



HOUSE OF FISCAL WISDOM

GLOBAL COMMISSION ON FINANCING DEVELOPMENT

PROJECT TERRA · RESEARCH REPORT

Grounding the Cloud

*The Material, Environmental and Fiscal Governance of Data
Centres in Tanzania*

TECHNOLOGY GOVERNANCE WORKING GROUP

AUGUST 2026

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This report is a publication of the House of Fiscal Wisdom and is cited to the House as its corporate author. Individual contributions are recorded separately, in accordance with the Contributor Roles Taxonomy (CRediT), adopted as ANSI/NISO Z39.104-2022, which describes what each person contributed to a research output without treating contribution and authorship as the same thing. Denis Omondi, Researcher at the House of Fiscal Wisdom, was responsible for research and the writing of the draft. Lyla Latif (PhD), Director of the House of Fiscal Wisdom was responsible for conceptualisation, methodology, the design of the research outline, supervision, review, writing and editing of the manuscript.

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Abbreviations

AI

Artificial Intelligence

DC

Data Centre

IDC

The International Data Corporation

AU

African Union

EAC

East African Community

CENELEC

European Committee for Electrotechnical Standardization

CET

Common External Tariff

CLF

Converged Licensing Framework

CPU

Central Processing Unit

GPU

Graphics Processing Unit

HDD

Hard Disk Drive

SSD

Solid-State Drive

SAN

Storage Area Network

EIA

Environmental Impact Assessment

EMA

Environmental Management Act

EPOCA

Electronic and Postal Communications Act

EPZ

Export Processing Zone

SEZ

Special Economic Zone

EWURA

Energy and Water Utilities Regulatory Authority

SDG

Sustainable Development Goal

MW

Megawatt

GW

Gigawatt

TWh

Terawatt Hour

ICT

Information and Communication Technology

IPP

Independent Power Producer

IEA

International Energy Agency

ISEZA

Investment and Special Economic Zones Act

LNG

Liquefied Natural Gas

NEMC

National Environment Management Council

NIDC

National Internet Data Center

PUE

Power Usage Effectiveness

WUE

Water Usage Effectiveness

UPS

Uninterruptible Power Supply

PDPA

Personal Data Protection Act

PDPC

Personal Data Protection Commission

PE

Permanent Establishment

SBDC

Space-Based Data Centre

TANESCO

Tanzania Electric Supply Company Limited

TCRA

Tanzania Communications Regulatory Authority

TRA

Tanzania Revenue Authority

TTCL

Tanzania Telecommunications Corporation Limited

VAT

Value Added Tax

WRMA

Water Resources Management Act

Table of Legislation

TANZANIA

Capital Markets and Securities Act, Cap 79
Cybercrimes Act, 2015 (Act No. 14 of 2015)
Electricity Act, 2008 (Act No. 10 of 2008)
Electronic and Postal Communications Act, 2010 (Act No. 3 of 2010)
Electronic Transactions Act, 2015 (Act No. 13 of 2015)
Energy and Water Utilities Regulatory Authority Act, Cap 414
Environmental Management Act, 2004 (Act No. 20 of 2004)
Excise (Management and Tariff) Act, Cap 147
Export Processing Zones Act, Cap 373 (repealed)
Finance Act, 2026
Income Tax Act, Cap 332
Investment and Special Economic Zones Act, 2025 (Act No. 6 of 2025)
Land Act, Cap 113
Personal Data Protection Act, 2022 (Act No. 11 of 2022)
Public Private Partnership (Amendment) Act, 2023 (Act No. 4 of 2023)
Special Economic Zones Act, 2006 (repealed)
Stamp Duty Act, Cap 189
Tanzania Communications Regulatory Authority Act, 2003 (Act No. 12 of 2003)
Tanzania Telecommunications Corporation Act, Cap 304
Urban Planning Act, 2007 (Act No. 8 of 2007)
Value Added Tax Act, Cap 148
Village Land Act, Cap 114
Water Resources Management Act, 2009 (Act No. 11 of 2009)
Water Supply and Sanitation Act, 2009 (Act No. 12 of 2009)

SUBSIDIARY LEGISLATION

Electronic and Postal Communications (Access, Co-location and Infrastructure Sharing) Regulations, 2018, as amended in 2022
Electricity (Development of Small Power Projects) Rules, 2019
Electricity (Standardized Small Power Projects Tariff) Order, 2019
Environmental Management (Environmental Impact Assessment and Audit) Regulations, 2005, GN No. 349 of 2005, as amended by GN No. 474 of 2018
Personal Data Protection Act (Date of Commencement) Notice, GN No. 326 of 2023
Tanzania Communications (Licensing) Regulations, 2005
Tanzania Petroleum Development Corporation (Establishment) Order, 1969, GN No. 140 of 1969

REGIONAL AND INTERNATIONAL INSTRUMENTS

African Union Convention on Cyber Security and Personal Data Protection (Malabo Convention), 2014

African Union, AU Data Policy Framework, 2022

East African Community Common External Tariff, 2022 version

OECD Model Tax Convention on Income and on Capital

United Nations Model Double Taxation Convention between Developed and Developing Countries

Regulation (EC) No 1099/2008 of 22 October 2008 on energy statistics

FOREIGN LEGISLATION AND CASES

Data Protection Act, 2019 (Kenya), Act No. 24 of 2019

Energy Act of 2020, Pub. L. No. 116-260, Div. Z (United States)

Heindel v Dorchester County (United States)

Executive Summary

Digital services are commonly described as though they live in a cloud. They do not. They live in buildings filled with servers, and those buildings consume electricity and water on a scale that few policymakers have measured. This report studies the data centre as a material object and as a fiscal one, and it does so from the standpoint of Tanzania, where the infrastructure is expanding faster than the rules that ought to govern it.

Part A explains what a data centre is. It sets out the definitions used in Tanzanian law and in international standards. It then describes the components from which the facilities are assembled and traces those components back to the minerals from which they are made. Copper, cobalt, aluminium and the rare earth elements sit beneath the digital economy, and much of that mineral wealth is mined in Africa while the value created from it is captured elsewhere.

Part B maps the eleven data centres operating in Tanzania, ten of them in Dar es Salaam and one in Dodoma, and assesses their demands on the electricity grid and on water supply, together with their carbon emissions and their possible effects on the health of surrounding communities.

Part C examines the fiscal treatment of these facilities. Tanzania taxes data centres under the ordinary regimes of income tax and value added tax, yet it also offers a widening set of incentives through the Investment and Special Economic Zones Act 2025 and the East African Community Common External Tariff. The report finds that incentives have moved ahead of safeguards. Tax reliefs are granted before the state has built the capacity to measure what the facilities consume or what the reliefs cost.

Part D surveys the legal framework by regulatory function rather than by instrument, following a facility from land acquisition through environmental authorisation to its supply of electricity and water and to its obligations over data, and finds that Tanzania has neither a data centre statute nor a data centre regulator, only general regimes into which a facility falls according to how it is classified. No authority bears a duty to know what these buildings consume. The report closes by naming the patterns of technology governance that the Tanzanian case reveals and by offering seven recommendations that are specific, measurable, achievable, relevant and time bound. The central argument is a simple one. A state that cannot see its data centres cannot govern them, and a state that cannot govern them will carry their costs while others take their gains.

“A state that cannot see its data centres cannot govern them, and a state that cannot govern them will carry their costs while others take their gains.”

Introduction

The governance of technology cannot be separated from the political economy of a state or from its progress towards the full realisation of socio-economic rights for its citizens. Nor can it be separated from the social contract, and it is at this junction that the taxation regime becomes a central concern for research under Project TERRA. Technology now organises much of human life. It shapes the health and education sectors, it structures the skills industry, and it mediates social relations, which is why its governance is critical. Governance here means the terms on which technology enters a state and a society, how it is used and traded, how it creates and modifies data, and how the algorithms built upon that data in turn shape human behaviour. These are broad concerns, and they do not fall evenly. Those who produce and market technology are not the same people as those who use it, and the effects of technology on climate and on the many economies people inhabit, whether formal, informal, illicit or algorithmic, will be felt differently by each. At the centre of this technological order stands a piece of physical infrastructure that receives far less attention than it deserves: the data centre. Understanding technology governance therefore requires understanding what data centres are, what happens inside them, how they are constructed and operated, and which minerals and natural resources their construction and operation consume.

The report proceeds in five movements. Part A introduces the concept of the data centre. It sets out the definitions adopted under Tanzanian law and international standards, describes the components and minerals from which data centres are built, explains how the facilities operate, and surveys the different types of data centre now found on land, underwater, in the stratosphere and in orbit. Part B then maps the data centres operating in Tanzania and assesses their environmental footprint, with attention to electricity, water, carbon and health.

Part C examines the taxation of data centres in Tanzania, including the tax incentives available and availed to data centre investors. Part D turns to the laws that guide data centres and to the wider regulatory framework. The report closes, in Part E, by drawing out the patterns of technology governance that the Tanzanian case reveals and by offering a set of specific, measurable, achievable, relevant and time-bound recommendations.

Method, Sources and the Limits of the Evidence

This report rests on three bodies of evidence. The first is a desk review of Tanzanian primary legislation, subsidiary legislation and published policy instruments, current to August 2026, together with the regional and international standards to which those instruments refer. The second is a review of the technical and scholarly literature on the construction, operation and resource consumption of data centres, drawn principally from engineering, energy and environmental sources, and supplemented by the emerging socio-legal literature on digital infrastructure. The third is a single field visit, to the ISOCEL Telecommunications facility in Cotonou, described at section A1.3, which allowed the team to see the anatomy of a working facility at first hand. That visit informs the descriptive account in Part A. It is not a proxy for Tanzanian conditions, and readers should hold that limitation in mind when the description in Part A is carried forward into the assessment in Part B.

The population of facilities used throughout Part B is taken from Data Center Map, a commercial directory, cross-checked against the published material of the operators themselves.¹ A directory is not a register. It

records facilities that market colocation or hosting services to third parties, and it will therefore under-record enterprise facilities operated by banks, insurers and other firms for their own use, government facilities that are not marketed commercially, and facilities under construction whose operators have not yet sought listing. The count of eleven should accordingly be read as a floor rather than as a census. That the state itself maintains no public register from which a census could be drawn is not a limitation of this study alone. It is a finding, and it is taken up in Part D.

A further class of evidence was sought and not obtained. No facility level data on installed electrical capacity, electricity consumption, water withdrawal, power usage effectiveness or generator running hours is published by any Tanzanian authority or by any operator in the country.² Where this report gives a figure for Tanzania, that figure is either an operator's own published claim or an estimate derived from published international ratios applied to Tanzanian conditions, and it is identified as such at the point at which it is used. The environmental figures in Part B should therefore be read as orders of magnitude rather than as measurements, and the report has preferred to state the absence of a number rather than to import one from another jurisdiction and present it as though it were Tanzanian.

This is a point of method rather than an apology. In a field where the object of study withholds its own quantities, the record of what was sought and not found is itself evidence about the governance arrangements under examination. The silences catalogued here are the empirical basis for the argument advanced at section E1.3, that opacity in this sector is a working practice rather than an oversight. The report is, finally, a first iteration. Its mapping is intended to establish a baseline against which the growth of the sector can later be measured, which is why recommendation (f) proposes that the exercise be repeated on a fixed cycle.

¹ Data Center Map, 'Tanzania Data Centers' <https://www.datacentermap.com/tanzania/> and 'Dar es salaam Data Centers' <https://www.datacentermap.com/tanzania/dar-es-salaam/> and 'Dodoma Data Centers' <https://www.datacentermap.com/tanzania/dodoma/> accessed 23 August 2026.

² The research team was unable to identify, in the published reporting of the Tanzania Communications Regulatory Authority, the Energy and Water Utilities Regulatory Authority, the National Environment Management Council or the Tanzania Revenue Authority, any source identifying data centres as a distinct class of licensee, consumer or beneficiary. The statement in the text records the outcome of that search and not a conclusion that no such data exists in unpublished form.

PART A

Understanding Data Centres



Part A lays the groundwork for the report. A reader cannot judge how data centres should be taxed or regulated without first understanding what these facilities are and what they consume. The Part therefore moves from legal definition to physical anatomy, and from anatomy to the minerals and resources on which that anatomy depends.

A1 Defining the Data Centre

The term data centre carries a precise meaning in Tanzanian law and a broader one in international standards, and the two are set out below.

A1.1 The Definition of a Data Centre under Tanzanian Law

Tanzania defines what a data centre is in two different legislations. The first is under the Tanzania Telecommunications Corporation Act³ and the other definition is under the 2022 amendment to the Electronic and Postal Communications (Access, Co-location and Infrastructure Sharing) Regulations, 2018. The Tanzania Telecommunications Corporation Act under section 3 defines a data centre as “a facility composed of networked computer servers, storage and associated components such as telecommunications systems, redundant power supply, environment controls and security equipment; and is used by Government, organisations and businesses to store, process and distribute large amounts of data”. The Act only defines a data centre but makes no provisions in relation to it.

The amendment to the Electronic and Postal Communications (Access, Co-location and Infrastructure Sharing) Regulations, 2018⁴ defines a data centre under regulation 3 as “a facility dedicated to the centralized accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control together with the necessary levels of resilience and security required to provide the desired service availability”. It further defines a public data centre as a data centre that provides services for co-location or co-hosting of the customer’s network, servers and storage equipment. Those offering data centre services to the public have a duty to comply with their obligations under their respective licences and to ensure professionalism in providing services particularly for tier 2, tier 3 and tier 4 data centres.⁵

A1.2 The Definition of a Data Centre under International Standards

European Union regulation also adopts a definition close to the two Tanzanian formulations, defining a data centre as “a structure or a group of structures used to house, connect and operate computer systems/servers and associated equipment for data storage, processing and/or distribution, as well as related activities.”⁶ A broader definition adopted by the European Committee for Electrotechnical Standardization (CENELEC) defines a data centre as “a structure, or group of structures, dedicated to the centralized accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control together with the necessary levels of resilience and security required to provide the desired service availability.”⁷

³ Tanzania Telecommunications Corporation Act, Chapter 304

⁴ Electronic and Postal Communications (Access, Co-location and Infrastructure Sharing) (Amendment) Regulations, 2022

⁵ Regulation 10 Electronic and Postal Communications (Access, Co-location and Infrastructure Sharing) (Amendment) Regulations, 2022

⁶ Point 2.6.3.1.16, of Regulation (EC) No 1099/2008 of 22 October 2008 on energy statistics and COM (2021)0558 — C9-0330/2021 — 2021/0203(COD) Article 2(45) <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022AP0315&qid=1778679549974>

⁷ CEN/CLC/ETSI Joint Coordination Group Green Data Centres, *Standardisation Landscape for the Energy Management and Environmental Viability of Data Centres* (10th Edition, 2023) 9.

Simply put, a data centre is a physical facility that houses computer systems and their related components.⁸ It may also be referred to as a data hall, data farm, data warehouse, computer room, server room, high-performance lab, hosting facility among other names.⁹

Data centres differ in size and capacity but share certain cross-cutting features. Their equipment can be summarised as equipment that monitors, manages and controls data centre assets. Obtaining real-time data is a huge task, especially in existing data centres, without adequate instrumentation to collect this data. This aspect reinforces the need for innovative methods to monitor and manage data centres in real time.¹⁰ A data centre has various components within it which differ from one data centre to another. Most data centres consist of a mechanical yard which hosts the cooling systems.¹¹

A1.3 A Case Example: The ISOCEL Data Centre in Benin

A useful example, and one the research team was able to visit in person, is the ISOCEL Telecommunications data centre in Benin. The company has 15 racks, some of which are rented out to customers. Businesses such as banks have their own data centres but outsource data centre services to act as a disaster recovery centre (having a backup data centre in another entity in case you lose your data centre or in case it gets destroyed). This short account gives practical content to the statutory definitions set out above. The interviewees from the data centre explained that data centres are going to advance because of the progression in Artificial Intelligence. Given the projected growth of such facilities, the absence of any meaningful regulatory response from African governments is a matter of concern, and it is a gap to which this report returns in its concluding recommendations.

A2 The Components of a Data Centre

Many of these data centre components have a limited service life and therefore must be frequently replaced at short intervals of two to five years.¹² The data centres are constructed using minerals and metals which may be common or critical raw materials.

A2.1 Servers

Data centres house servers which may be either stand-alone servers, blade servers, rack servers or unix.¹³ A server is a combination of hardware and software through which computers function and through which data is processed and stored. Servers are often equipped with central processing units (CPUs) or specialized accelerators, such as graphics processing units (GPUs), to enable high-performance computing, especially in AI workloads. Servers are typically housed in server racks and are connected to a network to allow data to be accessed, stored and processed.¹⁴ The computations of data centres are basically run on servers. These servers

⁸ Rihards Balodis and Inara Opmane, “History of Data Centre Development” (HAL, Open Science 2012) <https://inria.hal.science/hal-01526804/document>

⁹ Hwaiyu Geng, “Data Center Handbook” (2nd ed, John Wiley & Sons, Inc. 2015).

¹⁰ Levy and JO Hallstrom, “A new approach to data center infrastructure monitoring and management (DCIMM)” *IEEE 7th Annual Computing and Communication Workshop and Conference (CCWC)* (2017) 1–6

¹¹ Luiz André Barroso, Jimmy Clidaras and Urs Hölzle, *The Datacenter as a Computer: An Introduction to the Design of Warehouse-Scale Machines* (Morgan & Claypool Publishers, 2013).

¹² João Henrique & Ricardo Junior, “Data Centers, Critical Minerals, Energy, and Geopolitics: The Foundations of Artificial Intelligence” *Sociedade & Natureza* 37 (2025)

¹³ Fichter K and Hintemann R, “Beyond Energy: The Quantities of Materials Present in the Equipment of Data Centers” *Journal of Industrial Ecology* 18(6) (2014): 846–858

comprise general-purpose and specialized chips which are all tailored to the specific applications that are being provided at the respective times. Most of the energy that data centres make use of goes to the servers which are mounted into a rack and interconnected through local rack top ethernet switch. The switches in turn have several uplink connections to one or more cluster-level ethernet switches.¹⁵ A server has a management controller called the BMC (baseboard management controller).¹⁶ Its functions are to monitor sensors, manage alerts, boot and shut down the server, maintain configuration data and provide remote management.¹⁷ Storage is crucial for an efficient network access and it can be in high performance repositories known as “storage towers” or in smaller “storage bricks”.¹⁸ The number of servers vary depending on the size of the data centre, for example, a server closet has around 3 to 10 servers, a server room around 11 to 100; a small data centre around 101 to 500; a medium-sized data centre 501 to 5,000 and a large data centre has over 5,000 servers.¹⁹

A2.2 Network

Servers process data while the network infrastructure facilitates communication.²⁰ The different types of network accesses include the client–server network and the server-to-server network.²¹ The network component consists of switches, racks, server ports, structured cabling, SAN ports, copper cable and fibre-optic cable.²² This equipment enables the storage and processing of applications and data through switching, routing, load balancing and analytics. Data centres require low-latency, high bandwidth connections in order to run real-time applications. This calls for the installation of new fibre optic lines to create a link with the nearest high-speed internet junction. Some data centres go an extra mile as to connect long-distance fibre optics between their data centres.

A2.3 Storage

A data centre also contains a storage unit with a typical storage capacity of 600 terabytes.²³ Storage consists of technologies, software and devices that allow for the storing of data and applications within a data centre. Data centres face an increasing demand to store more data following increased usage of mobile phones and computers. Storage is the component most affected by this demand. Storage infrastructure of data centres includes hardware such as hard disks and solid-state drives (SSDs). The storage infrastructure of data centres needs to be scalable and highly available.²⁴ There are different storage solutions to data centres. One such significant solution is the storage area network (SAN). This is a dedicated network containing multiple storage

¹⁴ Elliott HAL, Mudd GM, Bishop C, “Mineral Requirements of Digital Technologies: Data Centres, Artificial Intelligence and Quantum Computing” *British Geological Survey Open Report* OR/25/098 (2025) <https://nora.nerc.ac.uk/id/eprint/541752/> accessed 18th June 2026.

¹⁵ Luiz André Barroso, Jimmy Clidaras and Urs Hölzle, *The Datacenter as a Computer: An Introduction to the Design of Warehouse-Scale Machines* (2nd edn, Morgan & Claypool Publishers 2013) 19.

¹⁶ Krishna Kant, “Data Center Evolution: A Tutorial on State of the Art, Issues, And Challenges” *Computer Networks* 53(17) (2009): 2939-2965.

¹⁷ Ibid

¹⁸ Ibid

¹⁹ Ibid

²⁰ Eduard Oró and Jaume Salom, “Data Centre Overview” *Advanced Concepts for Renewable Energy Supply of Data Centres* (1st edn River Publishers, 2022):1 – 26. <https://www.taylorfrancis.com/chapters/oa-edit/10.1201/9781003336990-1/data-centre-overview-eduard-or%C3%B3-jaume-salom>

²¹ Krishna Kant, “Data Center Evolution: A Tutorial on State of the Art, Issues, And Challenges” *Computer Networks* 53(17) (2009): 2939-2965.

²² Fichter K and Hintemann R, “Beyond Energy: The Quantities of Materials Present in the Equipment of Data Centers” *Journal of Industrial Ecology* 18(6) (2014): 846–858.

²³ Ibid

²⁴ Yaseein Soubhi Hussein and others, “Data Centre Infrastructure: Design and Performance” *Latest Advances and New Visions of Ontology in Information Science* (1st edn, Intech Open 2023)

devices. It is essentially a pool of block-level storage resources. Storage area networks employ high speed cabling and dedicated networking equipment.²⁵ Data centre storage systems are managed by distributed systems that are connected to the network of the data centre.

A2.4 Cabling

Cabling entails a network of cables allowing power supply and data transfer for critical operations, which require careful management to avoid downtime. Christian Bueger and Tobias Liebetrau in their article “Protecting Hidden Infrastructure: The Security Politics of the Global Submarine Data Cable Network” enunciate that undersea communication cables are the core critical infrastructure of the digital age. 99% of all transoceanic digital communication, whether financial transactions, emails, voice messages or other traffic, is transported through undersea fiber-optic cables. The global submarine cable network is a critical infrastructure that does not receive the analytical attention it deserves.²⁶ Research by Jonas Franken, Thomas Reinhold and others titled ‘Hidden structures of a global infrastructure: Expansion of the factors of the subsea data cable network’ outlines that fibre-optic subsea data cables currently provide about 99% of intercontinental data traffic. Moreover, over 550 active sub-sea data cables form bottlenecks for international telecommunication, which bundles data from the extensive land-based networks of terrestrial data cables transmission between continents.²⁷

A2.5 Power Supply

Data centres are required to be consistently in operation 365 days in a year. To attain this, constant power supply and a backup system must be in place. Therefore, physical infrastructure, such as rack and floor power distribution units (PDUs), remote power panels, busways and an uninterruptible power supply (UPS) are of necessity to provide power to IT equipment. Backup power is usually supplied by a generator to minimize downtime.²⁸ Other relevant power infrastructure components include power cables and distributors.²⁹ In data centres, IT hardware is normally housed in a rack or a cabinet which has internal power strips which the devices are plugged into. Most of the IT hardware have two power supplies which are fed from different electrical sources to provide redundancy.³⁰

A2.6 Cooling

The IT hardware of data centres converts electrical energy to heat necessitating a cooling system to remove the heat and to keep the IT hardware at an appropriate temperature. The cooling system also makes an allowance for heat gains within the space such as ceiling walls and lighting.³¹ Computer room air conditioning units regulate temperature and humidity and computer room air handler units prevent critical equipment from

²⁵ Ibid

²⁶ Bueger C and Liebetrau T, “Protecting Hidden Infrastructure: The Security Politics of the Global Submarine Data Cable Network” *Contemporary Security Policy* 42(3) (2021): 391–413

²⁷ Franken J, Reinhold T, Dörnfeld T and Reuter C, “Hidden structures of a global infrastructure: Expansion factors of the subsea data cable network” (2025) *Technological Forecasting and Social Change* 215 (2025)

²⁸ Elliott HAL, Mudd GM, etc., “Mineral Requirements of Digital Technologies: Data Centres, Artificial Intelligence and Quantum Computing” *British Geological Survey Open Report OR/25/098* <https://nora.nerc.ac.uk/id/eprint/541752/>

²⁹ Klaus Fichter & Ralph Hintemann, “Beyond Energy: The Quantities of Materials Present in the Equipment of Data Centers” *Journal of Industrial Ecology* 18(6) (2014): 846–858

³⁰ Vincent Fogarty and Sophia Flucker, *Data Centre Essentials: Design, Construction and Operation of Data Centres for the Non-Expert* (1st edn John Wiley & Sons 2023).

³¹ Ibid

overheating. For high-density AI server racks, advanced cooling technologies, such as liquid cooling, direct-to-chip, or immersion cooling are increasingly used.

A2.7 Cooling Methods

The cooling system in many data centres mainly consists of chilled water towers, computer room air conditioning (CRAC) units and air ducts. The water-cooled CRAC unit is joined together with a cooling tower. This results in a water-cooled system which uses a water loop to collect and transport heat away from the IT environment.³² CRAC units draw warm air into the air conditioner unit after which the heat from IT equipment, that is servers, is exchanged with chilled water.³³ Additionally, cold air also flows into the data centre rooms through perforated tiles and the fans in the servers take this air through the server chassis to cool the computer components.³⁴ The cold air is also drawn to other computer equipment in the racks. Afterwards, the heated exhaust air is directed upwards towards the ceiling of the room where it is collected by the intake vents of the CRAC units.³⁵ This is known as the hot-aisle/cold-aisle configuration and is the most preferred configuration by many data centres.³⁶ The configuration only works to cool the air hence supporting the chilled water system which functions to cool the components more efficiently.

Another cooling method used in data centres is the chilled water system where a computer room air handler (CRAH) is joined to a chiller. The chiller produces chilled water, that is, water refrigerated to about 8-15°C. The chilled water is then pumped through pipes to the CRAH units in the IT environment. CRAH units are similar to CRAC in appearance only but function differently. CRAH units cool the air by absorbing the heat from the computer rooms through chilled water coils which circulate chilled water. The water exiting CRAH units becomes warm and moves to the chiller which removes the heat before taking it to another stream flowing through another device known as a cooling tower.³⁷

A2.8 Other Physical and Security Infrastructure

There are other physical structures that also support and contain the components of the data centre, such as server racks and cable trays. This category does not include the construction materials associated with the building in which the data centre is housed. Any data centre requires an advanced infrastructure to support the efficient work of computing and data resources. This infrastructure that support data centres may include chillers, cooler pumps, valves, heat pumps, electrical distribution, high and low voltage systems, driers and air conditioning systems, together with flood, smoke and heat detectors and fire prevention systems.³⁸ The data centres must also be kept secure. Alarms, electronic door locks, biometric scanners and closed-circuit television (CCTV) are deployed to protect data and assets. Data centres perform functions such as storing client information and processing online payments and customers' orders. For payment processing and customer orders, maximum security is necessary. Therefore, the data centres should observe data protection of

³² Tony Evans, "The Different Technologies for Cooling Data Centers" *APC white paper* 59 (60) (2012). https://www.ins-is.co.uk/DC_Cooling.pdf

³³ Jie Liu & Andreas Terzis, "Sensing Data Centres for Energy Efficiency" *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 370(1958) (2012): 136-157. <https://www.jstor.org/stable/41348171?seq=1>

³⁴ Ibid

³⁵ B. Fakhim, M. Behnia, S.W. Armfield & N. Srinarayana, "Cooling solutions in an operational data centre: A case study" *Applied Thermal Engineering* 31(2011): 14-15 <https://www.sciencedirect.com/science/article/abs/pii/S1359431111001578?via%3Dihub>

³⁶ Ibid

³⁷ Tony Evans, "The Different Technologies for Cooling Data Centers" *APC white paper* 59 (60) (2012). https://www.ins-is.co.uk/DC_Cooling.pdf

³⁸ Norbert Meyer and others, "Data Centre Infrastructure Monitoring" *Partnership for Advanced Computing in Europe* (2016). <https://prace-ri.eu/wp-content/uploads/WP226.pdf>

the highest standards. In this regard, the data centre must incorporate cyber security and physical security of high magnitude. This will ensure that there is data integrity and maintain the trust of the customers in the data centres.³⁹

A3 Essential Minerals Used in Data Centre Components

Many of these data centre components have a limited service life and must therefore be frequently replaced at short intervals of two to five years.⁴⁰ The limited service life eliminates valuable metals from the supply chain thereby intensifying mineral extraction. In an average data centre facility, iron accounts for the largest share of material by weight followed by aluminium, synthetics and copper. Other relevant materials include glass, ceramics, inert materials and other precious metals.⁴¹

Data centres are constructed using minerals and metals which may be common or critical raw materials. These include gallium, germanium, metallurgical silicon, tantalum, platinum-group metals, copper, rare earth elements, silver and gold.⁴² For example, power cables are primarily made of copper and polyvinyl chloride.⁴³ Generators on the other hand are made up of high-grade steel, copper, and aluminium as well as smaller quantities of other materials.⁴⁴ Critical minerals form the core of these technologies providing structural strength, electrical conductivity, thermal management and data processing capabilities which are requisite for high-performance capability.⁴⁵

Rare earth minerals are essential in the production of semiconductor heterostructures, infrared sensors and lasers which are used in machine vision systems and neural network accelerators.⁴⁶ Palladium, a platinum-group metal, is utilised in the production of multilayer capacitors, contact elements and catalysts, as well as in coatings and thin films that improve the reliability of microchip interconnections.⁴⁷ Neodymium is employed in the development of high-strength permanent magnets used in electric motors, drive and cooling systems and data storage devices.⁴⁸ Rare metals are also required for the manufacturing of Graphics Processing Units (GPUs).⁴⁹ A GPU is a computer chip that can execute many calculations rapidly.⁵⁰ It is primarily developed for image rendering but its ability to process many tasks at the same time makes it useful for high-performance

³⁹ Yaseein Soubhi Hussein and others, “Data Centre Infrastructure: Design and Performance” *Latest Advances and New Visions of Ontology in Information Science* (1st edn, IntechOpen 2023)

⁴⁰ João Henrique & Ricardo Junior, “Data Centers, Critical Minerals, Energy and Geopolitics: The Foundations of Artificial Intelligence” *Sociedade & Natureza* 37 (2025). <https://www.scielo.br/j/sn/a/LC65bzyhKgVBL4zjk7p5Skm/?format=pdf&lang=en>

⁴¹ Klaus Fichter & Ralph Hintemann, “Beyond Energy: The Quantities of Materials Present in the Equipment of Data Centers” *Journal of Industrial Ecology* 18(6) (2014): 846–858.

⁴² João Henrique & Ricardo Junior, “Data Centers, Critical Minerals, Energy and Geopolitics: The Foundations of Artificial Intelligence” *Sociedade & Natureza* 37 (2025). <https://www.scielo.br/j/sn/a/LC65bzyhKgVBL4zjk7p5Skm/?format=pdf&lang=en>

⁴³ Klaus Fichter & Ralph Hintemann, “Beyond Energy: The Quantities of Materials Present in the Equipment of Data Centers” *Journal of Industrial Ecology* 18(6) (2014): 846–858.

⁴⁴ Ibid

⁴⁵ ‘Critical Minerals in Servers and Data Storage’ SFA (Oxford) <https://www.sfa-oxford.com/knowledge-and-insights/critical-minerals-in-low-carbon-and-future-technologies/critical-minerals-in-electronics/critical-minerals-in-servers-and-data-storage/> accessed 10 June 2026.

⁴⁶ Kukula I., “Critical Materials for AI: Securing Supply for The Technological Innovation” *The Scientific Heritage* 173 (2025): 88-92 <https://cyberleninka.ru/article/n/critical-materials-for-ai-securing-supply-for-the-technological-innovation/viewer>

⁴⁷ Ibid

⁴⁸ Ibid

⁴⁹ Nina-Simone Edwards, “Unveiling the Environmental Impact of Large Language Models on Indigenous Communities” *Tulane Environmental Law Journal* 38(1) (2025): 1-27 https://www.jstor.org/stable/pdf/27378747.pdf?refreqid=fastly-default%3Ab884e511b1358e700cf54ef9d9048ec2&ab_segments=0%2Fbasic_phrase_search%2Fcontrol&initiator=&acceptTC=1

⁵⁰ Avita Katal, Susheela Dahiya, Tanupriya Choudhury, “Energy Efficiency in Cloud Computing Data Center: A Survey on Hardware Technologies” *Cluster Computing* 25(1) (2022): 675-705.

computing (HPC) in cloud and server systems.⁵¹ They are therefore used widely in data centres, particularly in servers, to reduce the execution time of applications.⁵²

A3.1 Rare Earth Minerals across Africa and the World

Rare earth elements in Africa are geologically distributed in Southern Africa, East Africa, Central Africa, North Africa and West Africa due to the diverse tectonic and magmatic history of the continent.⁵³ As of May 2023, Africa had 64 rare earth elements deposits with Namibia (16 deposits) having the highest number of deposits.⁵⁴ When it comes to the mineral reserves, Tanzania ranks the highest in Africa. Other major rare earth elements deposits in Africa include inter alia Kenya, Malawi, Angola, South Africa, Mozambique, Madagascar, Namibia, Zambia and Burundi.⁵⁵

China possesses the largest reserves of rare earth minerals in the world while Africa has relatively few deposits.⁵⁶ It was noted that as of 2025, BRICS countries and their partners held the largest portion of proven rare earth minerals reserves with China holding about 34–40% followed by Vietnam at 17–18%, then Brazil at 16–18%, Russia at 15–16% and finally India at about 5%.⁵⁷ Other notable countries in possession of rare earth elements include Burma and the United States of America. Although African countries hold far less than 5% of the global rare mineral reserves, it is estimated that its total reserve, including off-balance reserves (those not yet economically viable,) could account for about one-third of the global rare earth minerals.⁵⁸ Notably, the United States, Canada and Australia are increasing their long-term investments in the African mineral deposits.⁵⁹ This may be attributed to a variety of factors. The first being the fact that China dominates the rare earth elements reserves and processing sectors; the other factor following the prospective reserve estimate mentioned before and the other possibility being that the rare earth elements deposits in some of the African countries are of higher grades than those in the United States and Australia.⁶⁰

A3.2 Minerals and Their Uses in Data Centres

Table 1 below maps some core minerals to their specific function within data centre hardware, infrastructure and systems.

⁵¹ Ibid

⁵² Sergio Iserte & Federico Silla, “Improving the Management Efficiency of GPU Workloads in Data Centers Through GPU Virtualization” *Concurrency and Computation: Practice and Experience* 33(2) (2021)

⁵³ Vincent B. Arohunmolase & Daniel O. Ajibola, “A Review on Rare Earth Elements (REEs) in Mine Tailings: Mineral Hosts, Extraction Chemistry and Recovery Potential” *Communication in Physical Sciences* 11(4) (2024): 1124-1142. <https://journalcps.com/index.php/volumes/article/view/755>

⁵⁴ Junping Ren, Alei Gu, Kai Sun, Hang Zhang, Jianwu, Hongwei Su, “A Review of Rare Earth Elements Resources in Africa” *Minerals* 15(9) (2025)

⁵⁵ Ibid

⁵⁶ Ibid

⁵⁷ R.V. Dmitrieva, S.A. Gorokhova, M.M. Agafoshina, “African Countries in The Rare Earth Metals Market: Outsiders Or Independent Players?”. *R-Economy*, 11(3) (2025): 273-284. https://elar.urfu.ru/bitstream/10995/146985/1/r-economy_2025_v11_3_01.pdf

⁵⁸ Ibid

⁵⁹ Ibid

⁶⁰ Ibid

TABLE 1*Core minerals and their functions in data centre hardware, infrastructure and systems*

Mineral	Functions in Data Centres
Copper	Copper has an exceptional thermal and electrical conductivity. It is therefore instrumental in the making of power distribution systems and server motherboards. ⁶¹ Copper is also required in chip wiring that carries both information and power. ⁶² Copper is therefore an important element in the networking component of data centres.
Lithium	As already averred, data centres require stable supply of energy in order to be consistently in service. Moreover, they require backup systems of power supply. These back-up power supply systems utilize Lithium-ion batteries. These types of batteries also incorporate cobalt and nickel together with other mineral components. ⁶³
Aluminium	Aluminium is required together with copper in the making of power cables and other electrical equipment which are used in data centres. Aluminium is widely used in server chassis, heat sinks and in cooling solutions. This is because aluminium is lightweight in nature, has a high thermal conductivity and is resistant to corrosion. Aluminium can efficiently dissipate heat which is crucial in preventing the overheating of processors and memory modules. Alloys of aluminium are also used in physical data centre infrastructure for their strength to weight ratio which helps to reduce the system weight while maintaining durability. ⁶⁴
Cobalt	Cobalt is a silvery-white metal discovered in the 1730s. It has a myriad of significant uses based on its properties. Cobalt is one of the three naturally occurring magnetic metals. Cobalt is used in Lithium-ion batteries which are an important component of the power back-up systems for data centres. Cobalt is also required in the making of laptop batteries, tablet batteries and mobile phone batteries. These are equipment which are all commonly used in data centres. ⁶⁵

⁶¹ Ibid⁶² Mulani Nikhil. "An Evolving AI Supply Chain." SSRN 5628470 (October 19, 2025). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5628470⁶³ Avita Katal, Susheela Dahiya, Tanupriya Choudhury, "Energy Efficiency in Cloud Computing Data Center: A Survey on Hardware Technologies" *Cluster Computing* 25(1) (2022): 675-705.⁶⁴ "Critical Minerals in Servers and Data Storage" *SFA (Oxford)* <https://www.sfa-oxford.com/knowledge-and-insights/critical-minerals-in-low-carbon-and-future-technologies/critical-minerals-in-electronics/critical-minerals-in-servers-and-data-storage/> accessed 10 June 2026.

Mineral	Functions in Data Centres
Nickel	Nickel has unique properties which are instrumental in the modern industrial processes. Nickel is widely used in the production of alloys together with other metals. It is also employed in electro-chemical processes and in solar batteries, a use of particular relevance to data centres. Moreover, nickel is also used in the manufacturing of lithium-ion batteries which are also important components in the continuous operation of data centres. Nickel consumption has also gained traction in the modern-day growth and development of the clean energy sector. ⁶⁶
Gold, Silver and Palladium	Used in electrical components and connections
Rare materials such as germanium, gallium, indium and hafnium	Useful in the making of circuit boards and other electronic components. ⁶⁷

A4 The Operation of Data Centres

The construction of data centres is a process that takes months and even years to complete. Barroso et al in “Data Centre as a Computer” outline that it requires a number of months to grade a site by levelling the ground and creating slopes to ensure proper drainage and a strong foundation for the building. They further outline that steps should also be taken to connect the utilities to the land such as water, sewer, power and roads. Another significant step is the construction of the electrical substation, which takes a substantial amount of time, usually 12 to 18 months. From this point the next steps now involve the actual infrastructure of the data centre including the data centre halls, the cooling and electrical plants and more.⁶⁸

Data centres form a critical support system of the digital economy and the Information Technology of many small, medium and large enterprises. Vincent Fogarty and Sophia Flucker point out in their book “Data Centre Essentials: Design, Construction and Operation of Data Centres for the Non-Expert” that data centres are part of an ecosystem of high-speed connectivity, the highways connecting data centres with the internet. Fogarty and Flucker further explain that some data centres focus on routing and exchange, others on the landing of sea cables, others on last-mile delivery, while others focus on processing and storage facilities. Fogarty and Flucker note, however, that despite these differences data centres have one thing in common, namely their connection to the same highway of high-speed fibres to transmit digital information.⁶⁹

⁶⁵ “The Cobalt Market and Cobalt Price” *SFA (Oxford)* <https://www.sfa-oxford.com/battery-metals-and-materials/markets/cobalt-market-and-cobalt-price-drivers/> accessed 11 June 2026.

⁶⁶ K. K. Mamrybayeva, A. N. Kuandykova, etc., “Review on Hydrometallurgical Processing Technology of Lateritic Nickel Ore for the Last 20 Years in the World” *Non-Ferrous Metals* 56(1) (2024): 13-21 <https://repository.satbayev.university/api/files/ry45rn63ze2oa47t16usm70ny.pdf>

⁶⁷ João Henrique & Ricardo Junior, “Data Centers, Critical Minerals, Energy and Geopolitics: The Foundations of Artificial Intelligence” *Sociedade & Natureza* 37 (2025). <https://www.scielo.br/j/sn/a/LC65bzyhKgVBL4zjk7p5Skm/?format=pdf&lang=en>

⁶⁸ Luiz André Barroso, Jimmy Clidas and Urs Hölzle, “The Datacenter as a Computer: An Introduction to the Design of Warehouse-Scale Machines” (2nd edn, Morgan & Claypool Publishers 2013).

⁶⁹ Vincent Fogarty and Sophia Flucker, *Data Centre Essentials: Design, Construction and Operation of Data Centres for the Non-Expert* (John Wiley & Sons 2023).

From the foregoing, data centres have certain critical components without which they will not be in a position to function. Servers and storage systems discussed above are part of these core components. Other core components include fibre-optic networks and network routing equipment to facilitate exchanges. These components of the data centre make use of electrical power to turn electrons into digital or optical signals. This conversion is what produces the digital realm as most people know it. Heat is also produced in this conversion process hence the need for a cooling system as discussed above.⁷⁰

Data centres can be described as the nervous system of the digital economy and, by extension, of the 21st century by extension. Beth Whitehead, Deborah Andrews, Amip Shah and Graeme Maidment in “Assessing the Environmental Impact of Data Centres” elucidate that data centres contain comprehensive mechanical and electrical infrastructures to support the energy intensive computing that is required to perform the physical housing of IT equipment such as computers, servers, switches, routers, data storage devices, racks and related equipment or the storage, management, processing and exchange of digital data. The data centre infrastructure is also designed to support the provision of application services or management for data processing, such as web hosting, internet, intranet and telecommunication.⁷¹ Businesses, corporations, educational establishments and governments use data centres to provide web hosting services, to store company information, to process company information and to process transactions which relate to the business.⁷²

A4.1 The Centrality of a Stable Power Supply

In the majority of data centres there is a 24/7 staff presence to facilitate monitoring and maintenance. This is done by the operations team, which works in shifts. The arrangement is significant because it ensures that any issue which would interfere with critical data centre infrastructure is dealt with promptly. This serves to lower disruptions in services of the data centre. Fogarty and Flucker point out that the data centre is not a static environment and installation, decommissioning, configuration changes, upgrading and maintenance of IT equipment are usually ongoing via the client’s remote hands team.⁷³

Data centres rely on a stable supply of power for smooth operations. The public grid is not effective for their operations as this grid can experience voltage shortages which would cause the data centre servers to malfunction or even experience longer outages which would crash the entire data centre. A standard data centre therefore adopts a unique system of power connectivity. The system is made such that between the public grid and the infrastructure there is first the transformer which transforms electrical energy from high/medium voltage to low voltage. After this electrical element, there is the switchgear, which is used to control, protect and isolate electrical equipment. In the framework of Data Centres, it connects the IT equipment to the main grid or to the backup diesel generator. There is also usually a backup generator to provide power in the event of a failure in the public grid. Before this generator is started, the battery or the flywheel is designed to keep the IT equipment of the data centre running although this usually takes a few seconds.⁷⁴

⁷⁰ Ibid

⁷¹ Beth Whitehead and others, “Assessing the Environmental Impact of Data Centres Part 1: Background, Energy Use and Metrics” (2014) 82 Building and Environment 82 (2014): 151-159. <https://www.sciencedirect.com/science/article/abs/pii/S036013231400273X>

⁷² Ibid

⁷³ Vincent Fogarty and Sophia Flucker, *Data Centre Essentials: Design, Construction and Operation of Data Centres for the Non-Expert* (John Wiley & Sons 2023).

⁷⁴ Eduard Oró and Jaume Salom, “Data Centre Overview” *Advanced Concepts for Renewable Energy Supply of Data Centres* (1st edn River Publishers, 2022):1 – 26.

A5 Energy and Water Consumption by Data Centres

A5.1 Cooling and Water Consumption

Servers produce more heat as compared to the data storage and processing infrastructure hence requiring powerful systems to offset the heat.⁷⁵ Data centres may be cooled by different methods and they mostly involve water loss through evaporation.⁷⁶ The data centres therefore consume large amounts of water with a small data centre of 1MW estimated to use around 25.5 million litres of water per year.⁷⁷ They may be cooled either through the air-cooled systems where cold air is blown through the servers⁷⁸ or through water-cooled systems.⁷⁹

Water demand is estimated to only increase with estimates suggesting a 55% increase between 2000 and 2050 attributable to agriculture and industrialisation.⁸⁰ Data centres also consume water in two ways; directly through the cooling mechanisms and indirectly through electricity generation.⁸¹ The increasing number of data centres in Africa, driven by the expansion of the digital economy, is expected to lead to massive freshwater consumption.⁸² The use of vast volumes of fresh water by data centres for cooling threatens freshwater resources, especially in regions already facing water scarcity.⁸³

Getting accountability begins with the data centres providing information to the public on how much water they consume. However, this has proven to be more theoretical than practical. Large corporations tend to shelter behind legal argument so as not to disclose their water usage. An example is the 2024 US case of *Heindel v. Dorchester County* involving Google's \$510 million "Project Orchid" datacentre. In this case, Frank Heindel accused Dorchester County of heavily redacting the data centre's projected water and sewer usage from public service agreement documents. Dorchester County claimed the data constituted "trade secrets" and therefore protected under state law. After several months of litigation, the county reversed its stance and publicised the daily and monthly water usage by the data centre.⁸⁴ Another tactic is to delay provision of information. For example, in September 2025, Microsoft unreasonably delayed providing its water consumption figures for one of its data centres, a request which should have typically taken 10 days.⁸⁵ Shifting to other sources of electrical energy could also move the strain away from water-dependent forms of electricity generation. It is suggested that by 2030, shifting from hydroelectric power generation to wind and solar energy

⁷⁵ Ibid

⁷⁶ Tony Evans, "The Different Technologies for Cooling Data Centers" *APC white paper* 59 (60) (2012). https://www.ins-is.co.uk/DC_Cooling.pdf

⁷⁷ Ibid

⁷⁸ Jie Liu & Andreas Terzis, "Sensing Data Centres for Energy Efficiency" *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 370(1958) (2012): 136-157. <https://www.jstor.org/stable/41348171?seq=1>

⁷⁹ Ibid

⁸⁰ David Mytton, "Data Centre Water Consumption" *npj Clean Water* 4(1) (2021) <https://www.nature.com/articles/s41545-021-00101-w.pdf>

⁸¹ Ibid

⁸² Noah Shumba, Opelo Tshekiso, Pengfei Li, Giulia Fanti & Shaolei Ren, "A Water Efficiency Dataset for African Data Centers" *Proceedings of the ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies* (21st July 2025): 453-460.

⁸³ Sophia N. Wilson, Sebastian Mair, Mophat Okinyi, Erik B. Dam & Janin Koch, "How Hyper-Datafication Impacts the Sustainability Costs in Frontier AI" *The 2026 ACM Conference on Fairness, Accountability, and Transparency* (2026): 441-466 <https://arxiv.org/pdf/2602.00056> & Jake Okechukwu Effoduh, "Africa's Energy Poverty in An Artificial Intelligence (AI) World: Struggle for Sustainable Development Goal 7" *The Journal of Sustainable Development Law and Policy* 15(3)(2024): 32-63 <https://www.ajol.info/index.php/jsdlp/article/view/282955>

⁸⁴ *Heindel v. Dorchester County* analysed in COMMISSION MEETING AGENDA (19th February 202) Revize Website <https://cms7files1.revize.com/mountpleasantww/02.19.25%20web%20packet.pdf> accessed 25th June 2026

⁸⁵ Sameer H. Shah, "Four Water Insecurity Concerns About Datacenters Driving the AI Revolution" *PLOS Water* 5(1) (2026)

could potentially reduce water usage in power generation by 50% in the UK, 25% in the USA, Germany and Australia and 10% in India.⁸⁶

A5.2 Energy Consumption

Due to the rapid growth of digitalisation, many African countries are developing data centres albeit with the aid of foreign investments and companies. Some of the major projects have been launched in Benin, Congo, Côte d'Ivoire, the Senegalese city of Diamniadio, Togo among other African states. However, the objectives pursued through the development of these data centres may not be fulfilled as many African countries are riddled with unreliable power supply.⁸⁷

The success of a data centre hinges on the reliability and availability of uninterrupted power supply.⁸⁸ The electricity is used to run servers and for cooling the data centre equipment. Just like water consumption, data centres also consume high amounts of electricity and are believed to have the fastest-growing carbon footprint of the ICT sectors.⁸⁹ Global warming is another major concern surrounding data centres. Currently, servers consume the most amount of electricity and with the increasing demand for data storage, storage equipment are expected to also consume a significant amount of energy.⁹⁰ Power Usage Effectiveness (PUE) is the ratio of the total electric power consumed by a data centre to the power consumed by its ICT equipment alone, so that a lower figure indicates a more efficient facility.⁹¹

Before electricity reaches the data centres from the public grid, a transformer transforms the electrical energy from high/medium voltage to low voltage.⁹² Data centres also have backup diesel generators that step in to supply electrical energy in case of power outages. Whenever the public grid fails, the battery or flywheel keeps the computer equipment running before the generator is started. A major concern with the use of diesel generators is the noise pollution.⁹³ Data centres also have switchgears whose function is to control and protect the electrical equipment.⁹⁴

Following the push towards energy reduction, reduction of carbon emission and the need to mitigate the environmental impact of data centres, it is becoming imperative to develop ways by which to measure the effectiveness of energy saving measures within data centres.⁹⁵ Notably, it sometimes becomes difficult to have the data centre operators publicly reveal their achievements.⁹⁶ Energy falls under Sustainable Development

⁸⁶ David Mytton, "Data Centre Water Consumption" *npj Clean Water* 4(1) (2021) <https://www.nature.com/articles/s41545-021-00101-w.pdf>

⁸⁷ Folashadé Soulé, "Digital Sovereignty in Africa: Moving beyond Local Data Ownership" (Center for International Governance Innovation, Policy Brief 185 (2024): 1-10. https://www.cigionline.org/static/documents/PB_no.185.pdf

⁸⁸ Eduard Oró and Jaume Salom, "Data Centre Overview" *Advanced Concepts for Renewable Energy Supply of Data Centres* (1st edn River Publishers, 2022):1 – 26.

⁸⁹ Beth Whitehead, Deborah Andrews, Amip Shah, Graeme Maidment, "Assessing the Environmental Impact of Data Centres Part 1: Background, Energy Use and Metrics" *Building and Environment* 82 (2014): 151-159

⁹⁰ Katuta Samuel, Peter Musau et al., "Analysis of Energy Utilization Metrics as a Measure of Energy Efficiency in Data Centres: Case Study of Wananchi Group (Kenya) Limited Data Centre" *2022 IEEE PES/IAS PowerAfrica* (2022): 1-5. <https://ieeexplore.ieee.org/document/9905342>

⁹¹ David Mytton, "Data Centre Water Consumption" *npj Clean Water* 4(1) (2021) <https://www.nature.com/articles/s41545-021-00101-w.pdf>

⁹² Eduard Oró and Jaume Salom, "Data Centre Overview" *Advanced Concepts for Renewable Energy Supply of Data Centres* (1st edn River Publishers, 2022):1 – 26.

⁹³ Peter Jones, David Hillier & Daphne Comfort, "Data Centres in the UK: Property and Planning Issues" *Property Management* 31(2) (2013): 103-114. <https://www.emerald.com/pm/article-pdf/31/2/103/2091704/02637471311309418.pdf>

⁹⁴ Eduard Oró and Jaume Salom, "Data Centre Overview" *Advanced Concepts for Renewable Energy Supply of Data Centres* (1st edn River Publishers, 2022):1 – 26.

⁹⁵ Daim, Tugrul, Krampits, et al. "Data center metrics: An Energy Efficiency Model for Information Technology Managers." *Management of Environmental Quality: An International Journal* 20(6) (2009): 712-731.

⁹⁶ Peter Jones, David Hillier & Daphne Comfort, "Data Centres in the UK: Property and Planning Issues" *Property Management* 31(2) (2013): 103-114) <https://www.emerald.com/pm/article-pdf/31/2/103/2091704/02637471311309418.pdf>

Goal (SDG) number 7 - ensuring access to affordable, reliable, sustainable and modern energy for all.⁹⁷ It is also a critical component that ensures the functioning of the data centre infrastructure.⁹⁸ The electrical energy is used to run servers and to cool the data centre equipment. A data centre can consume more than 500 MW of electrical power.⁹⁹ This power system includes the uninterruptible power supply (UPS), power cables and distributors and the generators (for emergencies in case of power outages). In 2022, the global electricity consumption by data centres was around 240 and 340 terawatt hours, which accounted for about 1-3%, and was projected to double by 2026.¹⁰⁰ In 2025, around 1.5% of the world's electricity was used to power data centres.

Of the global energy consumption, the United States, Europe and China are responsible for nearly 85% of the total.¹⁰¹

Analysis from Goldman Sachs predicts that the data centre demand for electricity will rise to 8% of the US power demand by 2030 from 3% in 2022.¹⁰² This is likely to be driven by the growth in artificial intelligence, increased data demand and a deceleration of power efficiency gains.¹⁰³ To mitigate this trend, the United States is putting in legislative measures to curb the rise in electricity demand. The USA's Energy Act of 2020 under section 1003 dictates the evaluation of data centres belonging to federal agencies once every 4 years by certified energy practitioners.¹⁰⁴ The same Act also mandates the establishment of an open data initiative relating to energy usage at federally owned and operated data centres, with the purpose of making the data available and accessible in a manner that encourages further data centre innovation, optimisation and consolidation. This also includes harmonization of the data with global specifications and metrics for data centre energy and water efficiency. The Act also stipulates the facilitation of the development of an efficiency metric that measures the energy efficiency of a data centre (including equipment and facilities).¹⁰⁵

A5.3 Carbon Emissions

Data centres are believed to have the fastest growing carbon footprint as compared to other ICT sectors.¹⁰⁶

The scale of the problem can be stated with some precision. The International Energy Agency estimates that data centres consumed around 415 terawatt hours of electricity in 2024, which amounted to roughly 1.5 per cent of global electricity use. The carbon consequences of that demand depend on the energy mix of the grid from which each facility draws, and where grids rely on gas and other fossil fuels, as the Tanzanian grid partly

⁹⁷ Sustainable Development Goals- Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all; <http://sdgs.un.org/goals/goal7> accessed 19th June 2026

⁹⁸ Klaus Fichter & Ralph Hintemann, "Beyond Energy: The Quantities of Materials Present in the Equipment of Data Centers" *Journal of Industrial Ecology* 18(6) (2014): 846–858

⁹⁹ Hwaiyu Geng, "Data Center Handbook" (2nd ed, John Wiley & Sons, Inc. 2015).

¹⁰⁰ Gianluca Guidi, Francesca Dominici, et al., "Environmental Burden of United States Data Centers in the Artificial Intelligence Era" *arXiv preprint arXiv:2411.09786* (2024). <https://arxiv.org/pdf/2411.09786>

¹⁰¹ International Energy Agency, "Energy and AI" *World Energy Output Special Report* P.57 <https://iea.blob.core.windows.net/assets/de9dea13-b07d-42c5-a398-d1b3ae17d866/EnergyandAI.pdf> accessed 20th June 2026

¹⁰² Brian Singer, "Generational Growth AI, Data Centers and the Coming US Power Demand Surge" (29th April 2024) Edward Conard <https://www.edwardconard.com/macro-roundup/a-goldmansachs-analysis-argues-us-power-demand-will-grow-at-2-4-year-through-2030-versus-0-over-the-last-decade-they-forecast-data-centers-will-be-8-of-power-demand-by-2030-from-3-currently/> accessed 21st June 2026

¹⁰³ Ibid

¹⁰⁴ Energy Act of 2020, Pub. L. No. 116-260, Div. Z

¹⁰⁵ Energy Act of 2020, Pub. L. No. 116-260, Div. Z

¹⁰⁶ Beth Whitehead, Deborah Andrews, Amip Shah, Graeme Maidment, "Assessing the Environmental Impact of Data Centres Part 1: Background, Energy Use and Metrics" *Building and Environment* 82 (2014): 151-159

does, the growth of data centres translates directly into emissions. A fuller treatment of the carbon question, grounded in facility level data, is reserved for the next iteration of this report.

A5.4 Community Concern: The South African Experience

Data centres consume millions of cubic metres of freshwater raising the cost of water and this has had the effect of causing societal conflict with these infrastructures as was seen in South Africa where environmental regulators had to intervene.¹⁰⁷ The strain on the electric grid was also another major concern which led to debates about the data centre in Cape Town.¹⁰⁸ Activists challenged the construction of the 160MW data centre by the US-listed Equinix.¹⁰⁹ They blamed the Cape Town Municipal Planning Tribunal for approving data centres in the absence of meaningful public participation and without providing information relating to issues of water and electricity usage disclosure and the potential impacts.

Submissions to the South African Human Rights Commission have been made by organisations such as the Climate Justice Coalition to try and voice their concern about the rapid rise of data centres in the country with a major focus on the lack of transparency and effective public participation.¹¹⁰ The magnitude of electric consumption by the proposed data centres also raised human rights concerns.¹¹¹

A6 Types of Data Centres in the World

A6.1 Classification by Size and Performance

Notably, there is no universal classification of data centres. Whereas some literature divides the data centres according to size, others list them according to performance (Uptime Institute), some according to the number of servers and others classify them according to their power capacities. For example, when it comes to size, large data centres have been defined as those with an electrical capacity of more than 10 MW and currently, there are around 500 of these globally with many of these being in the US, Europe and China.¹¹² The surge of data centres in the United States of America can be traced back to the early 2000s when the number of data centres rapidly increased in a bid to support the growing demand in digital services brought about by the widespread accessibility of the Internet.¹¹³

The location of many data centres in Northern Europe and the USA follows a variety of factors with one of the reasons being the proximity to ‘Silicon Valley’ and financial centres.¹¹⁴ The lower temperatures also help

¹⁰⁷ Kaustubh Aggarwal, “The Environmental and Economic Implications of Data Centres in the Age of AI” SSRN 7048258 (2025) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=7048258

¹⁰⁸ Nathalie Ortat, A. R. E. Taylor, Julia Velkova and Others, Powering ‘smart’ futures: datacentres and the energy politics of digitalisation (Energy futures, 2022) *Energy Futures: Anthropocene Challenges, Emerging Technologies and Everyday Life* (2022): 125-168

¹⁰⁹ Simon Jessop & Kirsten Donovan, “S. Africa: Campaigners want major data centre plan blocked until its water, power and environmental impact is fully disclosed” (18th May 2026) Business and Human Rights Centre <https://www.business-humanrights.org/en/latest-news/s-africa-campaigners-want-major-data-centre-plan-blocked-until-its-water-power-and-environmental-impact-is-fully-disclosed/> accessed 20th August 2026

¹¹⁰ “Climate Justice Coalition submission on the rapid expansion of data centres and digital infrastructure” (10th August 2026) Climate Justice Coalition <https://climatejusticecoalition.org/climate-justice-coalition-submission-on-the-rapid-expansion-of-data-centres-and-digital-infrastructure/> accessed 20th August 2026

¹¹¹ Tyrone McCrindle, “South Africa needs data centres, but not without transparency” (4th August 2026) GroundUp <https://groundup.org.za/article/south-africa-needs-data-centres-but-not-with-transparency/> accessed 20th August 2026

¹¹² Konstantin Pilz & Lennart Heim, “Compute at Scale a Broad Investigation into The Data Center Industry” *Cornell University arXiv preprint arXiv:2311.02651* (2023). <https://arxiv.org/pdf/2311.02651>

reduce the cost of cooling. The major internet-oriented companies like Google, Facebook and Amazon are investing in land near to or in the Arctic Circle so as to reduce the cost of cooling and due to the political stability of the region.¹¹⁵

A hyperscale data centre is not universally defined but Katal Avita and Susheela Dahiya while relying on the definition given by IDC, describe it to be a data centre with at least 5000 servers and 10,000 square feet of open field.¹¹⁶ Comparatively, they are much larger than the corporate data centres thereby outperforming them due to the advantage of economies of scale coupled with custom engineering.¹¹⁷

Peter Jones, David Hillier and Daphne Comfort in “*Data Centres in the UK: Property and Planning Issues*” note that in the United Kingdom, data centres are divided into four types namely, corporate data centres, wholesale data centres, retail data centres and data carrier data centres. Corporate data centres are found inside the company’s premises and are especially managed by the large companies or ¹¹⁸government for their own data storage. However, many companies are increasingly outsourcing data centres due to the costs associated with owning one’s data centre. Wholesale data centres (such as Digital Realty, Global Switch and Infinity) exist where companies lease data centres to meet the needs of large organisations such as banks, government departments and IT companies. The companies only provide the buildings and power with the leases typically lasting more than 10 years. Comparatively, in retail, colocation and carrier neutral data centres, the leasing companies provide data storage, processing and management services with shorter leases lasting between 3-5 years. Additionally, unlike wholesale data centres where the operator rents large facilities, the operator in retail data centres hosts many customers within the same facility. Examples include Interxion, Telecity Group and Telehouse. Carrier data centres are owned and managed by telecommunications or network carriers and are directly connected to that carrier’s communication network. The users may be the carriers themselves or small companies who rent rack space in the centre. The distinction of these data centres into the various groups is based on the UK’s context and may therefore not reflect the universal classification of the various data centres across the globe.

The European Standard EN 50600-1:2012 clusters data centres into three types: enterprise data centres, colocation data centres and hosting data centres.¹¹⁹ Enterprise data centres are built and operated by the end users such as banks and hospitals. A co-location or commercial/multi-tenant data centre is where a number of customers having their own IT networks, servers and equipment are housed in a data centre while the operator provides other supporting infrastructures such as security, power and cooling. For hosted or cloud service providers, a third party builds and operates these facilities so as to provide direct computing services to other businesses.

Data centres may also be categorised according to the size of their IT power capacity where a data centre with a power capacity of below 50 kW(kilowatts) is referred to as a server room, very small data centres operate at

¹¹³ Arman Shehabi, “Data Center Growth in the United States: Decoupling the Demand for Services from Electricity Use” *Environmental Research Letters* 13(12) (2018). <https://iopscience.iop.org/article/10.1088/1748-9326/aaec9c/pdf>

¹¹⁵ Ibid

¹¹⁶ Avita Katal, Susheela Dahiya, Tanupriya Choudhury in “Energy Efficiency in Cloud Computing Data Centers: A Survey on Software Technologies” *Cluster Computing* 25(1) (2022): 675-705.

¹¹⁷ Avita Katal, Susheela Dahiya, Tanupriya Choudhury in “Energy Efficiency in Cloud Computing Data Centers: A Survey on Software Technologies” *Cluster Computing* 25(1) (2022): 675-705 https://pmc.ncbi.nlm.nih.gov/articles/PMC9424070/pdf/10586_2022_Article_3713.pdf

¹¹⁸ Peter Jones, David Hillier & Daphne Comfort, “Data Centres in the UK: Property and Planning Issues” *Property Management* 31(2) (2013): 103-114. <https://www.emerald.com/pm/article-pdf/31/2/103/2091704/02637471311309418.pdf>

50–250 kW, small data centres at 250–1000 kW, medium size data centres at 1–2 MW (megawatts), large data centres 2–10 MW and very large data centres at above 10 MW.¹²⁰ The Uptime Institute also divides data centres into four different tiers as seen in table 2 below.¹²¹

TABLE 2
Uptime Institute classification of data centres by tier

Tier	Description
Tier I	This represents the basic capacity, and the facility must be completely shut down before repair and maintenance
Tier II	The components can be removed without shutting the data centre down, but any unexpected shutdown will affect the system
Tier III	Does not require shutdown before maintenance or repair of equipment
Tier IV	Many of its components are independent and the data centre requires constant cooling

A6.2 Classification by Location: Underwater, Terrestrial, Stratosphere and Space-Based Data Centres

Based on locality, data centres may be divided into four different categories; those found in water (underwater data centres), those on land (terrestrial data centres), those in the atmosphere (stratosphere data centres) and those found in outer space (space-based data centres). Diagram 1 illustrates the location concept below.

¹¹⁹ Eduard Oró and Jaume Salom, “Data Centre Overview” *Advanced Concepts for Renewable Energy Supply of Data Centres* (1st edn. River Publishers, 2022):1 – 26. <https://www.taylorfrancis.com/chapters/oa-edit/10.1201/9781003336990-1/data-centre-overview-eduard-or%C3%B3-jaume-salom>

¹²⁰ Ibid

¹²¹ “Tier Classification System” Uptime Institute <https://uptimeinstitute.com/tiers> accessed 23rd June 2026

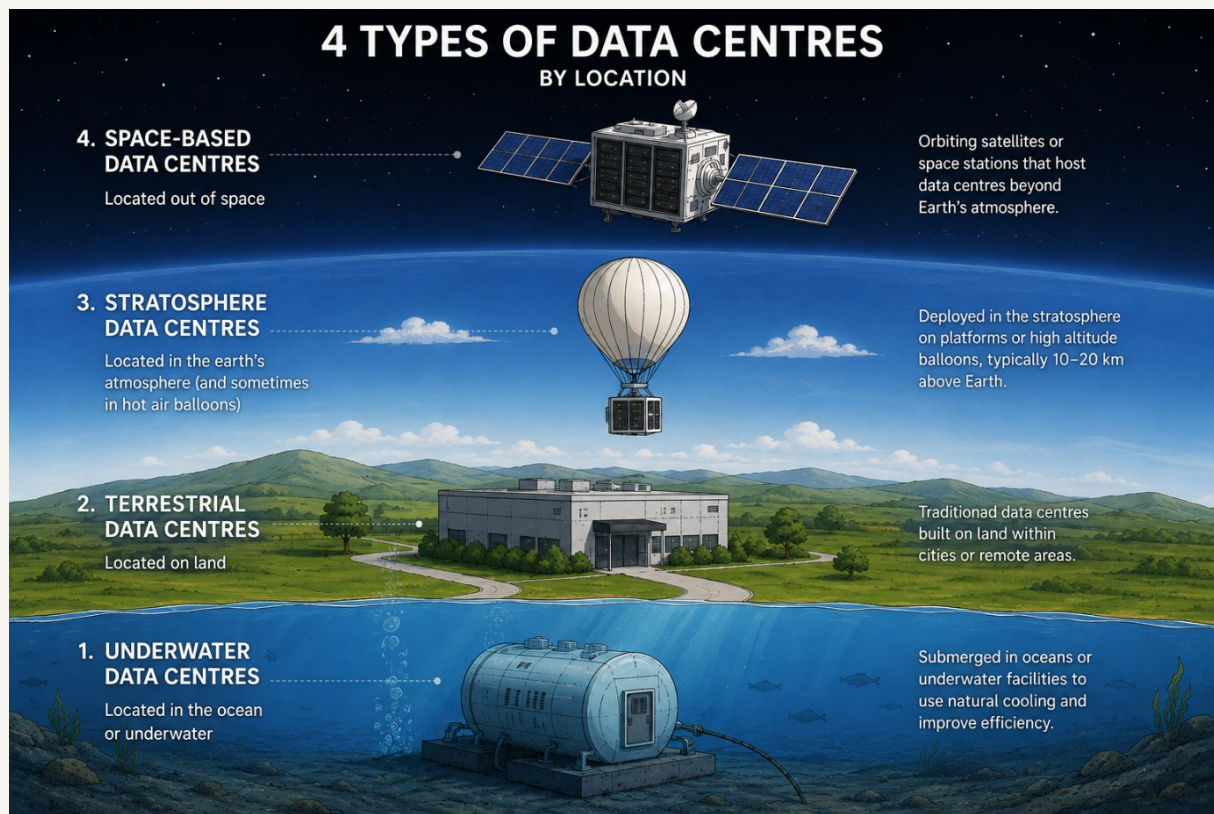


DIAGRAM 1 Classification of data centres by location. Source: Author-generated using OpenAI ChatGPT (GPT-5.6 Luna), 2026.

Underwater data centres have an advantage over terrestrial data centres due to their reduced cooling costs and reduced latency for coastal network subscribers.¹²² They have recently been gaining traction following the desire to counter the high energy consumption, the need to protect the environmental impact and security concerns surrounding conventional data centres.¹²³ Outer space is also emerging as another suitable option for setting up data centres due to the potential mitigation on environmental impact and the considerable amount of solar energy.¹²⁴ The choice of the environment outside the traditional data centre ecosystem is motivated by the need to reduce on costs. Setting up of data centres in such areas, e.g. the stratosphere and the ocean, is also riddled with its own challenges. For example, siting data centres in the oceans means they now directly interact with the environment and may potentially influence biological conservation.¹²⁵ Data centres in the stratosphere and ocean may also be collateral damage when found in the path of aerial or underwater missiles. Having data centres in the ocean or in outer space can reduce cooling and powering costs while also improving on power usage effectiveness but the deployment costs may be very high.¹²⁶ Launch costs have fallen but remain very high.

¹²² A.A. Periola, A.A. Alonge & K.A. Ogudo, “Heat Wave Resilient Systems Architecture for Underwater Data Centers” *Scientific Reports* 12(1) (2022): 17161. <https://www.nature.com/articles/s41598-022-21293-2.pdf>

¹²³ Mark Abner, Sanja Bauk, “On Underwater Data Centers: Surveillance, Monitoring, and Environmental Management in the Baltic Sea” *Journal of Information Technology & Applications* 14(2) (2024): 142-149 https://jita-au.com/wp-content/uploads/2025/01/Pages-from-JITA_Vol-14_Issue-2-WEB-7.pdf

¹²⁴ A. A. Periola, M. O. Kolawole, “Space-Based Data Centres: A Paradigm for Data Processing and Scientific Investigations” *Wireless Personal Communications* 107(1) (2019): 95-119. <https://link.springer.com/article/10.1007/s11277-019-06242-z>

¹²⁵ Ibid

A6.2.1 Underwater Data Centres

Traditional data centres use a lot of energy to remove the heat generated by the computer chips. An innovative solution is therefore to put the data centres in sealed capsules and immerse them in the oceans due to the ocean's near-infinite heat absorption capacities. The stable cold temperatures, coupled with the need to mitigate the environmental impact of data centres and the security concerns surrounding conventional data centres has led to the development of underwater data centres.¹²⁷ Underwater data centres consist of a metallic structure containing server racks and filled with nitrogen gas that prevents corrosion.¹²⁸ These data centres have an advantage over terrestrial data centres due to their reduced cooling costs and reduced latency for coastal network subscribers.¹²⁹ However, siting these data centres is difficult because the marine technologies and artificial reefs required are expensive.¹³⁰

The underwater data centre concept developed significantly in 2013 with Microsoft's Project Natick. In 2015, Microsoft deployed the first underwater prototype off the coast of California to demonstrate the feasibility of the project.¹³¹ It was submerged 30 feet below the ocean's surface. The second phase of the project was in 2018 where a larger data centre with 864 servers was deployed off the coast of Scotland's Orkney Islands to approximately 117 feet below the surface of the ocean.¹³² It was powered by renewable energy from nearby wind farms and solar farms. The data centre had a lower failure rate as opposed to the traditional terrestrial data centres owing to the cooler and more stable environment and the lack of human intervention. The success of this project prompted action from other companies and organisations such as Subsea Cloud, Offshore Oil Engineering Company¹³³ and China Communications Construction Company (CCCC) Third Harbor Engineering.¹³⁴

Operation

So far, underwater data centres have adopted two designs; the horizontal design and the vertical design.¹³⁵ The horizontal design was by Microsoft's Project Natick where a horizontal cylinder resembling a submarine with a length of 12.2 metres was immersed in the ocean.¹³⁶ The data centre was designed to operate for up to 5 years and potentially 20 years without human intervention.¹³⁷ The machines are cooled naturally by a heat exchanger that transfers heat from the servers to the surrounding ocean water. The China Communications

¹²⁶ A. A. Alonge, A. A. Periola, K. A. Ogudo, "Underwater Data Centres – Innovative Computing Solutions for Stowing Servers in Ocean Computing Platforms to Reduce Deployment Costs" *Nigerian Journal of Technological Development* 22(5) (2025): 210-218.

¹²⁷ Mark Abner, Sanja Bauk, "On Underwater Data Centers: Surveillance, Monitoring, and Environmental Management in the Baltic Sea" *Journal of Information Technology & Applications* 14(2) (2024): 142-149. https://jita-au.com/wp-content/uploads/2025/01/Pages-from-JITA_Vol-14_Issue-2-WEB-7.pdf

¹²⁸ Jennifer Sheldon, Weidong Zhu, et al., "AquaSonic: Acoustic Manipulation of Underwater Data Center Operations and Resource Management" *2024 IEEE Symposium on Security and Privacy (SP)*: 331-349.

¹²⁹ A.A. Periola, A.A. Alonge & K.A. Ogudo, "Heat Wave Resilient Systems Architecture for Underwater Data Centers" *Scientific Reports* 12(1) (2022): 17161. <https://www.nature.com/articles/s41598-022-21293-2.pdf>

¹³⁰ Ibid

¹³¹ Mark Abner, Sanja Bauk, "On Underwater Data Centers: Surveillance, Monitoring, and Environmental Management in the Baltic Sea" *Journal of Information Technology & Applications* 14(2) (2024): 142-149. https://jita-au.com/wp-content/uploads/2025/01/Pages-from-JITA_Vol-14_Issue-2-WEB-7.pdf

¹³² Ibid

¹³³ Ibid

¹³⁴ Jouma Ali Al-Mohamad, "Diving into the Future: Integrated Engineering for Building Ai-Powered Underwater Data Centers to Achieve 'Blue Computing'" *International Journal of Engineering Research and Development* 2(1) (2026): 1-11.

¹³⁵ Ibid

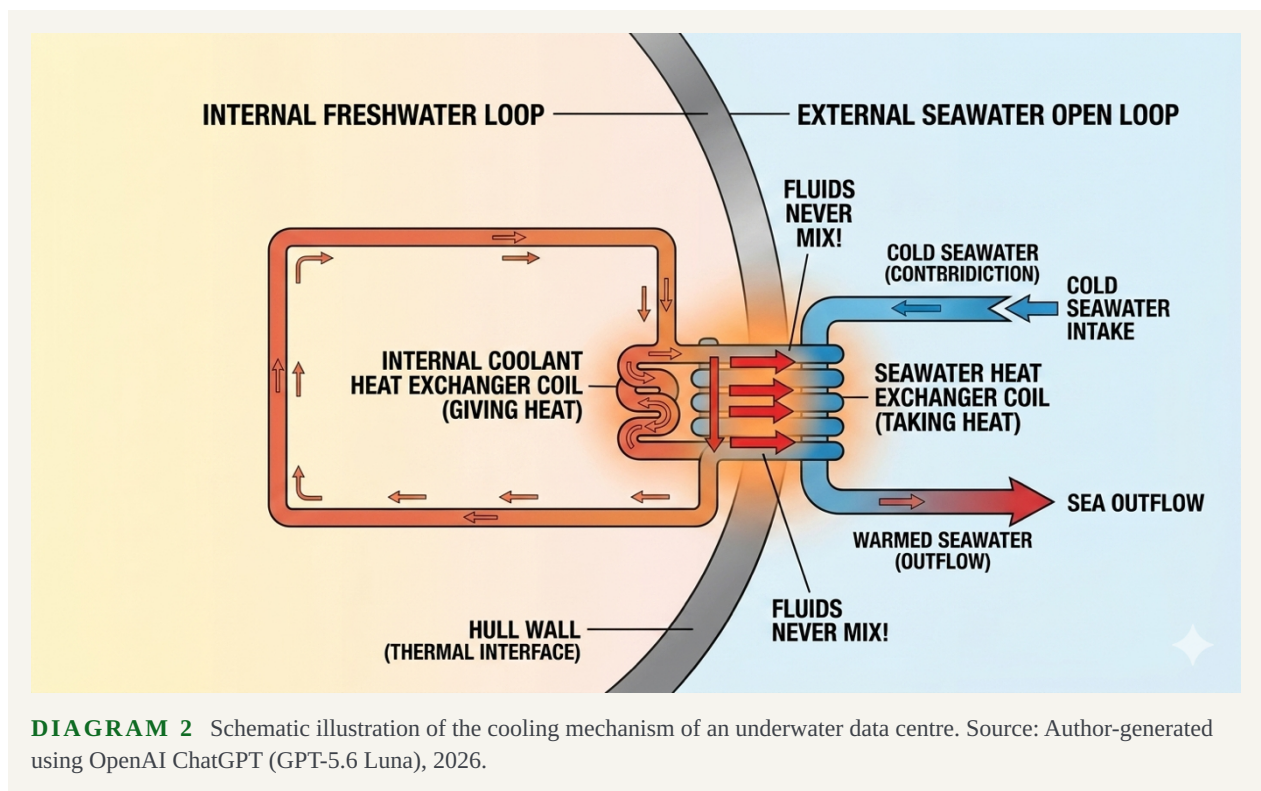
¹³⁶ Simon & Kevin, "Project Natick - Microsoft's Self-sufficient Underwater Datacenters" <https://www.ssoar.info/ssoar/bitstream/handle/document/57615/?sequence=1> (Open Access Repository, 2018)

¹³⁷ Ibid

Construction Company (CCCC) Third Harbor Engineering employed the vertical cylindrical design.¹³⁸ The 39-metre-tall cylinder weighing 1,900 tonnes is mounted on a steel pile foundation. The design is meant to improve stability against strong currents and ensure precise deployment.

Seawater destroys computer equipment and is therefore not pumped into the cylinders for cooling.¹³⁹ Cooling is achieved through conduction whereby a pure cooling fluid is circulated within pipes. There is the internal pipe system that loops inside the capsule to collect heat from the chips and the external pipe system that is in contact with the internal pipe system and absorbs the heat coming from the internal pipe system through the metal and dissipates it away into the sea.¹⁴⁰

Below is a simple diagram for illustration.



It is estimated that compared to the traditional data centres, this method can reduce the energy used in cooling by 95%.¹⁴¹

Challenges

A major challenge with the deployment of underwater data centres is the risk of corrosion by the surrounding saltwater. Two protective methods are used to counter the risk of corrosion; the first is the use of advanced coating consisting of epoxy coatings reinforced with glass flakes and the second is the use of anodes that corrode instead of the steel capsules.¹⁴²

¹³⁸ Ibid

¹³⁹ Ibid

¹⁴⁰ Ibid

¹⁴¹ Simon & Kevin, "Project Natick - Microsoft's Self-sufficient Underwater Datacenters" *IndraStra Global* 4(6) (2018). <https://www.ssoar.info/ssoar/bitstream/handle/document/57615/?sequence=1>

Whereas underwater data centres are an innovative solution to the problem of cooling in traditional data centres, they increase the temperature of the surrounding environment (although to a small degree).¹⁴³ The cumulative long-term effect may have an unpredictable effect on the water species especially those highly sensitive to temperature variations.

A6.2.2 Space-Based Data Centres

Outer space is also emerging as another suitable option for setting up data centres due to the potential mitigation on environmental impact and the considerable amount of solar energy.¹⁴⁴ The increasing number of satellites in the earth's orbit has led to an increase in space-generated data creating a need for space-based data centres (SBDCs), which reduce transmission overhead and minimise delays.¹⁴⁵ Space based data centres are launched in the low earth orbit (a zone between 160 and 2,000 kilometres above Earth's surface) and instead of the physical building, small server modules ("nodes") are used. SBDCs therefore process the data in the orbit, subsequently reducing the costs associated with transmitting large volumes of data to earth for processing.¹⁴⁶ They also improve latency and reduce the challenge of space-to-Earth link congestion (this occurs when many space satellites all try to send massive amounts of data to a limited number of ground station at the same time).¹⁴⁷

The high electricity consumption by data centres driven by the increasing adoption of Artificial Intelligence drives the need for SBDCs since they utilise solar energy hence not straining the grid. China, for example, projects that by 2030, data centres will account for 3.49% of the country's total electricity consumption.¹⁴⁸ The decreasing launch costs have made it attractive to move data centres to space.¹⁴⁹ Countries such as the United States, the first to launch an SBDC, together with Europe and China, have taken distinctive approaches to this opportunity.¹⁵⁰ The SBDC sector is still young, and states are expected to become more active towards 2030.¹⁵¹

The continuous solar power, extreme cold for radiative cooling and the potential carbon-neutral operation are some of the advantages associated with space-based data centres (SBDCs).¹⁵² The use of solar energy saves on electricity costs and the data centres can also offset their own manufacturing carbon footprint within 3 to 5 years of operation.¹⁵³ SBDCs also have unlimited scalability due to the abundance of space.

Challenges

However, the venture faces significant hurdles such as the possibility of total vehicle loss or partial failure during launches, ionizing radiation that may lead to degradation of components and their subsequent failure

¹⁴² Jouma Ali Al-Mohamad, "Diving into the Future: Integrated Engineering for Building Ai-Powered Underwater Data Centers to Achieve 'Blue Computing'" *International Journal of Engineering Research and Development* 2(1) (2026): 1-11.

¹⁴³ Ibid

¹⁴⁴ A. A. Periola, M. O. Kolawole, "Space-Based Data Centres: A Paradigm for Data Processing and Scientific Investigations" *Wireless Personal Communications* 107(1) (2019): 95-119.

¹⁴⁵ Jonas Weiss, Patricia Sagmeister etc, "Deep Tech to Space: Space Data Centers and AI Revolution at the Edge" *arXiv preprint arXiv: 2605.19892* (2026). <https://arxiv.org/pdf/2605.19892>

¹⁴⁶ Ibid

¹⁴⁷ Ibid

¹⁴⁸ Nathaniel Bleier, Muhammad Husnain Mubarik, Gary R. Swenson & Rakesh Kumar, "Space Microdatacenters" *Proceedings of the 56th Annual IEEE/ACM International Symposium on Microarchitecture* 2023): 900-915.

¹⁴⁹ Ibid

¹⁵⁰ Ibid

¹⁵¹ Ibid

¹⁵² Ibid

over time and the lack of easy human access for hands-on maintenance.¹⁵⁴ SBDCs are also costly when it comes to launching the data centre into space, the expensive premium design and components and the astronomical costs in repair.

A6.2.3 Stratosphere Data Centres

The desire to reduce the cost of cooling has led to the exploration of stratospheric platforms since the environment provides free cooling thus improving power usage effectiveness.¹⁵⁵ Data centres located in such an environment benefit from stratospheric cooling.¹⁵⁶

A6.2.4 Terrestrial Data Centres

Terrestrial data centres are designed to store vast volumes of data and to process the data within a controlled environment.¹⁵⁷ A typical data centre consists of racks of servers, graphic processing units (GPU), storage systems such as solid-state drives (SSD) and hard disk drives (HDD), networking infrastructure, power system which includes grid electricity, generators and batteries and finally the cooling infrastructure.¹⁵⁸ The data centres are like warehouses that store several servers and they require security to prevent theft and fire incidences. Data centres have a high energy demand which the Boston Consulting Group estimates will reach up to 130 GW by 2028.¹⁵⁹ The International Energy Agency (IEA) found that in 2024, data centres were responsible for the consumption of around 415 Terawatt-hours (TWh), which was about 1.5% of total global electricity and an annual increase of 12% over the past 5 years.¹⁶⁰ Depending on the pace of AI development, the figure may rise to between 650 TWh and 1050 TWh by 2026.¹⁶¹

¹⁵³ Mahmoud Al Ahmad, Qurban Memon, and Michael Pecht “Reliability and Risk in Space-Based Data Centers: A Lifecycle Assessment of Orbital Cloud Infrastructure” *Applied Sciences* 16(11) (2026): 5247.

¹⁵⁴ Ibid

¹⁵⁵ Periola, Ayodele Abiola, “Power Usage Effectiveness in Stratosphere Based Computing Platforms: Re-Evaluation and Need to Re-Establish Performance Benefits Via an Intelligent Light Server Selection Architecture.” *Wireless Personal Communications* 132(2) (2023): 1577-1591.

¹⁵⁶ A. A. Periola, A. A. Alonge and K. A. Ogudo, “Intelligent Scheduling for Stratosphere Cloud Platforms,” *2020 International Conference on Artificial Intelligence, Big Data, Computing and Data Communication Systems (icABCD)* (2020): 1-7

¹⁵⁷ Ori Bloch, Manu H. Nair, Mini C. Rai, Dirk Schaefer, Simon Reid, “Earth-Based Data Centres vs. Space-Based Data Centres: A holistic review” *Progress in Aerospace Sciences* 164 (2026)

¹⁵⁸ Ibid

¹⁵⁹ Vivian Lee and others, “Breaking Barriers to Data Center Growth” Boston Consulting Group 10 (2025) <https://www.bcg.com/publications/2025/breaking-barriers-data-center-growth>

¹⁶⁰ “Energy demand from AI” Energy and AI <https://www.iea.org/reports/energy-and-ai/energy-demand-from-ai> accessed 25th June 2026

¹⁶¹ Ibid

PART B

Data Centres in Tanzania and their Environmental Footprint

B

With the anatomy of the data centre established, Part B turns to Tanzania itself. It identifies the facilities now operating in the country and asks what their presence means for the electricity grid and water supply, and for the health of surrounding communities.

B1 Mapping Data Centres in Tanzania

Currently, Tanzania has 11 listed data centres, 10 being in Dar es Salaam and 1 located in Dodoma.¹⁶² It is well established that data centres are significant consumers of electricity and water. This is a major point of concern for both developing and developed countries. However, the situation is more dire for Africa due to the added pressure on local water resources since many countries are faced with the challenge of prolonged droughts and water shortages.¹⁶³

Those eleven facilities are set out in Table 3. The listing is drawn from a commercial directory and cross-checked against the published material of the operators, with the qualifications set out in the Introduction.¹⁶⁴

TABLE 3

Data centre facilities listed in Tanzania, August 2026

Facility	Operator	Location	Type	Installed capacity
Raxio Dar es Salaam TZ1	Raxio Group	Old Bagamoyo Road, Dar es Salaam	Carrier neutral colocation, Tier III	Not published
Wingu Africa Data Center	Wingu Africa Group Ltd	Mbezi Industrial Area, Dar es Salaam	Carrier neutral colocation and cable landing station, Tier 3	3 MW (directory figure)
National Internet Data Center	Tanzania Telecommunications Corporation	Mikocheni, Dar es Salaam	State owned colocation and cloud	Not published
Yas Salasala Data Center	Yas	Salasala Road, Dar es Salaam	Mobile network operator	Not published
Vodacom Mbezi Data Center	Vodacom Business	Vodacom Road, Dar es Salaam	Mobile network operator	Not published
Vodacom Dar es Salaam Data Center	Vodacom Business	Laibon Road, Dar es Salaam	Mobile network operator	Not published
Airtel Tanzania Data Center	Bharti Airtel	Bagamoyo Road, Dar es Salaam	Mobile network operator	Not published
Aptus Solutions Data Center	Aptus Solutions	Azikiwe Street, Dar es Salaam	Domestic hosting and colocation	Not published

¹⁶² Tanzania Data Centers (Data Center Map) <https://www.datacentermap.com/tanzania/>

¹⁶³ Noah Shumba, Opelo Tshekiso, Pengfei Li, Giulia Fanti, Shaolei Ren, “A Water Efficiency Dataset for African Data Centers” (COMPASS ‘25, 21 July 2025)

¹⁶⁴ Data Center Map listings for Tanzania, Dar es Salaam and Dodoma, as cited at section 1.1 above, accessed 23 August 2026. Facility type and tier are as described by the operators and by the directory and have not been independently verified.

Facility	Operator	Location	Type	Installed capacity
Flashnet Tanzania	Flashnet	PPF Tower, Garden Avenue, Ilala, Dar es Salaam	Domestic hosting and colocation	Not published
SEACOM Dar es Salaam CLS	SEACOM	Silver Sands, Kunduchi, Dar es Salaam	Colocation at a cable landing station	Not published
Vodacom Dodoma Data Center	Vodacom Business	Lusinde Road, Dodoma	Mobile network operator	Not published

Three features of the table carry analytical weight. The first is ownership. Nine distinct entities operate the eleven facilities, and of those nine only two, Aptus Solutions and Flashnet, are Tanzanian enterprises without a foreign parent, while one, the National Internet Data Center, is publicly owned through the Tanzania Telecommunications Corporation. The remainder are subsidiaries or brands of foreign headquartered telecommunications groups or of regional data centre and connectivity groups. The physical layer of Tanzania's digital economy therefore sits substantially in non-resident hands, a fact which bears directly on Part C, because the reliefs described there accrue in the first instance to non-resident shareholders, and on section C1.12, because the income that a non-resident derives through such a facility may not be within the Tanzanian tax base at all.

The second feature is concentration. Ten of the eleven facilities stand in Dar es Salaam, several of them within the same industrial areas, drawing on the same metropolitan grid and the same water supply. Their loads are cumulative even though their approvals are not. Where an environmental assessment is carried out at all it is carried out facility by facility, so that no authority holds an assessment of what the eleven together demand of the city. The regulatory consequence of that gap is examined at section D1.3.

The third feature is the column that is almost empty. For ten of the eleven facilities no installed capacity figure could be located in any public source, and for the eleventh the figure of three megawatts rests on a commercial directory rather than on an operator disclosure or a regulatory filing.¹⁶⁵ The two different commissioning dates reported for the Raxio facility, given as 2024 by the directory and as 2026 by the operator, are a further indication of the quality of the public record. Recommendations (b) and (d) below are keyed to thresholds of one megawatt and five megawatts. On present information the Tanzanian state cannot say how many of its eleven facilities would cross either threshold, which is the measurement problem of this report in its most concrete form.¹⁶⁶

B1.1 Electricity Consumption

The high consumption of electric energy by data centres results from the continuous operation of the facilities unlike other standard industries which may power down during non-peak hours.¹⁶⁷ For example, it was established that in the year 2024, data centres were responsible for the consumption of approximately 415 terawatt-

¹⁶⁵ Data Center Map, 'Wingu Africa Data Center Dar Es Salaam' <https://www.datacentermap.com/tanzania/dar-es-salaam/wingu-africa-data-center-dar-es-salaam/> accessed 23 August 2026. The figure of 3 MW is reported by the directory and has not been verified against the operator.

¹⁶⁶ Raxio Group, 'Raxio Tanzania' <https://www.raxiogroup.com/data-centres/tanzania/> accessed 23 August 2026. The Data Center Map listing records the facility as due for commissioning in 2024 while the operator's own page gives 2026, a discrepancy noted in the text.

hours (TWh) which equated to around 1.5% of global electricity use.¹⁶⁸ However, it is projected that this figure could rise up to around 945 TWh by 2030 due to the growth of Artificial Intelligence which requires high-performance accelerated servers operating continuously.¹⁶⁹ The increasing digitalisation and adoption of AI in Africa has led to an increase in the number of data centres in Africa but the facilities face unique challenges arising from the hot climates and grid limitations in the continent.¹⁷⁰ The challenge of grid reliability and the high cost of cooling perpetuate inequality in rural areas.

Just like other developing countries in Africa, Tanzania experiences low levels of electrification and increasing annual power demand.¹⁷¹ In order to avoid incurring exponential operational costs, data centres in the country would have to consider energy efficiency measures. Electricity consumers in Tanzania complain that the electricity power in the country is poor and unreliable. Domestic and industrial users also view the electricity charge rate in Tanzania to be relatively high.¹⁷² The inadequacy of electricity has the effect of impeding ICT integration for learning, especially in the rural areas.¹⁷³

The government in Tanzania acknowledges that data centres consume vast amounts of energy and water and also contribute to carbon emissions and e-waste.¹⁷⁴ Since data centres consume large amounts of electricity, which may strain the national grid and thereby deter investment, the ministry has called for laws and regulations that support partnerships between data centre providers and Independent Power Producers (IPPs) for them to adopt green energy.¹⁷⁵ The push for green data centres in Africa is backed by AU's, "Continental Artificial Intelligence Strategy" which has the objective of realising AI's positive and transformative potential. It highlights that only 10% of the data centre demand in Africa is served hence the need to build green data centres that meet environmental, sustainability and governance guidelines.¹⁷⁶

B1.2 Water

AI data centres consume huge amounts of freshwater in cooling the equipment and powering the facilities as compared to traditional data centres. With the water usage expected to rise exponentially, it exacerbates the existing risk of water stress for 1.5 billion people in the water scarce regions of the Global South.¹⁷⁷ Sub-

¹⁶⁷ Daniel Raphael Ejike Ewim, Nwakamma Ninduwezuor-Ehiobu, Ochuko Felix Orikipte, Blessed Afeyokalo Egbokhaebho, Akeeb Adepoju Fawole, Chiemela Onunka, "Impact of Data Centers on Climate Change: A Review of Energy Efficient Strategies" *The Journal of Engineering and Exact Sciences*, 9(6) (2023) 16397-01e.

¹⁶⁸ Energy and AI: Energy Demand from AI (2024) International Energy Agency (IEA) <https://www.iea.org/reports/energy-and-ai/energy-demand-from-ai>

¹⁶⁹ "Global Data Centre Electricity Consumption by Equipment Base Case 2020-2030" (2025) International Energy Agency (IEA) <https://www.iea.org/data-and-statistics/charts/global-data-centre-electricity-consumption-by-equipment-base-case-2020-2030>

¹⁷⁰ Ohaka Amarachi Mavisclara, Ibrahim Isiaka Oshobugie et al, "The AI-Driven Energy Surge: A comprehensive review of sustainable power solutions for data centers" *Global Journal of Engineering and Technology Advances* (2025): 1-6

¹⁷¹ Rodrick Frank Mero, "Building Blocks for Eco-efficient Cloud Computing for Higher Learning Institutions in Tanzania" *International Journal of Computer Applications Technology and Research* 7(4) (2018): 163-170.

¹⁷² Abdi T. Abdalla and Kwame Ibwe, "Smart Grid in Tanzania: Research Opportunities" *Tanzania Journal of Engineering and Technology* 42(2) (2023): 170-183.

¹⁷³ Zibiao Li, Jeanne Paula Ihrwe and Keyuan Sun Hebei University of Technology, China Godwin Norens Osarumwense Asemota, "Influence of Electricity Connection on ICT Usage in Six East African Community Countries" *Journal of Asian and African Studies* 60(1) (2025): 460-478

¹⁷⁴ "The Tanzania National Artificial Intelligence Strategy Framework" (Draft Version 0.6, July 2025) Ministry of Communication and Information Technology <https://www.scribd.com/document/870487808/Draft-Tanzania-AI-Strategy-1747414062> accessed 12th August 2026

¹⁷⁵ "Strategy for the Responsible Use of Artificial Intelligence in Tanzania" (Draft Version One, April 2024) Ministry of Information, Communication and Information Technology <https://www.scribd.com/document/870487808/Draft-Tanzania-AI-Strategy-1747414062> accessed 12 August 2026.

¹⁷⁶ "Continental Artificial Intelligence Strategy" (July 2024) African Union <https://au.int/en/documents/20240809/continental-artificial-intelligence-strategy> Accessed 12 August 2026.

¹⁷⁷ Jonas Kgomo, "Towards an Abundance Frontier for Africa" *Equiano Institute* (2025) <https://www.equiano.institute/assets/Abundance.pdf>

Saharan African cities have been documented to lack the ability to satisfy the water demand for the rapidly growing urban population.¹⁷⁸ To meet the water demand in Tanzania, residents buy water from vendors, harvest rainwater and dig shallow wells.¹⁷⁹ Purchasing water from vendors imposes a significant burden on the households especially for residents in Lukobe Ward, Morogoro Municipality. Research by Noah Shumba, Opelo Tshekiso, Pengfei Li, Giulia Fanti and Shaolei Ren reveal that in Tanzania, writing a 10-page report using Llama-3-70B consumes about 0.3 litres of water and writing the same report with GPT-4 consumes close to 30 litres of water.¹⁸⁰

B1.3 Carbon Emissions

The geographical location of a data centre influences its carbon emission. Data centre facilities with easier access to hydro power have lower carbon footprint as compared to those data centres situated in areas that are dependent on coal, oil or natural gas.¹⁸¹ Traditional air-based systems of cooling in data centres consume about 40% of the electricity demand of the facilities. The increase in energy consumption in Tanzania between the years 2010 and 2014 was one of the factors that significantly drove the growth in carbon emission in the country.¹⁸² The hot climate in Africa means that the data centres will use up more energy in cooling the facilities thus leading to high carbon emissions, especially if fossil fuels are predominantly used in powering the facilities.¹⁸³ Whereas the global carbon emission by data centres is relatively low, the continuous and cumulative effect of carbon contribution may be concerning.¹⁸⁴ Many industries in Tanzania still rely on coal and natural gas¹⁸⁵ thus making it imperative to have sustainability measures before adding data centres to the conundrum.

As countries commit to net zero emissions through instruments such as the Paris Agreement, the digital infrastructure must follow energy efficiency goals and take adequate measures to protect the environment.¹⁸⁶ If no timely interventions are made, global emissions by data centres could increase significantly.¹⁸⁷

B1.4 Potential Health Impacts

Research on the data centres of Virginia in the United States indicates that data centres' reliance on diesel generators for backup could contribute to air pollution which may have both short-term health effects and

¹⁷⁸ Uhagile, F.S. Salehe, "Tap Water Scarcity and Alternative Water Sources Used at Household Level in Morogoro Municipality, Tanzania" *Tanzania Journal of Agricultural Sciences* 23(2) (2024): 288-300

¹⁷⁹ Ibid

¹⁸⁰ Noah Shumba, Opelo Tshekiso, Pengfei Li, Giulia Fanti, Shaolei Ren, "A Water Efficiency Dataset for African Data Centers" *Proceedings of the ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies* (2025): (pp. 453-460).

¹⁸¹ D. Bouley, "Estimating a Data Center's Electrical Carbon Footprint. Schneider Electric – Data Center Science Center," *Schneider electric white paper library* (2011): 14-22.

¹⁸² Yida Sun, Qi Hao, Can Cui, Yuli Shan, Weichen Zhao, Daoping Wang, Zhenke Zhang, and Dabo Guan, "Emission accounting and drivers in East African countries" *Applied Energy* 312, (15 April 2022): 118805.

¹⁸³ Ohaka Amarachi Mavisclara, Ibrahim Isiaka Oshobugie et al, "The AI-Driven Energy Surge: A Comprehensive Review of Sustainable Power Solutions for Data Centers" *Global Journal of Engineering and Technology Advances* (2025)

¹⁸⁴ Daniel Raphael Ejike Ewim, Nwakamma Ninduwezuor-Ehiobu, Ochuko Felix Orikpote, Blessed Afeyokalo Egbokhaebho, Akeeb Adepoju Fawole, Chiemela Onunka, "Impact of Data Centers on Climate Change: A Review of Energy Efficient Strategies" *The Journal of Engineering and Exact Sciences* 09(6) (2023)

¹⁸⁵ Elisha Bitesigirwe and Santos Kihwele, "Hybrid Solar - Coal Thermal Energy System for Industrial Process Heat at Sayona Drinks Limited in Tanzania" *(Tanzania Journal of Engineering and Technology (TJET))* 45(1) (2026): 91-103.

¹⁸⁶ Babar Tariq, "Sustainable Digital Infrastructure: Assessing the Energy Efficiency and Environmental Impact of Global Data Centers" *Journal of Sustainable Development Indicators* 1(4) (2025): 1-18. <https://hrcak.srce.hr/file/494938>

¹⁸⁷ Ohaka Amarachi Mavisclara, Ibrahim Isiaka Oshobugie et al, "The AI-Driven Energy Surge: A comprehensive review of sustainable power solutions for data centers" *Global Journal of Engineering and Technology Advances* 24 (03) (2025): 328-344.

long-term health effects.¹⁸⁸ The strain on local water supplies may also degrade the water quality increasing water scarcity and waterborne diseases.¹⁸⁹

The persistent noise resulting from the continuous cooling of data centre equipment and backup generators can cause sleep disturbance and impact mental health in the long-term.¹⁹⁰ Tanzania will not be immune to these challenges.

B1.5 Liquefied Natural Gas as an Alternative Cooling Source

Notably, air conditioning, as a form of cooling in data centres, has a massive impact on the average PUE of a data centre.¹⁹¹ Life cycle assessment reveals that the cooling technologies employed in data centres can consume up to 40% of the total energy demand.¹⁹² This translates to a very significant portion of the data centre energy usage. Reducing this percentage means effectively reducing the strain on the national grid. Using the cold energy from LNG as opposed to the traditional cooling methods of chillers and cooling towers could potentially lower electricity consumption and further reduce greenhouse gas emissions by more than 50%.¹⁹³

The use of LNG has been linked to significant advantages such as the reduction of fossil fuel usage hence enabling the long-term operation of data centres.¹⁹⁴ The cold air from LNG can be used for cooling the data centres thereby significantly reducing PUE from 2.00 to 1.36. Using LNG also reduces the CO₂ emitted from electricity consumption by data centres equipment thereby promoting sustainability and reducing environmental risks.

LNG demand is projected to reach approximately 600–650 million tonnes per annum by 2030. Maytungkorn Sermasuk, Yanin Sukjai and others in “Utilising Cold Energy from Liquefied Natural Gas (LNG) to Reduce the Electricity Cost of Data Centres” explain that LNG is produced by cooling natural gas to –162 °C under atmospheric pressure. It is colourless, odourless, non-toxic, and non-corrosive. Liquefying natural gas provides a cost-effective means of transporting it over long distances, particularly from gas-producing countries to importing countries across ocean routes exceeding 2,000 km. Upon arrival at the port, the LNG is transferred from the carrier into storage tanks before undergoing regasification. The regasification process can be carried out using different types of vaporisers, including open rack vaporisers, submerged combustion vaporisers, and intermediate fluid vaporisers. Open Rack Vaporisers account for approximately 90% of installed vaporisers. During regasification, LNG is converted from its liquid state at approximately –162 °C back into gaseous natural gas at around 25 °C. In Open Rack Vaporisers, approximately 250 kW of cold energy per tonne of LNG is transferred to seawater. They further explain that integrating an LNG receiving terminal with a data centre using an intermediate fluid vaporiser could provide approximately 29.82 MW of cold energy which could reduce the annual cooling costs by more than USD 9.87 million while also lowering carbon dioxide (CO₂) emissions by approximately 34,772 tonnes per year. The cold energy from LNG will

¹⁸⁸ Neha Gour, Luis Ortiz and Edward Maibach, “Health implications of the rapid rise of data centers in Virginia: an exploratory assessment” *Frontiers in Climate* (06 February 2026)

¹⁸⁹ Ibid

¹⁹⁰ Ibid

¹⁹¹ Maytungkorn Sermasuk, Yanin Sukjai and Others, “Utilising Cold Energy from Liquefied Natural Gas (LNG) to Reduce the Electricity Cost of Data Centres” *Energies* 14 (19) (2021): 6269.

¹⁹² Husam Alissa and Others, “Using Life Cycle Assessment to Drive Innovation for Sustainable Cool Clouds” *Nature*, 641 (8062) (2025): 331-338.

¹⁹³ Ibid

¹⁹⁴ Maytungkorn Sermasuk, Yanin Sukjai and Others, “Utilising Cold Energy from Liquefied Natural Gas (LNG) to Reduce the Electricity Cost of Data Centres” *Energies* 14 (19) (2021): 6269.

cool the data centre equipment hence effectively maximising on economic efficiency while also reducing CO₂ emissions.¹⁹⁵ LNG is also safer to use since so far there are no recorded cases of accidents or spills during transportation.¹⁹⁶

¹⁹⁵ Sandeep Yadav, Srinivas Seethamraju, Rangan Banerjee, “Cold Energy Recovery from Liquefied Natural Gas Regasification Process for Data Centre Cooling and Power Generation” *Energy* 283 (2023): 128481.

¹⁹⁶ Muhammad Haziq Noor Akashah and Others, “Utilization of Cold Energy from LNG Regasification Process: A Review of Current Trends” *Processes* (2023), 11, 517.

PART C

The Fiscal Treatment of Data Centres

C

Part C moves from the environmental ledger to the fiscal one. The question is no longer what data centres take from Tanzania in resources but what they contribute to it in revenue, and on what terms the state has chosen to tax or to exempt them.

C1 The Taxation of Data Centres in Tanzania

C1.1 The Drive for Data Centre Investment

The number of data centres in East and West Africa rose sharply from 9 in 2012 to 134 in 2022.¹⁹⁷ Estimates projected an additional 56 facilities to be launched by the end of 2026.¹⁹⁸ The development is largely led by investments from American, French and Chinese companies and from the African governments.¹⁹⁹ Lilian Rwegimbura in “Data and Artificial Intelligence Governance in Tanzania: Building a Responsible, Secure, and Inclusive Digital Future” calls for accelerated investment in Tanzania’s data centres.²⁰⁰ She implores Tanzania to encourage growth of data centres in the private sector through tax incentives and streamlined approvals.²⁰¹ Tanzanian ministries have also echoed the desire to attract foreign investment in the digital economy so as to position the country in the digital map. Tanzania’s ministry of Information, Communication and Information Technology recognise the role that data centres play in the ICT sector.²⁰² The country has been undertaking various measures to improve its digital initiatives and to this extent, they hope to enhance and promote usage of data centres.²⁰³ The country has therefore attracted investments in public data centres.²⁰⁴

The desire for investment is also driven by the need for advanced computing resources such as GPUs and by the imperative of upgrading power systems and connectivity towards sustainable energy.²⁰⁵ This has driven the country to champion investment in data centres so as to localise data storage, improve data security, process and host data for local entrepreneurs and innovators.²⁰⁶ The plan was to develop 4 tier three and 1 tier four data centres by June 2025 and to also enhance and optimise the existing government data centre.²⁰⁷ Efforts in data centre investment led to the establishment of 2 public data centres by the end of December 2023. As of December 2025, Tanzania had 3 Tier III public data centres.²⁰⁸ In an effort to foster further investment

¹⁹⁷ Adoni Conrad Quenum, “Data Centers in West & East Africa Surged Approximately 1400% Over 2012-2022 (report)” *Wearetech.africa* (29th April 2024) <https://www.wearetech.africa/en/fils-uk/news/telecom/data-centers-in-west-east-africa-surged-approximately-1400-over-2012-2022-report> Accessed 29th April 2026

¹⁹⁸ “Legal aspects of data centres in Africa”. Clyde & Co, (13th April 2026) <https://www.clydeco.com/en/insights/2026/april/legal-aspects-of-data-centres-in-africa> Accessed 29th April 2026

¹⁹⁹ Adoni Conrad Quenum, “Data Centers in West & East Africa Surged Approximately 1400% Over 2012-2022 (report)” *Wearetech.africa* (29th April 2024) <https://www.wearetech.africa/en/fils-uk/news/telecom/data-centers-in-west-east-africa-surged-approximately-1400-over-2012-2022-report> Accessed 29th April 2026

²⁰⁰ Lilian Julius Rwegimbura, “Data and Artificial Intelligence Governance in Tanzania: Building a Responsible, Secure, and Inclusive Digital Future” *Secure, and Inclusive Digital Future (June 15, 2026)* (2026). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=6943578 Accessed 11 August 2026.

²⁰¹ Ibid

²⁰² “Tanzania Digital Economy Strategic Framework 2024–2034 (United Republic of Tanzania 2024)” Ministry of Information, Communication and Information Technology, <https://www.tzabroad.com/wp-content/uploads/2024/03/MPANGO-MKAKATI-WA-UCHUMI-WA-KIDIJITALI-2024-2034.pdf> accessed 11 August 2026.

²⁰³ “Tanzania National Broadband Strategy (2021-2026)” Ministry of Information, Communication and Information Technology (September 2021)

²⁰⁴ “Strategy for the Responsible Use of Artificial Intelligence in Tanzania” (Draft Version One, April 2024) Ministry of Information, Communication and Information Technology, <https://www.scribd.com/document/870487808/Draft-Tanzania-AI-Strategy-1747414062> accessed 12 August 2026.

²⁰⁵ “The Tanzania National Artificial Intelligence Strategy Framework” (Draft Version 0.6, July 2025) Ministry of Communication and Information Technology

²⁰⁶ “Tanzania Digital Economy Strategic Framework 2024–2034 (United Republic of Tanzania 2024)” Ministry of Information, Communication and Information Technology <https://www.tzabroad.com/wp-content/uploads/2024/03/MPANGO-MKAKATI-WA-UCHUMI-WA-KIDIJITALI-2024-2034.pdf> accessed 11 August 2026.

²⁰⁷ Ibid

²⁰⁸ Lilian Julius Rwegimbura, “Data and Artificial Intelligence Governance in Tanzania: Building a Responsible, Secure, and Inclusive Digital Future” *Secure, and Inclusive Digital Future (June 15, 2026)* (2026).

in local public data centres, attract foreign companies for hyper-scale data centre construction and also to support market competition, the government set in their 2024 draft version of “Strategy for the Responsible Use of Artificial Intelligence in Tanzania” to come up with regulatory and licensing frameworks and also purposed to ensure conducive investment policies.²⁰⁹ In the same framework, the government vows to invest in Graphics Processing Unit (GPU) Clusters to encourage data centre development since the clusters are material when dealing with complex unstructured data like languages, images and audio data.²¹⁰

C1.2 The Income Tax Act

Under section 4 of Tanzania’s Income Tax Act²¹¹, every person or corporation with a domestic permanent establishment in Tanzania that is earning income to the country is liable to pay income tax. Section 2 defines a person to include, inter alia, an individual, a corporation or an entity.²¹² Both resident and nonresident corporations are taxed at 30% unless thirty percent or more of their equity ownership listed with the Dar es Salaam Stock Exchange is issued to the public, in which case they shall be taxed at a reduced corporate rate of twenty five percent for three consecutive years from the date of listing.²¹³ Income tax is only charged on the income sourced from the country and therefore does not extend to gains from foreign permanent establishments.²¹⁴ However, before the income tax is charged, a person may deduct losses from the current year of income and the previous year of income.²¹⁵ Losses accrued in running the business include debts and liabilities incurred in purchasing assets.²¹⁶

Apart from losses, other deductions include expenditure incurred in running the business and also costs occasioned in repair or maintenance of a depreciable asset owned by the person.²¹⁷ Depreciable assets include, among other things, computers and data handling equipment together with peripheral devices.²¹⁸ It is calculated according to the diminishing value method, using the following formula:

$$A \times B \times C / 365$$

Where—

(A) is the depreciation basis of the pool at the end of the year of income;

(B) is the depreciation rate applicable. The depreciation rates applicable is 37.5%.²¹⁹

(C) is the number of days in the person’s year of income.

The law allows a person to deduct costs incurred in the course of business but does not extend the deductions to expenses of a personal or domestic nature or expenditure of a capital nature (expenditure that secures a benefit lasting longer than twelve months).²²⁰ According to the second schedule under paragraph 1, the

²⁰⁹ “Strategy for the Responsible Use of Artificial Intelligence in Tanzania” (Draft Version One, April 2024) Ministry of Information, Communication and Information Technology <https://www.scribd.com/document/870487808/Draft-Tanzania-AI-Strategy-1747414062> accessed 12 August 2026.

²¹⁰ Ibid

²¹¹ Income Tax Act, CAP 332

²¹² Section 2 of the Income Tax Act, CAP 332

²¹³ First Schedule Paragraph 3 Income Tax Act

²¹⁴ Section 6 and 19 of the Income Tax Act, CAP 332

²¹⁵ Section 19 of the Income Tax Act, CAP 332

²¹⁶ Section 18 Income Tax Act, CAP 332

²¹⁷ Section 14(1) and section 17 Income Tax Act, CAP 332

²¹⁸ Third Schedule paragraph 1(1) under Class 1 Income Tax Act, 2004

²¹⁹ Paragraph 3 Third Schedule Income Tax Act, 2004

²²⁰ Section 11 of the Income Tax Act CAP 332

following are exempt from income tax; government income from activities related to the functions of the government; income from business activities within the Export Processing Zone, and Special Economic Zone during initial period of ten years; and income derived from investments exempted under any written laws operational in Tanzania Zanzibar.²²¹ The Tanzanian government has a tier III data centres that offers its hosting and colocation services to the public meaning that all income from the data centre is exempt from income tax.²²² Additionally, the minister may exempt an income from taxation as specified in a gazette.²²³

C1.3 The Value Added Tax Act

Tanzania imposes a Value Added Tax (VAT) on all taxable supplies and imports²²⁴ at the rate of 18%²²⁵ unless such goods have been exempted under section 6 of the Act. This is the standard rate for most East African countries like Burundi, Rwanda and Uganda. However, the challenges in VAT collection and administration calls for reforms and digitalisation.²²⁶

In 2020 and 2021, the country granted VAT exemptions under various gazette notices in line with section 6(2) of Tanzania's VAT Act for various hardware and software materials that were imported and locally purchased by the Tanzania Petroleum Development Corporation (TPDC) and through contractors "for the project of supply, installation, configuration, testing and commissioning of Network Devices for Data Centre and for other Government Department".²²⁷ This included things such as power supply cables, network modules, flash memory, storage cards and defence software just to mention but a few. Based on government notices so far, this is the only clear case of the government extending a tax relief to data centre. Section 6(2) allows VAT exemption by the Minister responsible for finance where a government entity imports or purchases goods or services to be used solely for implementation of a project funded by the Government.²²⁸ TPDC is established as a public corporation by the Tanzania Petroleum Development Corporation (Establishment) Order²²⁹ meaning that it is a government entity and therefore exempt from VAT on the imported data centre equipment as documented in the gazette.

C1.4 The Excise (Management and Tariff) Act

Tanzania's Excise (Management and Tariff) Act²³⁰ aims to regulate the manufacture, importation, and supply of specific commodities such as wine²³¹, spirits, soft drinks, petroleum products, old motor vehicles²³², used vehicle spare parts, natural gas, etc. The Act is mostly geared towards controlling harmful behaviour, protecting local industries, and preventing the dumping of substandard goods in the country.²³³ As far as the Act is concerned, no notable item in relation to data centres has been exempted from excise duty under the Act.²³⁴

²²¹ Second Schedule Paragraph 1(1) (b), (o) and (p) Income Tax Act, 2004

²²² From <https://nidc.co.tz/>

²²³ Section 10 Income Tax Act, CAP 332

²²⁴ Section 3 of Tanzania's Value Added Tax Act (Chapter 148)

²²⁵ Section 5(1) of Tanzania's Value Added Tax Act (Chapter 148)

²²⁶ Heriel Emanuel Nguvava, "Value Added Tax Administration and Economic Development: Evidence From Tanzania" *Malete Journal of Accounting and Finance* 7(1) (June 2026) :22-30

²²⁷ Government Notice No. 870 of 2020 and Government Notice No. 8 of 2021 <https://tanzlii.org/en/akn/tz/act/gn/2021/8/eng@2021-01-01>

²²⁸ Section 6(2)(b) of Tanzania's Value Added Tax (Cap 148)

²²⁹ Tanzania Petroleum Development Corporation (Establishment) Order, 1969 - Government Notice 140 of 1969

²³⁰ CAP 147

²³¹ Section 55(1) Excise (Management and Tariff) Act

²³² Section 124 Excise (Management and Tariff) Act

²³³ Heriel E. Nguvava and Lyafufiye Anyambilile, "Influence of Excise Duty on Tax Revenue Collection in Tanzania" *International Journal of Economics, Business and Management Research* 08(12):154-164

C1.5 The Stamp Duty Act

The Stamp Duty Act makes provisions for the charging of stamp duty on all instruments (documents which purport to create, transfer, limit, extend or extinguish rights or liabilities²³⁵) except those exempted under section 16.²³⁶ The Act grants the Minister responsible for finance power to exempt items from payment of stamp duty by notice in a government gazette.²³⁷ So far there has been no such notice granting stamp duty exemption to a data centre.

C1.6 The East African Community Common External Tariff

Notably, high tariffs on the importation of ICT equipment may limit potential technological growth thus impeding data centre progress but optimised import taxes may boost tax revenue due to increased taxable activities.²³⁸ Under EAC CET 2020 chapter 84, automatic data processing machines including storage units, machines comprising at least one CPU, machines for processing data, monitors and projectors designed for use with an automatic data processing machine etc. attract an import duty of 0% across the East Africa Community.²³⁹ Automatic data processing machines refer to machines that can perform arithmetic computation and those that can store or execute the processing program.²⁴⁰ They however do not include things such as microphones, printers, speakers, copying machines, television cameras, monitors, projectors, apparatus for transmitting or receiving voice, images or other data etc when presented separately.²⁴¹

C1.7 Investment Incentives and Strategic Projects

Section 10(3) of the Income Tax Act allows for income tax exemptions following agreements for strategic projects. The 2026 Finance Act expands this section to include agreements for strategic investments and special strategic investment approved by the National Investment Development Committee and the Cabinet under the Tanzania Investment and Special Economic Zones Act.²⁴² According to the 2023 amendment to the Public Private Partnership Act, any ministry, government department or agency, local government authority, public or statutory corporation can determine what constitutes a strategic project.²⁴³ What this provision means is that should a data centre be declared as a strategic project by the cabinet, then it would benefit from income tax exemption. Alternatively, should the government declare a data centre investment as a strategic investment or a special strategic investment, it will be granted additional benefits in accordance with the relevant laws.²⁴⁴

C1.8 Taxes in Free Zones

Currently, Tanzania does not have any data centre located within a special economic zone.²⁴⁵

²³⁴ Excise (Management and Tariff) Act, Section 135A and 136

²³⁵ Stamp Duty Act, Section 2

²³⁶ Stamp Duty Act, Section 5(1)

²³⁷ Stamp Duty Act, section 16(1)

²³⁸ Grayson Kisinga, Severine Kessy and Mashaka Mkandawile, "Impact of ICT Adoption, Economic Growth, and Internet Connectivity Phases on Tax Revenue in Tanzania" *Business Management Review* 28.1 (2025): 1-22.

²³⁹ East African Community Common External Tariff (Version 2022), HS 8471.49.00 (0%)

²⁴⁰ Chapter 84(6)(A) East African Community Common External Tariff (Version 2022)

²⁴¹ Chapter 84(6)(D) East African Community Common External Tariff (Version 2022)

²⁴² Finance Act of 2026, section 21

²⁴³ Public Private Partnership (Amendment) Act, 2023; Act 4 of 2023

²⁴⁴ Investment and Special Economic Zones Act, 2025, Section 21(2)

²⁴⁵ Data Centres in Tanzania (Data Center Map) <https://www.datacentermap.com/>

C1.9 The Export Processing Zones Act (Repealed)

The Act established export processing zones²⁴⁶ with the aim of promoting investment for export led industrialisation.²⁴⁷ It granted tax benefits such as remission of customs duty, exemption from payment of withholding tax on rent, dividends and interest for the first ten years, exemption from payment of taxes and levies for a period of ten years, exemption from value added tax on utility and wharfage charges etc.²⁴⁸

C1.10 The Special Economic Zones Act 2006 (Repealed)

Just like the Export Processing Zones Act, the Special Economic Zones Act granted tax incentives such as exemption from payment of stamp duty, VAT on utility charges, taxes and duties for goods of capital nature.²⁴⁹ It also exempted payment of corporate tax, property tax, and withholding tax on rent, dividends and interest for an initial period of ten years.²⁵⁰ It also granted remission of customs duty, VAT and other taxes.²⁵¹ Tax and duty exemptions under the Act were subject to the provisions of the relevant tax laws.²⁵²

C1.11 The Investment and Special Economic Zones Act 2025

The Investment and Special Economic Zones Act, 2025 (ISEZA) repealed the Tanzania Investment Act, the Export Processing Zones Act, and the Special Economic Zones Act of 2006 effectively combining them into one legislation.²⁵³ Many of the tax benefits outlined in the SEZ Act and TIA persisted under section 19 and 21 of ISEZA respectively. The Act guarantees tax incentives for investors within the SEZ with licences.²⁵⁴ These include benefits such as exemption from customs duty, value added tax, corporate income tax, withholding tax, port charges etc.²⁵⁵ The Act also exempts VAT on water, electricity, and on construction materials and construction services.²⁵⁶ This means that if a data centre were to be located in a special economic zone in Tanzania, it would benefit from both construction and operational cost deductions. Just like the SEZ Act, ISEZA also subjects tax incentives to compliance with the terms and procedures set out in the laws governing those attractions.²⁵⁷ Notably, the tax incentives given under ISEZA mirror that which were given under SEZ Act. Furthermore, section 25 of the Act treats special areas for production for export as special processing zones, meaning that such areas also gain from the benefits given to SEZs. In Africa, while SEZs have moderately benefited countries like Kenya and Ethiopia, the spillover effects to the local industries have been limited²⁵⁸ thus highlighting the need for tax benefits to be linked to verifiable economic outcomes as opposed to being offered unconditionally.²⁵⁹

²⁴⁶ Section 3 of the Export Processing Zones Act CAP 373

²⁴⁷ Section 4 (a) of the Export Processing Zones Act CAP 373

²⁴⁸ Section 21(1) of the Export Processing Zones Act CAP 373

²⁴⁹ Section 38, 39 and 40(c) Special Economic Zones Act, 2006

²⁵⁰ Ibid

²⁵¹ Section 38(e) and 39(a) Special Economic Zones Act, 2006

²⁵² Section 41 Special Economic Zones Act, 2006

²⁵³ Section 51(1) Investment and Special Economic Zones Act, 2025 (Act No. 6 of 2025)

²⁵⁴ Section 19(2) Investment and Special Economic Zones Act, 2025 (Act No. 6 of 2025)

²⁵⁵ Section 19(2) (a-l) Investment and Special Economic Zones Act, 2025 (Act No. 6 of 2025)

²⁵⁶ Section 19(2) (i) and (l) Investment and Special Economic Zones Act, 2025 (Act No. 6 of 2025)

²⁵⁷ Section 19(4) Investment and Special Economic Zones Act, 2025 (Act No. 6 of 2025)

²⁵⁸ Appiah-Kubi, Maitah, K., and Others, "Impact of Tax Incentives on Foreign Direct Investment: Evidence from Africa" *Sustainability* 13(15) (2021): 8661.

²⁵⁹ Justice Iddrisu Lambon & Evans O. N. D. Ocansey, "The Effects of Tax Waivers, Concessionary Tax Rates, Tax Holidays, Tax Exemptions, and Free Zone Industries on Economic Growth" *International Journal of Economics and Financial Issues* 16(4) (2026): 1-12.

C1.12 The Prior Question of Taxable Presence

The preceding sections describe how Tanzania taxes a data centre. They do not answer the prior question of whom Tanzania is taxing. A data centre is a building filled with equipment, and the income associated with it divides into at least three streams which fall to be treated differently. There is the rental or colocation fee that the owner of the facility earns from letting rack space and power. There is the operating income of the enterprise that owns the servers within the racks. There is the revenue that a non-resident cloud, content or platform provider earns from customers whose traffic is stored, processed or delivered through that equipment. Only the first of these is securely within the Tanzanian base under the regimes examined above.

Whether the second and the third fall within it is a nexus question. Under Article 5 of both the OECD and the United Nations Model Conventions a permanent establishment is a fixed place of business through which the business of an enterprise is wholly or partly carried on, and it is accepted in the commentary that computer equipment at a given location may constitute a permanent establishment of the enterprise that operates it where the equipment is at that enterprise's disposal, while a website hosted on that equipment, having no tangible presence, does not.²⁶⁰ Where an enterprise merely leases rack space from a colocation provider and maintains no personnel at the site, the analysis turns on whether the equipment is at its disposal and on whether the functions performed there are preparatory or auxiliary. The practical consequence is that a non-resident provider may derive substantial revenue from Tanzanian users while maintaining that the Tanzanian facility performs only storage or delivery functions of an auxiliary character.

Tanzanian domestic law works with the concept of a domestic permanent establishment and taxes a non-resident person on income having a source in the country.²⁶¹ Whether the presence of servers at a Dar es Salaam colocation facility gives rise to such an establishment has not, so far as this report has been able to establish, been tested before the Tax Revenue Appeals Board or the Tax Revenue Appeals Tribunal, and no published ruling of the Commissioner General addresses it. The point is therefore open in a jurisdiction that is actively soliciting the facilities which raise it. The significance of that omission for the argument of this report is direct. Part C shows a state granting reliefs in order to attract facilities. If those facilities generate principally rental income in domestic or foreign hands while the larger value that passes through them is booked offshore, then Tanzania is forgoing revenue on the small base in order to host infrastructure whose large base it cannot reach. Read alongside the ownership pattern at section B1, the position is that the country supplies the land, the grid, the water and the fiscal concession, and receives in return a tax base composed largely of rent. That is the colonial trade pattern described at section E1.4, expressed in the language of corporate income tax rather than of commodity export. The first step towards closing the gap is administrative rather than legislative, since the Commissioner General may issue a public ruling setting out the circumstances in which server capacity at a Tanzanian facility gives rise to a domestic permanent establishment, and the question should be settled before further incentives are granted rather than after.

²⁶⁰ OECD Model Tax Convention on Income and on Capital, Article 5 and the Commentary on Article 5 dealing with electronic commerce; United Nations Model Double Taxation Convention between Developed and Developing Countries, Article 5 and Commentary.

²⁶¹ Income Tax Act, Cap 332, sections 2, 6 and 19.

PART D

The Legal and Regulatory Framework

D

Tanzania has no data centre statute and no data centre regulator. What it has is a set of general regimes, each of them designed for something else, into which a data centre may or may not fall according to how it is structured and how it is classified.

D1 The Regulatory Framework Applicable to Data Centres in Tanzania

In 2016, the Ministry of Works, Transport and Communication acknowledged that the country lacked appropriate frameworks for deployment and utilization of ICT infrastructures such as data centres.²⁶² Having realistic governance frameworks that account for the infrastructural hurdles such as electricity inefficiency is of importance.²⁶³

This Part surveys the law that governs a data centre in Tanzania. It does not restate material already given. The statutory definitions of the data centre are at section A1.1, the policy instruments that express the state's ambitions for the sector are at section 8.1 and section 9.1, and the fiscal statutes are at sections 9.2 to 9.11. The Part is organised by regulatory function rather than by instrument, following a facility through its lifecycle and asking at each stage what must be obtained, what must be disclosed, and which authority holds the mandate. The organising question is not what Tanzanian law says about data centres, which is very little, but what a data centre must do in order to exist lawfully in Tanzania and what the state learns about the facility in the course of its doing so.

The conclusion may be stated in advance. Tanzania has no data centre statute and no data centre regulator. What it has is a set of general regimes, each of them designed for something else, into which a data centre may or may not fall according to how it is structured and how it is classified. That is not the same as an absence of regulation. It is a condition in which regulatory obligation attaches by accident of classification rather than by design, and in which the state acquires no consolidated picture of the sector because no authority is charged with holding one.

D1.1 The Regulatory Perimeter: Licensing under the Electronic and Postal Communications Act

The Electronic and Postal Communications Act 2010 establishes the converged licensing framework administered by the Tanzania Communications Regulatory Authority, under which four categories of licence are available, being network facilities, network services, application services and content services.²⁶⁴ The framework is technology neutral and service neutral by design, which is a virtue when the question is how to accommodate new services on existing networks and a difficulty when the question is how to capture a new kind of building.

The difficulty is concrete. The network facilities category is the one into which a data centre would most naturally fall, since it covers physical infrastructure provided in connection with the delivery of application and content services. Yet facilities established for the purpose of self support, or for sharing with other providers in order to provide application services, are exempted from the requirement to hold that licence.²⁶⁵ An enterprise facility operated by a bank for its own systems is therefore outside the net, and a carrier neutral

²⁶² Ministry of Works, Transport and Communication, "National Information and Communications Technology Policy 2016" (May 2016) <https://www.ega.go.tz/uploads/publications/sw-1574848612-SERA%202016.pdf> accessed 12 August 2026.

²⁶³ Lilian Julius Rwegimbura, "Data and Artificial Intelligence Governance in Tanzania: Building a Responsible, Secure, and Inclusive Digital Future" (SSRN, 15 June 2026) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=6943578 Accessed 11 August 2026.

²⁶⁴ Electronic and Postal Communications Act, 2010 (Act No. 3 of 2010), sections 11 to 14; Tanzania Communications Regulatory Authority Act, 2003 (Act No. 12 of 2003).

²⁶⁵ Tanzania Communications (Licensing) Regulations, 2005, Schedule. Under the network facilities licence category, facilities established for the purpose of self support, or for sharing with other providers in order to provide application services, are exempted from the licence requirement.

colocation facility whose tenants are themselves licensed application service providers may also be outside it, depending on how the arrangement is characterised. The obligations imposed by regulation 10 of the amended access and co-location regulations, discussed at section A1.1, bind those who offer data centre services to the public under a licence. They do not create a licence for those who do not already hold one.

The result is that the definition examined in Part A performs an identifying function without performing an authorising one. Tanzanian law can say with some precision what a data centre is. It cannot say, from any register kept by any authority, how many data centres it has authorised, on what terms, or with what obligations attached. This is the evidentiary foundation for the pattern named at section E1.1.

One further provision deserves attention because it connects the licensing perimeter to the ownership pattern at section B1. Section 26 of the Act requires the holder of a network facilities or network services licence to maintain a minimum public shareholding of twenty five per cent of its issued and paid up share capital, obtained through a public offer under the capital markets legislation, as a continuing obligation throughout the life of the licence.²⁶⁶ That is a local ownership rule of real fiscal consequence, since it converts a share of the returns on communications infrastructure into a domestically held asset. Whether it binds a foreign owned carrier neutral data centre depends entirely on whether the facility is licensed as a network facility, which returns the analysis to the exemption described above. A rule designed to localise the ownership of communications infrastructure may thus be avoided, without any evasive intent, simply by classifying a facility as something other than a network facility.

D1.2 Land, Siting and Planning

All land in Tanzania is public land vested in the President as trustee, and a non-citizen may hold land for investment purposes through a derived right of occupancy obtained through the investment authority rather than by direct grant.²⁶⁷ Development consent and building permission are matters for the urban planning authority of the locality under the Urban Planning Act 2007 and the by-laws made under it.²⁶⁸

This is the stage at which a community learns that a data centre is to be built near it, and it is therefore the stage at which consent, in any meaningful sense, is either sought or bypassed. The planning process, however, assesses buildings. It asks about footprint, height, access, setback and use class. It does not ask how much electricity the building will draw from the grid that serves the neighbourhood, or how much water it will take from a supply that residents already supplement by purchase from vendors, as section B1.2 records. A planning authority asked to approve what is, in land use terms, a windowless warehouse is not asked the questions that would make the decision a decision about resources at all. The siting choices that will determine the cumulative load on the Dar es Salaam grid are accordingly being taken by authorities that do not hold, and are not required to seek, the information that would make those choices legible.

The routing of foreign investors through the investment authority compounds the difficulty, since that authority's statutory purpose is the promotion and facilitation of investment rather than its restraint, and the incentives described at section C1.7 are administered by the same body that grants access to the land. Promotion and scrutiny are lodged in one institution, which is a familiar arrangement in African investment law and a persistent source of the sequencing problem identified at section E1.2.

²⁶⁶ Electronic and Postal Communications Act, 2010, section 26, read with the Capital Markets and Securities Act, Cap 79.

²⁶⁷ Land Act, Cap 113; Village Land Act, Cap 114.

²⁶⁸ Urban Planning Act, 2007 (Act No. 8 of 2007).

D1.3 Environmental Authorisation

The Environmental Management Act 2004 requires an environmental impact assessment for projects of the kinds listed in the Third Schedule to the Act, elaborated in the First Schedule to the Environmental Impact Assessment and Audit Regulations 2005 as subsequently amended.²⁶⁹ Projects in the mandatory category require a full assessment; borderline projects are screened by reference to the criteria in the Second Schedule and may be required to produce an abridged assessment; projects in the residual category submit a project brief. The National Environment Management Council screens and reviews, the Minister issues the certificate, and a sectoral licensing authority may not issue its licence until the certificate has been granted.

Data centres are not named as a project category in the schedules. Entry into the assessment regime therefore depends upon screening, and upon whether the project is characterised by reference to something other than its function, such as the area of its built footprint, the capacity of its standby generation or the volume of its fuel storage. A facility screened into the residual category will proceed on a project brief. The consequence is that the two resource questions which Part B identifies as central to the environmental significance of these buildings, being their draw on the electricity grid and their withdrawal of water, are not questions that the environmental regime is presently framed to ask of this class of facility, because the facility is not in the schedule that would trigger the asking.

Two further observations follow. The first concerns cumulative effect. Assessment under the Regulations is project specific, and there is no requirement that the assessment of an eleventh facility in a city take account of the ten that precede it. The second concerns the end of life. The Act contains provisions on safe decommissioning and site rehabilitation, and the components catalogued in section A2 have service lives measured in a small number of years, so that a data centre is a continuous generator of electronic waste rather than a single act of construction.²⁷⁰ The minerals argument developed in Part A ends at the point of import. It should be extended to the point of disposal, since the same materials that are extracted from African ground and imported as finished equipment will, on present arrangements, be discarded within Tanzania without any specific regulatory provision addressed to the volumes involved.

It is worth noting, because it bears on the feasibility of recommendation (d), that adding data centres above a stated capacity to the schedules would be an exercise of the Minister's existing power to make regulations under the Act. It requires no primary legislation and no parliamentary time.

D1.4 Electricity

The Electricity Act 2008 makes generation, transmission, distribution and supply licensable activities, subject to exemptions, and confers the licensing and tariff functions on the Energy and Water Utilities Regulatory Authority.²⁷¹ A data centre, however large, is in the ordinary case a consumer, and consumers are not licensed. Its standby diesel generation is self supply and will normally fall within an exemption. The practical result is that some of the largest single private diesel installations in a Tanzanian city may be operating without any licence,

²⁶⁹ Environmental Management Act, 2004 (Act No. 20 of 2004), Third Schedule; Environmental Management (Environmental Impact Assessment and Audit) Regulations, 2005, Government Notice No. 349 of 2005, First and Second Schedules, as amended by Government Notice No. 474 of 2018 and subsequently in 2024.

²⁷⁰ Environmental Management Act, 2004, provisions on safe decommissioning and site rehabilitation, read with section 3 of this report on the service life of data centre components.

²⁷¹ Electricity Act, 2008 (Act No. 10 of 2008), sections 17 and 18; Energy and Water Utilities Regulatory Authority Act, Cap 414.

and therefore without any regulatory record of their capacity, their fuel consumption or their running hours, which are precisely the quantities that would be required to assess the emissions discussed at section B1.3.

The Act also constrains the ambition, recorded at section 8.1, that data centre operators should partner with independent power producers in order to secure green energy. Direct supply from a generator to a private consumer is a licensable activity, and the small power projects rules made under the Act are addressed to projects selling into the distribution network rather than to corporate offtakers taking supply directly.²⁷² Whether a data centre may contract directly with an independent producer, or wheel power across the national network under an open access arrangement, is not clearly answered by the Act, the rules or the published practice of the regulator. The absence of a corporate power purchase agreement framework is therefore a legal constraint on the green data centre policy, not a technical one, and it is a constraint that the state has the means to remove.

Nothing in the framework requires a large consumer to report its consumption publicly. The distribution licensee holds metered data as a commercial matter between supplier and customer. This is significant for the design of recommendation (b), because it shows that the disclosure sought there can be achieved through the licence conditions of the distribution licensee and through the reporting duties that the regulator already imposes, without the enactment of new primary legislation.

D1.5 Water

The Water Resources Management Act 2009 subjects specified uses of water to a water use permit, makes use in excess of a permit an offence, provides for conditions implied in every permit, and empowers a basin water board to suspend or vary permits where the source is over-committed.²⁷³ Utility supply to premises is governed separately under the Water Supply and Sanitation Act 2009 and regulated by the energy and water regulator.²⁷⁴

The permit regime is the one instrument in Tanzanian law that already possesses the architecture which Part B calls for. It measures, it prices, it attaches conditions, and it can be curtailed when a resource is under stress. What it lacks is application to this class of user. A facility that takes municipal supply requires no abstraction permit, so its consumption is invisible to the basin board charged with managing the resource from which the municipal supply is ultimately drawn, and a facility that sinks its own borehole falls within a regime whose enforcement capacity in an expanding city is thin. The Act further provides for a Water Register, which is a standing public instrument capable of carrying facility level disclosure without any new administrative machinery being created.²⁷⁵

There is a fiscal dimension here that the environmental framing tends to obscure. An abstraction permit carries a water use fee; a municipal connection carries a tariff. Neither is calibrated to a continuously operating industrial user in a water stressed coastal city, and neither is published in a form that would allow the public to know what the user pays or takes. Where a resource is scarce and its price is set without reference to the scarcity, the difference is a subsidy, and it is a subsidy that does not appear in any tax expenditure account because it is not administered as a tax.

²⁷² Electricity (Development of Small Power Projects) Rules, 2019; Electricity (Standardized Small Power Projects Tariff) Order, 2019.

²⁷³ Water Resources Management Act, 2009 (Act No. 11 of 2009), Part VII, sections 43 to 48.

²⁷⁴ Water Supply and Sanitation Act, 2009 (Act No. 12 of 2009).

²⁷⁵ Water Resources Management Act, 2009, section 82.

D1.6 Data Protection, Cybersecurity and Localisation

The Personal Data Protection Act 2022 came into force on 1 May 2023, established the Personal Data Protection Commission, requires the registration of data collectors and data processors, and regulates the transfer of personal data outside the country.²⁷⁶ The Cybercrimes Act 2015 and the Electronic Transactions Act 2015 complete the picture.²⁷⁷ The report has not identified any statutory scheme designating data centres as critical national infrastructure with resilience or continuity obligations attached, which is a notable absence given that a single metropolitan concentration hosts almost the whole of the national colocation capacity.

A colocation provider will in most configurations be a data processor and must therefore register with the Commission. It follows that the register maintained under the data protection legislation is, in practice, closer to a register of the entities operating data centres in Tanzania than anything held by the communications regulator, although it is organised by legal person rather than by facility and is not designed to answer questions about physical infrastructure. That an accidental by-product of privacy regulation is the state's best available list of data centre operators is a fair measure of how the sector is governed.

The restriction on transfers abroad has a consequence that is fiscal rather than privacy related, and the report treats it as central. A localisation requirement manufactures domestic demand for hosting capacity. It creates a captive market by law. A state that guarantees demand occupies a materially stronger bargaining position than one that competes for the same investment by offering tax relief, because it has something to withhold. Read against Part C, Tanzania is doing both at once, creating the demand through regulation and then paying for the supply through exemption. The position advanced here is that where the state guarantees the market it should not also guarantee the exemption, and that localisation should be treated as consideration given, to be set against the reliefs sought.

D1.7 Institutional Mandates and the Spaces Between Them

The survey above identifies eight authorities with some purchase on a data centre. The communications regulator licenses, but only where the facility is classified as a licensee. The environment council and the responsible Minister assess, but only where the project is screened into the regime. The energy and water regulator licenses electricity undertakings and regulates water utilities, but its mandate is addressed to suppliers rather than to consumers. A basin water board permits abstraction, but only where water is abstracted rather than purchased. The urban planning authority approves buildings. The investment and special economic zones authority promotes and grants concessions. The data protection commission registers processors. The revenue authority assesses tax. Each holds a fragment of the facility defined by its own subject matter, and no instrument requires the fragments to be assembled.

The gap is therefore precise and can be stated in a sentence. No authority in Tanzania bears a statutory duty to know, at facility level, what a data centre consumes. This is the evidentiary basis for the pattern named at section E1.3, and it refines that pattern in an important way. Opacity in this sector is not principally a matter of operators withholding information. It is a property of institutional design, in which information is not so much refused as never required, and it will not be cured by exhortation to transparency because there is no obligation for an operator to breach.

²⁷⁶ Personal Data Protection Act, 2022 (Act No. 11 of 2022), brought into force on 1 May 2023 by Government Notice No. 326 of 2023. The Act establishes the Personal Data Protection Commission and requires the registration of data collectors and data processors.

²⁷⁷ Cybercrimes Act, 2015 (Act No. 14 of 2015); Electronic Transactions Act, 2015 (Act No. 13 of 2015).

The sharpest illustration lies in the interaction between two provisions already examined. The Investment and Special Economic Zones Act 2025 exempts qualifying investors from value added tax on water and electricity and on construction materials and services.²⁷⁸ No authority measures the water and electricity so exempted. The state has therefore fixed the price of a quantity it does not know, and it has done so in favour of a class of consumer whose defining characteristic is that it consumes those two things continuously and at scale. The reliefs may still be justified. They cannot presently be evaluated, and a relief that cannot be evaluated cannot be defended on the evidence.

D1.8 The Regulatory Sandbox

The draft artificial intelligence strategies discussed at section B1.1 and section C1.1 contemplate the development of regulatory and licensing frameworks for the sector, and the proposal for a regulatory sandbox has been raised in that context. The report has not identified any published sandbox framework applicable to data centres, and the proposal accordingly exists in draft policy rather than in law.

The instrument nonetheless merits scrutiny before it is adopted, because its logic does not fit the problem. A sandbox suspends or relaxes defined rules for a defined cohort of participants for a defined period, under close supervision, so that the regulator may observe what happens and calibrate the rules accordingly. It presupposes two things. It presupposes that rules exist which are worth suspending, and it presupposes that the regulator can measure the outcomes of their suspension. Neither condition holds here. Where there is no data centre rule to relax, a sandbox is not a relaxation of regulation but a substitute for it, and where no authority can measure electricity or water at facility level the regulator will learn nothing from the experiment it is conducting.

The proper sequence is the reverse of the one proposed. Measurement should come first, rules second, and controlled relaxation third. A sandbox adopted at the present stage would formalise the very pattern that section E1.2 identifies, in which facilitation is put in place before safeguards, and it would do so under the reassuring vocabulary of experimentation.

D1.9 The Continental and Comparative Frame

The African Union Convention on Cyber Security and Personal Data Protection, adopted at Malabo in 2014, entered into force on 8 June 2023 upon the deposit of the fifteenth instrument of ratification, and remains the only binding regional treaty on data protection outside Europe. Tanzania is neither a party to it nor a signatory of it.²⁷⁹ The AU Data Policy Framework of 2022 and the Continental Artificial Intelligence Strategy cited at section B1.1 are policy instruments rather than legal ones, and they impose no obligation.²⁸⁰ The state that hosts the facilities is therefore bound by no continental instrument addressed to the data they contain, still less to the resources they consume.

Comparison with neighbouring jurisdictions does not disturb this picture so much as generalise it. Kenya operates a data protection statute of 2019 and a substantially larger colocation market, and South Africa has produced the community objections to the Cape Town development described at section A5.4.²⁸¹ The report

²⁷⁸ Investment and Special Economic Zones Act, 2025 (Act No. 6 of 2025), section 19(2)(i) and (l), discussed at section 9.11 above.

²⁷⁹ African Union Convention on Cyber Security and Personal Data Protection, adopted at Malabo on 27 June 2014, entered into force 8 June 2023 following the deposit of the fifteenth instrument of ratification. See African Union, 'List of Countries which have Signed, Ratified/ Acceded to the African Union Convention on Cyber Security and Personal Data Protection' https://au.int/sites/default/files/treaties/29560-sl-AFRICAN_UNION_CONVENTION_ON_CYBER_SECURITY_AND_PERSONAL_DATA_PROTECTION_0.pdf accessed 23 August 2026. The United Republic of Tanzania appears neither among the ratifying states nor among the signatories.

²⁸⁰ African Union, AU Data Policy Framework (2022).

²⁸¹ Data Protection Act, 2019 (Kenya), Act No. 24 of 2019.

has not identified a dedicated data centre statute in Kenya, Nigeria, South Africa or Morocco. The absence in Tanzania is thus regional rather than particular, and the space that national and continental law has left vacant is occupied instead by the Uptime Institute tier classifications and the CENELEC definitions examined in Part A, which are privately or externally authored and which no African state has had a hand in drafting. That is the finding on which the argument at section E1.5 rests, and it is worth stating plainly that a continental framework would not merely harmonise national rules but would give African states an authorship they presently lack.

D1.10 What the Survey Shows

Four findings emerge from this Part and carry forward into Part E. The first is definition without authorisation, in that the state has defined the data centre with precision while creating no licence, register or authorisation addressed to it as such. The second is regulation by accident of classification, in that every regime capable of applying is a general regime, and entry into each depends on how a particular facility happens to be characterised rather than on what it does. The third is the absence of any measurement mandate anywhere in the system, which leaves the state unable to quantify the consumption it is already subsidising. The fourth is the granting of exemption before quantity is known, which converts a fiscal choice into a wager.

A fifth observation is more encouraging and should be recorded, since a report that describes only absence invites the reply that reform is impracticable. Much of what the recommendations below require can be built from instruments that already exist. Facility level disclosure of electricity use can be attached to the conditions of the distribution licence. Disclosure of water use can be carried on the Water Register created by the 2009 Act. Environmental assessment can be extended to this class of facility by amendment of a schedule within the Minister's existing regulation making power. The registration duties under the data protection legislation already generate a list of operators. What is missing is not statutory machinery. It is the decision to point the machinery that exists at an object the state has so far declined to see.

PART E

Patterns and Recommendations

E

The Tanzanian case is specific, yet the habits of governance it reveals are not. Five patterns recur across the material assembled in this report, and each carries a lesson for fiscal and regulatory design.

E1 Patterns of Technology Governance

The Tanzanian case is specific, yet the habits of governance it reveals are not. Five patterns recur across the material assembled in this report, and each carries a lesson for fiscal and regulatory design.

E1.1 Definition without Regulation

Tanzanian law defines the data centre with some precision, in the Telecommunications Corporation Act and in the regulations made under the Electronic and Postal Communications Act, yet definition has not matured into regulation. The state knows what a data centre is but has not decided what a data centre owes. The gap between naming an object and governing it is the first and most basic pattern this report records.

E1.2 Incentives before Safeguards

The fiscal architecture examined in Part C grants reliefs from income tax and value added tax, together with customs concessions, before any framework exists to measure what the facilities consume or to evaluate what the reliefs cost. Tanzania is not unusual in this respect. Across the continent, investment promotion has run ahead of impact assessment, and the sequencing is not accidental. It reflects a political economy in which states compete for capital they cannot fully see.

E1.3 Opacity as Method

Secrecy around resource consumption is not an oversight but a business practice. In Dorchester County in the United States, litigation was required before the water consumption of a Google facility entered the public record. In South Africa, community objections to the Equinix development in Cape Town turned on the absence of disclosed information about electricity demand. Nothing in Tanzanian law currently compels a data centre operator to disclose its electricity or water use, which means the pattern of opacity will reproduce itself unless disclosure is mandated.

E1.4 Extraction beneath the Cloud

Fiscal sociology teaches that a tax system expresses the social relations beneath it, and the data centre economy rests on an extractive relation of long standing. The minerals catalogued in Part A, from cobalt and copper to the rare earth elements, are drawn substantially from African ground and processed elsewhere, before returning to the continent embodied in equipment that enters duty free under the Common External Tariff. The continent supplies the material base of the digital economy while importing its finished infrastructure, and the fiscal settlement mirrors that asymmetry. This is the colonial trade pattern in contemporary dress.

E1.5 Standard Taking rather than Standard Setting

The technical standards that define and organise data centres are written in Brussels and in Washington rather than in Dodoma or Addis Ababa. Tanzania receives the CENELEC definitions and the Uptime Institute tiers as settled facts. A state that takes its standards from elsewhere will also take its regulatory imagination from elsewhere, and the African Union has yet to fill that space with a continental framework of its own.

E2 Conclusion and Recommendations

E2.1 Conclusion

Five findings anchor this report. First, the data centre is a material institution whose demands on electricity and water, and on the minerals from which it is built, are measurable and rising, in Tanzania as elsewhere. Second, Tanzania hosts eleven listed facilities, ten of them in Dar es Salaam and nine of them operated by entities without a Tanzanian parent, and not one of them publishes the electricity or water it uses. Third, the fiscal regime rewards data centre investment through exemptions and concessions whose cost has never been published, including exemptions from value added tax on the very electricity and water that no authority measures. Fourth, the legal framework consists of general regimes into which a data centre falls by accident of classification, so that no authority holds a statutory duty to know what these facilities consume. Fifth, the prior question of whether a non-resident enterprise operating through a Tanzanian facility is taxable in Tanzania at all remains unsettled, which means the state is granting reliefs against a base it has not defined.

From these findings follow seven recommendations, framed to be specific, measurable, achievable, relevant and time bound.

E2.2 Recommendations

- a** The Ministry responsible for information, communication and information technology should, jointly with the Tanzania Communications Regulatory Authority, prepare a consolidated regulatory framework for data centres. A draft should be published for comment within eighteen months of this report and adopted within thirty months.
- b** Parliament should require every data centre with an installed electrical capacity above one megawatt to disclose annually, in a public register, its electricity consumption, its water consumption, its power usage effectiveness and its generator running hours. The reporting obligation should take effect within twelve months of enactment.
- c** All fiscal incentives granted to data centre investors should be made conditional and time limited. New incentives should carry a sunset clause of no more than ten years. The Tanzania Revenue Authority should review each incentive every three years against its stated objectives, and the Government should publish an annual tax expenditure statement for the sector from the financial year 2027/28.

- d** No data centre with an installed capacity above five megawatts should be licensed without an environmental and social impact assessment that includes a public hearing in the host community. The National Environment Management Council should issue regulations to this effect within twelve months.
- e** The Government should institute an efficiency audit of all public sector data centres every four years, modelled on section 1003 of the United States Energy Act of 2020, with the first audit completed by the end of the financial year 2027/28.
- f** The research gaps identified in this report should be closed on a stated timetable. The carbon estimates at sections 6.3 and 8.3 rest on international ratios rather than on Tanzanian measurement and should be recalculated once facility level data becomes available under recommendation (b). The mapping at section B1 should be repeated within twenty-four months so that growth in the sector can be tracked against a fixed baseline, and it should be extended to the enterprise and government facilities that a commercial directory does not record.
- g** The Commissioner General of the Tanzania Revenue Authority should publish, within twelve months, a ruling setting out the circumstances in which server capacity located at a Tanzanian data centre gives rise to a domestic permanent establishment of a non-resident enterprise, and the Ministry responsible for finance should review the treaty network against the nexus positions advanced in the negotiation of the United Nations Framework Convention on International Tax Cooperation. No further incentive should be granted to a data centre investor until that question has been settled.

SPOTLIGHT

Tanzania stands early in its data centre build out, which is precisely why the moment matters. Rules adopted now will cost little and shape much. Rules deferred until the sector matures will be written against the resistance of established interests. The choice between the two is the real subject of this report.

Grounding the Cloud

The Material, Environmental and Fiscal Governance of Data Centres in Tanzania



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