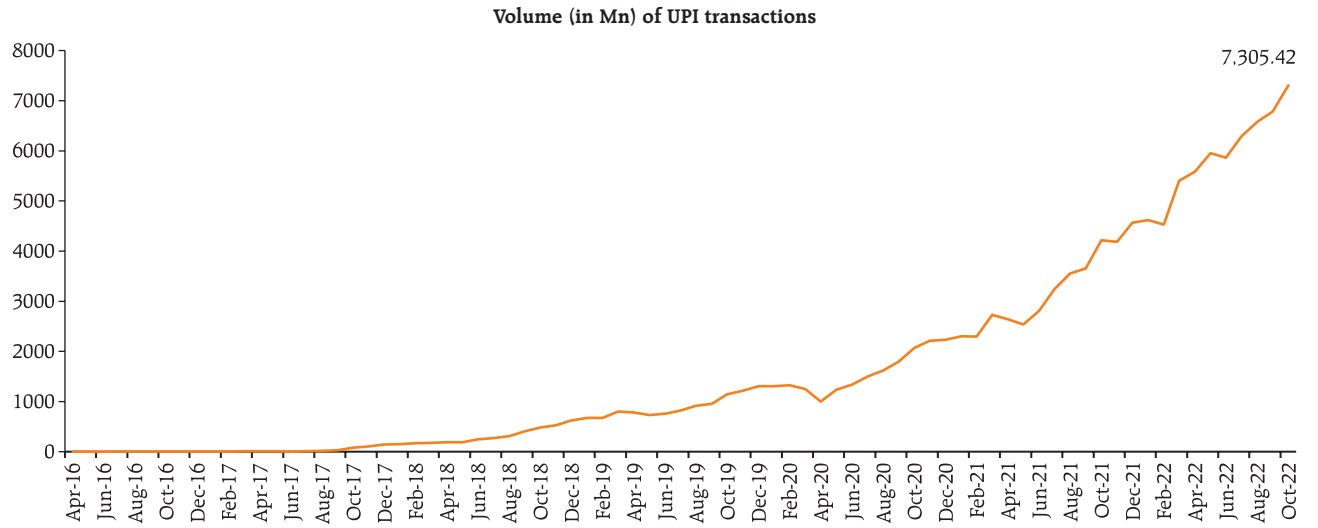
1 Ministry of Finance notification dated 11 October, 2022

2 At times, a single data centre would consume quantity of electricity that could light up an entire city.

3 https://pib.gov.in/PressReleasePage.aspx?PRID=1768712

Chart 1: Growth in the volume of UPI transactions since its launch in April 2016



Source: https://www.npci.org.in/what-we-do/upi/product-statistics

there is an increasing demand for dedicated data centres equipped with state-of-the-art infrastructure. This is expected to expand further on account of growing financial inclusion, growth of retail payment system Unified Payments Interface (UPI), availability of National Electronic Funds Transfer (NEFT) System on a 24x7 basis, round the clock Real Time Gross Settlement System (RTGS), *etc.* Chart 1 shows the growth in the volume of UPI transactions since its launch in April 2016 which underscores the importance of data centres in India.

With the growing dependence of banks and financial institutions on digital infrastructure, it has become imperative for them to ensure round-the-clock availability of the backend IT infrastructure at the data centre. Further, in view of the proposed introduction of 5G technology, Internet of Things (IoT), *etc.* as a part of the fourth industrial revolution[4], the need for digital infrastructure in India is bound to increase manifold as it would lead to growth of data. The growth of digital infrastructure would require scaling up cyber security and as a result necessitate an expansion of the data centre capacity in India.

Robust data centre infrastructure is further necessitated by data localisation requirements and protection of digital sovereignty of our country in an increasingly interconnected world. The Reserve Bank of India's guidelines[5] on storage of payment system data which mandates all payment system operators to ensure that the data related to payment systems operated by them needs to be stored in a system only in India has also increased the requirement for establishing local data centres in the country.[6] India also offers advantages of having a favourable geographical location on the world map, availability of economic resources, established global connectivity through submarine cables and skilled manpower,

[4] The Fourth Industrial Revolution represents a fundamental change in the way we live, work, and relate to one another. It is a new chapter in human development, enabled by extraordinary technology advances commensurate with those of the first, second and third industrial revolutions. The Fourth Industrial Revolution is about more than just technology-driven change; it is an opportunity to help everyone, including leaders, policymakers and people from all income groups and nations, to harness converging technologies to create an inclusive, human-centred future. https://www.weforum.org/focus/fourth-industrial-revolution

[5] https://www.rbi.org.in/scripts/NotificationUser.aspx?Id=11244

[6] In July 2019, following mandates by the Reserve Bank of India (RBI), PayPal opened a tech center in Hyderabad to ensure all data is stored exclusively on local servers. https://www.pymnts.com/news/international/2019/paypal-sets-up-tech-center-in-india-for-data-localization/

enabling the nation to become a global data centre hub.[7]

3. Challenges Posed by Data Centres to the Environment

The environmental impact of data centres can be measured from the amount of power consumption and electronic waste generated by them. Data centres consume about 3 per cent of the global electricity supply and account for about 2 per cent of the total greenhouse gas (GHG) emissions.[8] The reason data centres are power guzzlers is due to the amount of energy required to cool their servers and systems. Global data centre electricity consumption in 2020 was 200-250 Terawatt-hour[9] (TWh), or around 1 per cent of global electricity demand. This excludes energy used for cryptocurrency mining, which was ~100 TWh in 2020.[10]

Another challenge posed by data centres is the generation of electronic waste, also known as e-waste[11], which is a byproduct of data centre refresh[12] activity.

Table 1: Global trends in digital and energy indicators, 2015-2021

Energy Usage	2015	2021	Change
Internet users	3 billion	4.9 billion	60%
Internet traffic	0.6 ZB	3.4 ZB	440%
Data centre workloads	180 million	650 million	260%
Data centre energy use (excluding crypto)	200 TWh	220-320 TWh	9.4
Crypto mining energy use	4 TWh	100-140 TWh	+2 300-3 300%
Data transmission network energy use	220 TWh	260-340 TWh	19.4

Source: https://www.iea.org/reports/data-centres-and-data-transmission-networks

With data centres using EEE and cooling infrastructure in abundance, these are left over as e-waste after periodic refresh activity of the data centre. The EEE are a complex mixture of several components, many of which have toxic chemical formulations. These components with toxic chemicals, if disposed in an unsustainable manner, can adversely impact human health and the environment (Table 2). The growing amount of e-waste is mainly fuelled by higher consumption rates of EEE, shorter life cycles and fewer repair options. The global generation of e-waste grew by 9.2 Mt since 2014 and is projected to rapidly grow to 74.7 Mt by 2030 with Asia generating the highest quantity of e-waste in 2019 at 24.9 Mt.[13]

The above challenges posed by traditional data centres to the environment have necessitated the greening of data centre operations.

4. Green Data Centres

A green data centre is one in which mechanical, electrical and computer systems are designed for maximum energy efficiency and minimum

[7] Draft Data Centre Policy 2020 by MeitY. Reference. https://www.meity.gov.in/writereaddata/files/Draft%20Data%20Centre%20Policy%20-%2003112020_v5.5.pdf

[8] https://www.independent.co.uk/climate-change/news/global-warming-data-centres-to-consume-three-times-as-much-energy-in-next-decade-experts-warn-a6830086.html

[9] A terawatt-hour is a unit of energy equal to outputting one trillion watts for one hour. It is equal to $3.6x10^{15}$ Joules. This value is large enough to express annual electricity generation for entire countries and is often used when describing major energy production or consumption. https://energyeducation.ca/encyclopedia/Watt-hour

[10] https://www.iea.org/reports/data-centres-and-data-transmission-networks

[11] Electronic waste (e-waste) is a generic term used to describe all types of old, end-of-life or discarded electrical and electronic equipment (EEE), such as household appliances; office information and communications equipment; entertainment and consumer electronic equipment; lighting equipment; electric and electronic tools; toys; and leisure, sports and recreational equipment that are powered by electricity. E-waste contains both valuable and hazardous materials that require special handling and recycling methods. Reference: https://www.gartner.com/en/information-technology/glossary/electronic-e-waste

[12] Data centre refresh refers to installations of new servers and related hardware and cooling systems in order to deploy updated equipment intended to improve reliability, enable new and anticipated capabilities, and save money in the long term. Reference: https://www.techtarget.com/whatis/definition/server-refresh-cycle

[13] The Global E-waste Monitor 2020: Quantities, flows and the circular economy potential. Reference. https://collections.unu.edu/eserv/UNU:7737/GEM_2020_def_july1.pdf

Table 2: Toxic Metals Present in E-waste and Their Effects on Humans

Materials	Weight (%)	Recycling (%)	Location	Effects
Lead	6.2988	5	Acid battery, CRT	Kidney failure, central and peripheral nervous systems, damage to the reproductive systems
Cadmium	0.0094	0	Battery, CRT, housing	Long term cumulative poison, Bone disease
Mercury	0.0022	0	Batteries, switches, housing	Chronic damage to brain, liver damage, causes damage to the central and peripheral nervous systems as well as the fetus
Chromium VI	0.0063	0	Decorative hardener, corrosion protection	DNA damage, lung cancer
Plastic	22.99	20	Computer mouldings, cablings	Generates dioxins and furans

Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3908467/

environmental impact. A green data centre ensures sustainability in its operations by enabling improvement of power usage effectiveness (PUE)[14] by addressing energy consumption, reduction in data processing, precision and comfort air conditioning systems, lighting & building envelop; encouraging the use of water in a sustainable manner through reduce, recycle and reuse strategies; substituting conventional power consumption through onsite and offsite renewable energy sources; collecting and handling e-waste in an environmentally safe manner; and provides adequate ventilation, daylight and occupant well-being facilities for the staff.[15]

Green data centres can have a number of tangible and intangible benefits. The tangible benefits include a sizeable reduction in energy and water consumption. The intangible benefits of green data centre include enhanced air quality, excellent daylighting and health

Box1: Banks having IGBC rated Green Data Centre in India

A study of the annual reports of 12 public sector banks and 14 private sector banks in India revealed that only two private sector banks have at least one of their data centres certified by IGBC as a green data centre.

Initiatives by banks

1. ICICI Bank's Data Centre is the first IGBC Platinum rated data centre in India.

   Source: ICICI Bank Annual Report FY2018-19 - https://www.icicibank.com/annual-report-microsite/ICICI_AR_2019.pdf

Some of the green features incorporated in ICICI Bank's Data Centre include the following:

i. A reduced PUE (Power Usages Effectiveness) of 1.36 at 33 per cent loading

Chart 2: IGBC rated green data centres of banks in India

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[14] Power usage effectiveness (PUE) is a ratio that describes how efficiently a computer data centre uses energy; specifically, how much energy is used by the computing equipment (in contrast to cooling and other overhead that supports the equipment). Reference. https://en.wikipedia.org/wiki/Power_usage_effectiveness

[15] IGBC Green Data Center Rating System

ii. Wheeling of 15 MW offsite renewable energy (9000 units to offset grid energy)

iii. Photovoltaic installed at facade for onsite renewable energy generation

iv. LED-based energy-efficient lighting fixtures and procurement of green-certified products and materials

The bank also has employees who are certified IGBC Accredited Professionals who are equipped to manage its green building facilities.

Source: https://www.expresscomputer.in/news/icici-bank-unique-distinction-of-a-platinum-rated-green-data-centre/50034/

2. HDFC Bank's Bengaluru Data Centre 'Netmagic-DC3B' is also a certified green data centre under the IGBC Green Data Centre Rating System. The bank has also implemented several energy saving and environment-friendly measures at its data centres.

Source: HDFC Bank Annual Report FY2020-21 - https://v1.hdfcbank.com/htdocs/common/2021/July/AR/hdfc-AR/environment.html

3. Kotak Mahindra Bank in its Annual Report for FY 2020-21 has mentioned having green data centres which are designed for maximum energy efficiency and minimum environmental impact. The bank also stated that they are emphasizing desktop virtualisation to further reduce power and cooling requirements.

and well-being of the staff operating such facilities.[16] Maintaining energy efficiency and bringing sustainability in operations is at the core of a green data centre which usually strives to have a lower PUE.

A green data centre not only benefits the environment but also assists modern businesses in reducing electricity consumption and carbon emissions, thereby reducing the overall operating expenditure[17].

5. Way Forward

The inclusion of data centres in the harmonised list of infrastructure by the Government of India has given an impetus for their rapid growth by creating an enabling environment for the flow of foreign investments and private capital in this sector. This would not only pave the way for better access to finance but would also create incentives for all stakeholders with a focus on renewable energy. Since banks and fintech companies store a huge amount of data, this coupled with the need for data localisation is likely to spur significant demand for local data centres. In view of the above, the following aspects could be considered while setting up new data centres / refreshing old data centres by banks and financial institutions:

i. Banks hosting in-house data centres may explore acquiring industry recognised green data centre accreditation such as IGBC certified green data centre[18], LEED certification for green data centre, *etc.* which would offer tangible benefits such as a reduction in power usage effectiveness, reduction in water consumption, *etc.* Intangible benefits include enhanced air quality, better daylighting, *etc.*

ii. Banks could decide on a timeline for acquiring the IGBC or LEED certification for all their data centres and deploy accredited professionals to manage the operations at the green data centres.

iii. Adopting greener energy options and replacing outdated or inefficient technology would help reduce the cost of running data centres and also minimise the carbon emissions generated by data centres[19].

[16] IGBC Green Data Center Rating System. Abridged Reference Guide October 2016

[17] For example, by disposing off old assets at their data centres, HDFC Bank avoided 1.4 million KWh of electricity during FY 2020-21 (Source: HDFC Bank Annual Report 2020-21)

[18] https://igbc.in/igbc/redirectHtml.htm?redVal=showgreendataenrenosign

[19] https://cio.economictimes.indiatimes.com/news/data-center/indias-data-center-market-big-enough-for-all-players-to-co-exist-rajesh-tapadia-ceo-nxtra-by-airtel/92810152

iv. Banks could set a timeline for 100% sourcing of the energy consumption in their data centres through renewable energy to reduce the emissions. They could also prepare a strategy to make their data centres carbon neutral and offset their greenhouse gas emissions by measuring and equipoising them.

v. Banks could integrate green measures in their data centre operations, including in their design, materials, construction, energy consumption, waste management, *etc.* In their upcoming data centres, sustainability aspects may be incorporated even before construction and banks may opt for green certification of these facilities by fulfilling the requirements on the same lines as leading real estate firms for select new commercial / residential building projects.

vi. Bank may look into capacity building and training of the professionals/ architects who can provide services for construction, maintenance, and operations of the data centre.

vii. Data centres being high power consumption locations, they could be prioritised by banks in their transition towards lower emissions and switching over to renewable energy to meet their power consumption needs.[20] Data centres could operate on a net-zero emissions basis by purchasing renewable energy from suppliers and offsetting any non-renewable power consumed through green credits purchased from these suppliers.

viii. Old and energy inefficient IT infrastructure in banks may be upgraded to new and AI-driven smart systems to optimise energy consumption. Also, as cooling systems consume a major chunk of the total energy in data centres, new AI-driven smart systems could be configured to optimise the power usage and improve the air flow in the data centres.

Box2: Initiatives at National and Sub-national levels for promoting sustainability in data centre operations

The Tamil Nadu State government introduced its data centre policy in November 2021 with a vision to develop Tamil Nadu as the number one destination for Data Centres by catering to all the specific requirements of Data Centres and providing them with an attractive business environment. The policy, among its various other targets, has also given emphasis on sustainability through the promotion of green technologies. In this regard, it provides a 25% subsidy on the cost of undertaking below listed green and sustainable initiatives, subject to an upper limit of ₹ 5 Crore:

i. Green Buildings which obtain green rating under the Indian Green Building Council (IGBC/LEED Certification)

ii. Green Buildings which obtain green rating for Integrated Habitat Assessment (GRIHA) systems

Source: TN State data centre policy; https://cms.tn.gov.in/sites/default/files/documents/TN_Data_Centre_Policy_2021.pdf

The Karnataka State government introduced its data center policy in April 2022 with one of the targets to encourage establishment of 'futuristic' data centres', powered by renewable energy source, through adoption of energy efficient and sustainable practices leading to a reduction in carbon footprints. It provides below incentives to the data centre for using energy from renewable sources in their operations.

i. Data centres using energy from renewable sources above 50 % will be reimbursed ₹ 0.50 surcharge per unit for 5 years.

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[20] Axis Bank, for instance, has entered into an agreement to purchase solar power under a Power Purchase Agreement (PPA) Model for its Business Continuity Centre (Data Centre) at Bengaluru. Page 76 i.b; https://www.axisbank.com/docs/default-source/annual-reports/for-axis-bank/annual-report-for-the-year-2020-2021.pdf

ii. Data centre entities shall be eligible for green power tariff reimbursement of upto 5 MW, capped at ₹ 1.25 Crore. The same shall be disbursed within 5 years with an annual ceiling of ₹ 25 lakhs.

Source: Karnataka State data centre policy; https://itbtst.karnataka.gov.in/storage/pdf-files/Data%20Center%20Policy.pdf

Further, the draft data centre policy 2020, released by the Ministry of Electronics and Information technology (MeitY) also encourages the use of renewable energy for Data Centres - solar or wind based power - by collaborating with Ministry of Power on their various green and sustainable energy initiatives.

Source: https://www.meity.gov.in/writereaddata/files/Draft%20Data%20Centre%20Policy%20-%2003112020_v5.5.pdf

ix. Banks may also work on adopting smart lighting solutions and modern technology to achieve a lower power usage effectiveness, thereby saving on power consumption.

x. Electronic waste generated as part of data centre refresh activity may be channelised through government approved recyclers to ensure sustainable de-commissioning. The concept of 3Rs i.e. Reduce, Recycle and Reuse which is useful in reducing waste, reusing and recycling resources and products may also be adopted in data centre operations.

xi. Currently there are limited regulatory / statutory guidelines in India mandating green energy usage in data centre operations and the adoption of greener ways in data centre operations is voluntary. This may be addressed by making adoption of renewable energy, sustainable waste management, *etc.* mandatory in a phased manner in high power consumption operations like data centres.

6. Conclusion

While India has established itself as an emerging market for the data centre industry owing to its geographical advantage and a vast coastline making it suitable for submarine cable landing, recent policy initiatives are expected to spur flow of huge capital into this sector. Globally, there has been a growing preference to invest in green data centre technologies. There has also been a shift in consumer preferences towards greener and sustainable alternatives.

Given that the Indian data centre industry is in a high growth phase it is better placed to adopt green technologies for both existing and upcoming data centres. What is needed at this point of time is to channelise the upcoming investments in a sustainable manner guided by policy directives and industry level efforts so that the new data centres being built are 'born green' in their characteristics and the existing data centres are also converted to green data centres. Voluntarily embracing sustainable practices in data centre operations by some of the data centre developers is also a welcome move, however, a regulatory regime mandating green energy usage in data centre operations, at a time when India is poised to become the next data centre hub, could act as a guiding light for data centre developers and significantly improve the adoption of sustainable practices in data centre operations.

"The less we do to address climate change now, the more regulation we will have in the future." - Bill Nye