Environmental Committee

Topic A:

Mitigating the Environmental Effects of Data Centres and Large Language AI Models

I. Introduction

Data centres are large and centralized facilities that house organizations' computing resources and IT infrastructure, such as servers, storage systems, and networking equipment. These facilities typically operate continuously to manage and process digital information. With recent technological advancements and the rapid expansion of large language models, organizations' reliance on data centres, particularly for AI model training, has increased.

This growth is accompanied by substantial energy consumption, significant water used for cooling, and, as a result, higher levels of carbon emissions. According to the International Energy Agency (IEA), global data centres already account for approximately 1–2% of worldwide electricity consumption, and this share is expected to rise as AI and cloud workloads expand. The high energy demand often relies on fossil fuels, resulting in greenhouse gas emissions, which contribute to climate change.

Certain countries with advanced technological infrastructure, such as the United States of America, Japan, and Singapore, operate large-scale data centres and are actively exploring energy efficiency measures, renewable energy integration, and innovative cooling technologies. Meanwhile, developing nations such as Brazil, Mexico, and South Africa, which host growing tech hubs, are increasingly dependent on foreign investment in data centres, creating challenges for enforcing environmental standards and ensuring sustainable growth.

The environmental impacts of data centres extend beyond emissions. Improper management of cooling systems and power infrastructure can strain local water resources and contribute to heat pollution. As awareness of these impacts grows, governments, international organizations, and leading technology companies are implementing policies, corporate strategies, and sustainability frameworks to reduce the carbon footprint of AI and data infrastructure, in line with global initiatives such as the Paris Agreement and the UN Sustainable Development Goals (SDGs).

II. Definition of Key Terms

Data Centre: A physical or virtual infrastructure used to house computer systems and associated components, such as storage systems and telecommunications.

Virtual Data Centre (VDC): a cloud-based infrastructure that pools and virtualizes IT resources like servers, storage, and networking, delivering them as a unified service to a single tenant.

Large Language Models (LLMs): Artificial intelligence systems trained on vast datasets to understand and generate human-like text or perform complex natural language tasks.

Carbon Footprint: The total greenhouse gas emissions caused directly or indirectly by an activity, measured in units such as CO_2 equivalents.

Renewable Energy Integration: The practice of using energy from sources like solar, wind, or hydro to power data centres, reducing reliance on fossil fuels.

Energy Efficiency: Measures taken to reduce the amount of energy required to perform computing operations without sacrificing performance.

III. Background Information

Modern data centres are extremely energy-intensive, with global IT infrastructure accounting for approximately 1–2% of worldwide electricity consumption. The energy used comes from a mix of fossil fuels, renewables, and nuclear power. Data centres have a large carbon footprint because powering servers and cooling systems often relies heavily on fossil fuel energy. This results in significant greenhouse gas emissions, and as global demand for AI models continues to grow, their associated carbon footprint will increase.

Recent advances in cooling technologies, server optimization, and renewable energy sourcing are being increasingly explored to mitigate these environmental effects, thereby promoting both renewable energy integration and improved energy efficiency. Furthermore, as public awareness of the environmental impacts of AI and data management grows, leading businesses are developing policies and corporate strategies to reduce their carbon emissions and environmental footprint.

Key environmental and energy impacts of data centres include

- **Global electricity consumption** by data centres corresponds roughly to **1–1.3%** of global final electricity demand.
- In **2024**, global data centre **electricity consumption** was estimated at **1.5%** of global electricity consumption.
- Data centres and associated data transmission networks accounted for approximately **330 million tonnes** of **CO_2** equivalent in 2020, representing around **0.9%** of energy-related greenhouse gas emissions.
- In a study of over 2,100 data centres in the United States (2023–2024), the sector was found to consume more than **4%** of total U.S. electricity; **56%** of that electricity was generated from fossil fuels, leading to over **105 million tonnes** CO_2 and representing **2.18%** of U.S. total emissions in 2023.
- Many data centres use significant volumes of water for cooling: a one-megawatt data centre can consume up to **25.5 million litres of water** per year just for cooling, this is comparable to the daily water needs of roughly 300,000 people. The rapidly increasing

demand triggered by AI and cloud services is projected to further raise electricity demand to nearly **3%** of projected global electricity demand by 2030.

IV. Relevant UN Treaties

The **Paris Agreement (2015):** mandates reducing GHG emissions, implying that managing and operating such infrastructure must be done in an emissions-conscious way, ideally shifting toward **low-carbon** energy sources. This emphasis encourages countries to transition to sustainable energy sources, which directly applies to data centre operations.

The **UN Sustainable Development Goals (SDGs)**, particularly Goal 7 and Goal 13, provide a framework for integrating sustainability in the technology sector. These SDGs mandate that states and companies ensure energy is sustainable and climate-smart, which can be directly applied to modern data centres.

UN initiatives such as the **Climate Neutral Data Centre Pact** (CNDCP) set voluntary targets for energy efficiency and carbon neutrality in IT infrastructure. The CNDCP provides concrete, sector-specific commitments and metrics that directly apply to data centres and, by extension, to AI model infrastructure.

V. Major countries/Groups Involved

Canada: Multiple hyperscale cloud providers and major AI research initiatives, with a strong focus on green IT policy and sustainability.

Brazil: Largest cloud and AI infrastructure in Latin America.

Chile: Has emerging AI projects and invested in data centres, including energy-efficient designs.

Costa Rica: Attracting green data centre investment; emphasis on renewable energy-powered digital infrastructure.

Singapore: Key data centre hub in Southeast Asia. Leader in energy-efficient operations and AI adoption.

Japan: Advanced AI R&D and large-scale data centre operations; strong focus on technological sustainability.

Republic of Korea (South Korea): Rapid AI adoption; major hyperscale data centre projects; energy efficiency a priority.

South Africa: Leading African country in regional data centre capacity; hosts AI research initiatives.

Nigeria: Growing tech sector and cloud adoption; some MNC investment in regional data centres.

Egypt: North African hub for data centres and cloud infrastructure; supports AI development.

Jordan: Emerging regional AI and data centre projects; government promotes digital infrastructure.

VI. Possible Solutions

1. *Establish regulations for IT hardware used in Data centres:*

    a. cooling mechanisms
    b. Regulations to enforce carbon neutrality
    c. Regulations to enforce reduced fossil-fuel consumption

2. *Call for the partial use of renewable energy sources when updating and building new data centres:*
    a. energy sources such as solar, wind, and hydro
    b. aiming to reduce dependence on fossil fuels

3. *Collaborate among member states to optimize server utilization and invest in research to upgrade to energy-efficient hardware*
    a. Propose R&D groups/scientist sub-bodies that research and work towards energy efficiency
    b. Invest in reforestation
    c. Invest in renewable-energy projects

4. *Establish guidelines for where data centres can be built*
    a. avoiding forests
    b. water-scarce regions
    c. environmentally sensitive areas
    d. Protect against the destruction or disruption of ecosystems

5. *Call for governments to implement policy frameworks established here to independently:*
    a. enforce energy-efficiency standards within own borders
    b. offer tax incentives to firms actively succeeding in reducing carbon emissions and environmental impacts
    c. require mandatory environmental-impact reporting for transparency and research
    d. impose financial penalties on organizations that fail to comply or to work toward a greener future.

VII. Bibliography

Liu, Ruoxi, et al. *Environmental Burden of United States Data Centers in the Artificial Intelligence Era*. 2024, arXiv:2411.09786. arXiv, https://arxiv.org/abs/2411.09786

Kiersz, Andy. *"Ranked: The Top 25 Countries with the Most Data Centers."* **Visual Capitalist**, 11 Mar. 2024, www.visualcapitalist.com/ranked-the-top-25-countries-with-the-most-data-centers/