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THE ENVIRONMENTAL COST OF CLOUD STORAGE: THE HIDDEN CARBON FOOTPRINT OF OUR DIGITAL LIVES

Ms. Vennam Lakshmi Srinija, Ms. H.Sharanya, Ms. Habeeba, Ms. Rohitha

Students, BS-MS Computer Science, Vishwa Vishwani Institutes of Systems And Management
Thumukunta, Telangana, India | Email: lakshmisrinijavennam@gmal.com, hebbatamsharanya@gmail.com, habeeba3197@gmail.com, rrohitha606@gmail.com
Mobile: +91 9963691097, +91 7901252455, +91 8519970405, +91 9182822417

Abstract

Cloud storage has become an essential part of modern digital life, supporting online communication, social media, business operations, and numerous digital services. However, the increasing demand for digital storage and processing places greater demands on data-centre infrastructure, which requires electricity and resources to maintain its operations. This article examines the environmental impact of cloud storage, focusing on electricity consumption, carbon emissions, water use, and sustainable data-centre management. It adopts a descriptive research approach based on secondary sources, including research papers on energy-efficient cloud computing, data-centre environmental footprints, renewable energy integration, and carbon-neutral infrastructure. The reviewed literature highlights the importance of improving energy efficiency, integrating renewable energy sources, optimizing computing workloads, and managing cooling systems effectively. It also demonstrates that the environmental impact of data centres varies according to factors such as electricity sources, infrastructure efficiency, and geographical location. Based on these insights, the article discusses practical measures that cloud service providers and organizations can adopt to reduce the environmental footprint of digital storage. It also highlights the role of responsible digital data management in supporting more sustainable computing practices. The article emphasizes that reducing the environmental cost of cloud storage requires a combination of technological innovation, efficient resource utilization, and collective responsibility.

Keywords: Cloud Storage, Cloud Computing, Data Centres, Carbon Emissions, Energy Efficiency

1. Introduction

Cloud storage has become an essential part of modern digital life. It enables individuals, businesses, and organizations to store, access, manage, and share data over the internet without relying entirely on physical storage devices. Activities such as uploading photographs, sending emails, using social media, backing up files, and accessing online applications depend on digital infrastructure. As the volume of digital information continues to grow, cloud storage services have become increasingly important for storing and managing data efficiently.

Despite its convenience, flexibility, and scalability, cloud storage has environmental impacts that are often overlooked. Cloud services rely on data centres containing servers, storage systems, networking equipment, and cooling infrastructure. These facilities consume electricity to store, process, and transfer information. When this electricity is generated using fossil fuels, it can contribute to greenhouse gas emissions and climate change. Data centres may also require water for cooling and other operational activities. The environmental impact of cloud storage therefore depends on several factors, including the source of electricity, energy efficiency, cooling methods, geographical location, and utilization of computing resources.

The International Energy Agency (IEA, 2025), in its report *Energy and AI*, estimates that data centres consumed approximately 415 terawatt-hours (TWh) of electricity in 2024, representing around 1.5% of global electricity consumption. The report projects that data-centre electricity consumption could reach approximately 945 TWh by 2030, driven mainly by the expansion of artificial intelligence and other digital services. Although these figures represent data centres as a whole rather than cloud storage alone, they highlight the growing importance of managing the energy requirements of digital infrastructure.

Previous research has examined the environmental footprint of data centres and the importance of energy-efficient cloud computing. Researchers have explored approaches such as efficient resource allocation, workload optimization, server utilization, improved cooling systems, and renewable energy integration. These approaches can help reduce energy consumption and associated environmental impacts while maintaining the performance and reliability of cloud services. However, achieving more sustainable digital infrastructure requires attention not only to technological improvements but also to how digital resources are managed and used.

Against this background, the present study examines the environmental cost of cloud storage through a review of existing research and credible secondary sources. It focuses on electricity consumption, carbon emissions, water use, energy-efficient computing techniques, and

renewable energy adoption. The study also considers practical measures that cloud service providers, organizations, and individual users can adopt to encourage responsible digital storage practices. By examining these issues together, the study aims to improve awareness of the environmental consequences associated with digital storage and highlight approaches that can contribute to more sustainable cloud computing.

2. Review of Literature

Previous studies have examined the environmental impact of data centres, energy consumption in cloud computing, renewable energy integration, and techniques for improving the sustainability of digital infrastructure. These studies provide a foundation for understanding the environmental cost associated with cloud storage. The following review discusses important research contributions related to energy efficiency, carbon emissions, renewable energy, and sustainable data-centre management.

2.1 Energy Efficiency in Cloud Computing

Katal et al. (2023) reviewed software-based technologies for improving energy efficiency in cloud computing data centres. Their study discussed approaches related to software-level power management and energy-efficient container technologies. The research highlights the importance of managing computing resources efficiently to reduce unnecessary energy consumption. These approaches are relevant to sustainable cloud services because better resource management can help improve energy efficiency while supporting computing workloads.

Bharany et al. (2022) conducted a systematic mapping study of energy-efficient techniques in sustainable cloud computing. The researchers selected and reviewed 119 primary studies and classified techniques such as virtualization, virtual-machine consolidation, power-aware methods, and thermal management. Their review provides an overview of approaches investigated to reduce energy consumption and environmental impacts in cloud data centres. These findings support the importance of efficient resource utilization and energy-aware management in developing more sustainable cloud services.

Buyya et al. (2024) proposed an integrated approach to improving energy efficiency and sustainability in cloud computing. Their study emphasized that managing servers, networking equipment, cooling systems, and computing workloads together can be more effective than optimizing individual components separately. The authors discussed approaches such as dynamic resource provisioning, workload scheduling, and learning-based management

techniques to reduce energy consumption while maintaining quality of service. Their research highlights the importance of coordinated data-centre management in reducing the energy requirements and carbon footprint of cloud computing.

2.2 Environmental Footprint of Data Centres

Siddik et al. (2021) examined the environmental footprint of data centres in the United States, focusing on electricity consumption, greenhouse gas emissions, and water use. Their study estimated that data centres accounted for approximately 1.8% of US electricity consumption and around 0.5% of total US greenhouse gas emissions. The researchers also found that datacentre water use and electricity-related impacts vary by geographical location, with some facilities and their associated power supplies linked to water-stressed regions. The study highlights the importance of considering energy consumption, carbon emissions, and water availability together when assessing data-centre sustainability. However, its estimates relate to US data centres overall and should not be interpreted as measurements of cloud storage alone.

Shehabi et al. (2024) examined electricity consumption in U.S. data centres using historical estimates and future demand scenarios. Their report estimated that data centres consumed 176 terawatt-hours (TWh) of electricity in 2023, accounting for approximately 4.4% of total U.S. electricity consumption. The authors also projected that annual electricity use could reach between 325 and 580 TWh by 2028, depending on future computing demand and infrastructure efficiency. The report highlights the importance of improving the energy efficiency of servers, storage equipment, and cooling systems. These findings demonstrate the growing energy requirements of digital infrastructure. However, the estimates are specific to U.S. data centres as a whole and should not be interpreted as figures for cloud storage alone (Shehabi et al., 2024).

2.3 Renewable Energy and Carbon-Neutral Data Centres

Deng et al. (2014) reviewed approaches for integrating renewable energy sources, such as solar and wind power, into cloud data centres. Their study examined renewable-energy forecasting, infrastructure capacity planning, workload scheduling within data centres, and load balancing across geographically distributed facilities. A major challenge is that renewable energy generation can vary with weather and other environmental conditions, making it difficult to match electricity supply with computing demand. The study highlights the importance of coordinating renewable-energy availability with data-centre operations to reduce electricity costs and carbon emissions. These approaches are relevant to sustainable cloud storage because

storage services depend on the wider infrastructure that supports cloud computing (Deng et al., 2014).

Cao et al. (2022) conducted a systematic review of technological and policy approaches for reducing carbon emissions from data centres. Their study identified three important technological directions: increasing the use of renewable energy, improving energy efficiency, and enhancing energy recovery and reuse. The authors also examined carbon-market mechanisms and the carbon-neutrality commitments of major cloud providers. Their review indicates that reducing data-centre emissions requires coordinated action involving infrastructure improvements, cleaner energy sources, and suitable policy measures. These approaches are relevant to cloud storage because its environmental impact depends partly on how the supporting data-centre infrastructure is powered and managed (Cao et al., 2022).

2.4 Global Data-Centre Energy Demand and Sustainability

The International Energy Agency (IEA, 2025), in its report *Energy and AI*, examined the relationship between digital technologies and electricity demand. The report estimated that data centres consumed approximately 415 TWh of electricity worldwide in 2024, accounting for around 1.5% of global electricity consumption. It projected that data-centre electricity consumption could reach approximately 945 TWh by 2030, driven mainly by artificial intelligence and the growth of other digital services. The report also discussed renewable energy, electricity-grid constraints, and energy efficiency. These findings provide global context for understanding the growing energy requirements of digital infrastructure. However, the report's figures cover data centres as a whole and do not measure the electricity consumption of cloud storage separately.

2.5 Summary of the Literature

The reviewed studies identify several factors that influence the environmental sustainability of cloud computing and data centres. Katal et al. (2023), Bharany et al. (2022), and Buyya et al. (2024) discuss approaches to improving energy efficiency through software optimization, resource management, and workload coordination. Siddik et al. (2021) and Shehabi et al. (2024) examine the environmental footprint and energy requirements of data centres, while Deng et al. (2014) and Cao et al. (2022) address renewable energy integration and strategies for reducing carbon emissions. The International Energy Agency (2025) provides a broader perspective on global data-centre electricity demand.

Taken together, these studies show that environmental sustainability involves electricity consumption, carbon emissions, water use, energy efficiency, and the choice of energy sources. However, the studies differ in their geographical scope and research focus, and many reported estimates relate to data centres as a whole rather than cloud storage alone. This review therefore brings together these perspectives to examine the environmental challenges associated with cloud storage and identify practical measures for service providers, organizations, and individual users.

3. Research Gap

Previous research has examined energy efficiency in cloud computing, the environmental footprint of data centres, renewable energy integration, and strategies for reducing carbon emissions. These studies provide useful insights into improving the sustainability of digital infrastructure, but they often focus on particular technologies, environmental indicators, or geographical regions.

A key challenge is understanding how these different environmental factors relate to cloud storage specifically. Data-centre electricity and water consumption estimates generally cover several activities, including cloud computing, artificial intelligence, and other digital services. Therefore, such estimates cannot be directly treated as measurements of the environmental impact of cloud storage alone. There is a need to examine electricity consumption, carbon emissions, water use, energy efficiency, and renewable energy together while recognizing this limitation.

To address this gap, the present study reviews existing research and institutional reports to bring these perspectives together. It also considers practical sustainability measures for cloud service providers, organizations, and individual users. Since the study is based on secondary sources, it provides a descriptive synthesis of existing evidence rather than a direct measurement of cloud storage's carbon footprint.

4. Research Objectives

The main objectives of this study are:

1. To understand the role of cloud storage and data centres in supporting modern digital activities.
2. To examine the environmental impacts associated with data-centre electricity consumption, carbon emissions, and water use.

3. To review energy-efficient cloud computing techniques and renewable energy strategies that can help reduce environmental impacts.
4. To identify sustainable practices that cloud service providers and organizations can adopt to improve energy efficiency and resource utilization.
5. To suggest practical measures that individuals can follow to encourage responsible digital storage practices and support environmental sustainability.

5. Research Methodology

This study adopts a descriptive research approach based on secondary data. It examines existing research papers, academic journals, and credible institutional reports related to cloud computing, data-centre energy consumption, environmental impacts, and sustainable computing practices.

The information is collected from published studies on energy-efficient cloud computing, the environmental footprint of data centres, renewable energy integration, and carbon-neutral datacentre strategies. Reports such as the International Energy Agency's *Energy and AI* (2025) and the *2024 United States Data Center Energy Usage Report* are used to understand electricity consumption trends and sustainability challenges.

The collected information is reviewed thematically under the following areas: electricity consumption, carbon emissions, water use, energy-efficient technologies, renewable energy adoption, and sustainable digital storage practices. The findings from the selected sources are compared to identify common themes, environmental challenges, and potential solutions. Greater attention is given to studies and institutional reports that provide relevant evidence on electricity consumption, carbon emissions, water use, energy efficiency, and renewable energy. Since the sources differ in geographical scope and research focus, their findings are interpreted within their stated limitations rather than treated as directly comparable measurements.

This study does not involve primary data collection, surveys, or experimental testing. Its conclusions are based on the available secondary sources. The geographical scope and limitations of individual reports are considered while interpreting their findings, and datacentre-wide estimates are not treated as measurements of cloud storage alone.

6. Conceptual Background

6.1 Cloud Storage and Data Centres

Cloud storage is a technology that enables users to store and access digital information through the internet. Instead of storing all files on personal devices, users can save documents, photographs, videos, and other information on remote servers managed by cloud service providers. These services depend on data centres, which contain servers, storage devices, networking equipment, and supporting infrastructure. Data centres provide the physical foundation for storing and accessing digital information.

6.2 Electricity Consumption

Data centres require electricity to operate servers, storage systems, networking equipment, and cooling systems. As digital information and online services increase, managing electricity consumption becomes an important sustainability challenge. The amount of energy required depends on factors such as equipment efficiency, workload, infrastructure design, cooling requirements, and resource utilization. Efficient management of computing resources can help reduce unnecessary electricity consumption.

6.3 Carbon Emissions

Carbon emissions are an important environmental concern associated with digital infrastructure. The electricity used by data centres can lead to greenhouse gas emissions, depending on the sources used to generate that electricity. Facilities that rely more heavily on fossil fuels may have higher electricity-related emissions than facilities supplied by lowercarbon energy sources. The overall carbon footprint of digital infrastructure may also include other sources of emissions, depending on the boundaries of the assessment. Therefore, improving energy efficiency and increasing the use of renewable electricity can help reduce the emissions associated with cloud services.

6.4 Water Consumption

Water use is an important environmental consideration in data-centre operations. Some data centres use water in their cooling systems to manage the heat generated by computing equipment, while water may also be used indirectly in electricity generation. The amount of water required depends on factors such as cooling technology, local climate, facility design, and operating practices. It is also important to distinguish between water withdrawal, which refers to water taken from a source, and water consumption, which refers to water not returned

to the same source in the short term. Therefore, assessing the environmental impact of digital infrastructure requires consideration of both electricity use and water-related impacts.

6.5 Energy Efficiency and Sustainable Cloud Computing

Energy efficiency means delivering computing services while using less energy for a comparable level of performance. In cloud computing, approaches such as workload optimization, efficient resource allocation, appropriate server utilization, virtual machine consolidation, and improved cooling management can help reduce unnecessary energy use. However, the actual energy savings depend on how these techniques are implemented and on the characteristics of the workload and infrastructure. Their effectiveness should therefore be assessed alongside service reliability, performance, and resource requirements.

6.6 Renewable Energy Integration

Renewable energy sources, including solar and wind power, can help reduce reliance on fossilfuel-based electricity in data-centre operations. However, their environmental benefits depend on factors such as the availability and timing of electricity generation, grid conditions, energy storage, and the facility's overall energy demand. Because solar and wind generation can vary with weather conditions, coordinating renewable energy supply with data-centre operations can be challenging. Combining renewable energy adoption with efficient infrastructure management can support lower-carbon and more sustainable cloud services.

6.7 Responsible Digital Storage Practices

Organizations and individual users can support responsible digital storage by reviewing their storage needs, managing backups, removing unnecessary duplicate files, and applying suitable data-retention policies. These practices can improve data organization and may help reduce avoidable storage requirements. However, deleting files does not automatically lead to an immediate or measurable reduction in data-centre energy consumption, because the effect depends on how cloud providers manage storage systems and infrastructure. Therefore, responsible digital storage should complement, rather than replace, improvements in datacentre energy efficiency and resource management.

7. Analysis and Discussion

7.1 Growing Electricity Demand in Digital Infrastructure

Electricity demand is a major factor in assessing the environmental impact of cloud storage. Cloud storage services depend on data centres that operate servers, storage devices, networking

equipment, and cooling systems. The electricity required by this infrastructure varies according to workload, facility design, equipment efficiency, and operating conditions. The International Energy Agency (2025) estimated that data centres worldwide consumed approximately 415 terawatt-hours (TWh) of electricity in 2024, representing around 1.5% of global electricity consumption. Although this estimate covers data centres as a whole rather than cloud storage alone, it highlights the growing energy requirements of digital infrastructure. Therefore, improving resource utilization and energy efficiency is important for supporting more sustainable cloud services.

7.2 Carbon Emissions Associated with Cloud Storage

Carbon emissions associated with cloud storage depend largely on the electricity required to operate the supporting data-centre infrastructure and the sources used to generate that electricity. When electricity is generated from fossil fuels, its use can contribute to greenhouse gas emissions. In contrast, electricity supplied by lower-carbon sources can reduce the emissions associated with data-centre operations. Siddik et al. (2021) estimated that data centres accounted for approximately 0.5% of total U.S. greenhouse gas emissions, highlighting the importance of reducing the emissions associated with data-centre operations. However, the total emissions of data centres should not be treated as the carbon footprint of cloud storage alone, because these facilities support various digital services. Therefore, assessing cloud storage sustainability requires a clear understanding of electricity sources, operational efficiency, and the boundaries used to calculate emissions.

7.3 Water Consumption and Cooling Requirements

Water consumption is another important consideration when evaluating the environmental impact of data centres. Some facilities use water-based cooling systems to remove heat generated by servers and storage equipment, while additional water may be used indirectly during electricity generation. The level of water use depends on factors such as cooling technology, local climate, facility design, and operational practices. Siddik et al. (2021) examined the environmental footprint of data centres in the United States and highlighted the importance of considering water use alongside electricity consumption and greenhouse gas emissions. However, their findings relate to data centres overall and do not measure the water footprint of cloud storage separately. Therefore, sustainable data-centre management should consider both energy efficiency and responsible water use, particularly in regions facing water scarcity.

7.4 Role of Energy-Efficient Cloud Computing

Energy efficiency is an important strategy for reducing the environmental impact of data-centre operations. Techniques such as efficient workload scheduling, server utilization, virtual machine consolidation, and improved cooling management can help reduce unnecessary electricity consumption. Katal et al. (2023) reviewed software-based approaches to improving energy efficiency in cloud computing data centres, while Bharany et al. (2022) examined techniques including virtualization, virtual machine consolidation, power-aware methods, and thermal management. These studies highlight the importance of efficient resource management in sustainable cloud computing. However, the actual benefits depend on the workload, infrastructure, and implementation of these techniques. Therefore, data-centre operators should evaluate energy savings alongside service performance and reliability.

7.5 Renewable Energy and Sustainable Infrastructure

Renewable energy can help reduce the carbon emissions associated with electricity used by data centres. Solar and wind power are important alternatives to fossil-fuel-based electricity, but their availability can vary with weather conditions and time of day. Deng et al. (2014) examined the opportunities and challenges of integrating renewable energy into cloud data centres, including renewable-energy forecasting, workload scheduling, and coordination between facilities. Cao et al. (2022) also reviewed technological and policy approaches to reducing data-centre carbon emissions, including renewable energy adoption and energyefficiency improvements. These studies suggest that cleaner electricity sources should be combined with effective infrastructure management to support more sustainable cloud services.

However, the environmental benefits depend on how renewable energy is supplied and used.

7.6 Responsible Digital Storage Practices

Responsible digital storage practices can help organizations and individuals manage their data more effectively. Reviewing storage requirements, removing unnecessary duplicate files, managing backups, and applying appropriate data-retention policies can improve data organization and help avoid unnecessary storage needs. However, deleting files does not necessarily produce an immediate or measurable reduction in electricity consumption, because the effect depends on how cloud providers manage their storage infrastructure. Organizations should therefore combine responsible data management with efficient cloud resource allocation

and sustainable infrastructure practices. Cloud users can also consider the storage capacity they require and the retention period of their data when selecting and managing cloud services.

7.7 Overall Discussion

The discussion shows that the environmental impact of cloud storage is connected to several aspects of data-centre operations, including electricity consumption, carbon emissions, water use, energy efficiency, and renewable energy adoption. The reviewed studies and institutional reports provide evidence of the growing resource requirements of digital infrastructure and identify approaches that may improve its sustainability. However, most available estimates relate to data centres as a whole rather than cloud storage specifically. Consequently, the findings should be interpreted as evidence about the wider infrastructure supporting cloud services, not as a direct measurement of cloud storage's individual environmental footprint. Overall, improving data-centre efficiency, using lower-carbon electricity, managing water responsibly, and adopting appropriate data-management practices can contribute to more sustainable digital infrastructure.

8. Major Findings

1. **Growing electricity requirements:** Data centres require substantial electricity to support digital services. The International Energy Agency (IEA, 2025) estimated global data-centre electricity consumption at approximately 415 TWh in 2024 and projected that it could reach 945 TWh by 2030.
2. **Environmental impact of electricity generation:** The carbon emissions associated with data-centre operations depend partly on the sources used to generate electricity. Lower-carbon electricity can help reduce electricity-related emissions.
3. **Importance of water management:** Data-centre cooling may require water, and electricity generation can also involve indirect water use. Both direct and indirect water impacts should be considered when assessing sustainability.
4. **Benefits of energy-efficient technologies:** Software optimization, efficient resource allocation, server management, and improved cooling can help reduce unnecessary energy consumption.

5. **Role of renewable energy:** Solar, wind, and other lower-carbon electricity sources can support more sustainable digital infrastructure. Their effectiveness depends on availability, grid conditions, and operational requirements.
6. **Need for coordinated sustainability measures:** Cloud providers, organizations, and individual users all have roles in promoting sustainability. Responsible storage practices should complement infrastructure-level improvements.
7. **Importance of accurate environmental assessment:** Data-centre statistics cover multiple activities, including cloud computing, artificial intelligence, and other digital services. These figures should not be interpreted as the environmental impact of cloud storage alone.

9. Suggestions and Recommendations

Based on the reviewed literature and the major findings, the following recommendations are suggested to reduce the environmental impact associated with cloud storage and digital infrastructure.

9.1 Improve Energy Efficiency

Cloud service providers should improve the energy efficiency of their data centres through suitable server technologies, efficient workload scheduling, and better resource utilization. Virtual machine consolidation and power-aware resource management can help reduce unnecessary energy use when implemented appropriately. Providers should also monitor energy performance and maintain service reliability while introducing efficiency improvements. The effectiveness of these measures should be evaluated according to the facility's workload, infrastructure, and operating conditions.

9.2 Increase the Use of Renewable Energy

Cloud service providers should increase the use of renewable electricity, including solar and wind power, wherever feasible. They should evaluate the carbon intensity of their electricity supply and consider renewable energy availability when planning data-centre operations. Suitable energy storage, grid coordination, and efficient workload management can help address variations in renewable electricity generation. Providers should also report their renewable energy progress transparently so that organizations can make better-informed decisions when selecting cloud services.

9.3 Adopt Efficient Cooling and Water Management

Data-centre operators should select cooling technologies based on local climate, water availability, facility design, and energy requirements. Regular monitoring of water use and cooling performance can help identify opportunities to improve efficiency. In regions experiencing water scarcity, operators should give particular attention to the local environmental effects of water withdrawal and consumption. They should also assess the tradeoffs between water use and electricity consumption when choosing cooling methods, rather than evaluating either factor in isolation. These measures can support more responsible management of data-centre resources.

9.4 Strengthen Sustainable Data Management

Organizations should establish clear data-retention policies and regularly review stored information to identify obsolete files and unnecessary duplication. They should manage backups according to business requirements and select cloud storage plans based on actual storage capacity, security, availability, and retention needs. Organizations can also review their storage usage periodically to improve data organization and avoid unnecessary storage commitments. However, these practices do not automatically guarantee immediate reductions in data-centre energy consumption, because the environmental benefits depend on how cloud providers manage their infrastructure and storage resources.

9.5 Improve Environmental Reporting and Transparency

Cloud service providers should publish clear and consistent information about their data centres' electricity consumption, carbon emissions, water use, and renewable energy adoption. Reports should explain the geographical scope, measurement methods, and limitations of the data so that readers can interpret the results accurately. Where possible, providers should distinguish storage-related activities from other computing workloads instead of presenting overall data-centre figures as the environmental impact of cloud storage alone. Transparent reporting can help organizations compare sustainability information, make informed cloudservice decisions, and identify opportunities for improvement.

9.6 Promote Environmental Awareness

Organizations, educational institutions, and cloud service providers should increase awareness of the environmental resources required to support digital services. Awareness programmes can explain how electricity consumption, carbon emissions, and water use are connected to datacentre operations. Individuals can contribute by reviewing stored files, managing backups,

and avoiding unnecessary duplication of data. Organizations can also encourage employees to follow appropriate data-retention practices. However, individual actions should be presented as complementary measures rather than guaranteed ways to reduce data-centre energy consumption. Greater awareness, combined with infrastructure-level improvements, can support more responsible digital practices.

9.7 Encourage Further Research

Future research should investigate the environmental impact of cloud storage separately from other data-centre activities wherever reliable data are available. Researchers could compare different storage technologies, geographical regions, electricity sources, and cooling methods to understand how these factors influence energy consumption, carbon emissions, and water use. Studies could also examine how storage demand and data-retention practices relate to infrastructure resource requirements. Clear measurement boundaries and transparent reporting methods would help improve the reliability of comparisons. Further research in these areas could provide more specific evidence to guide cloud service providers, organizations, policymakers, and users towards sustainable digital storage practices.

10. Conclusion

Cloud storage has become essential to modern digital life, supporting communication, business activities, and information sharing. However, its supporting infrastructure consumes electricity, water, and other resources, creating environmental challenges.

The reviewed literature highlights the importance of energy efficiency, improved cooling systems, renewable energy, and responsible data management in reducing the environmental impact of data centres. Cloud service providers and organizations can contribute by optimizing infrastructure and adopting cleaner energy sources.

Transparent environmental reporting and further research are needed to measure the specific environmental impact of cloud storage more accurately. Cooperation among technology providers, organizations, and policymakers can encourage sustainable practices.

Ultimately, balancing the benefits of cloud storage with environmental responsibility is essential for reducing environmental impacts and building a more sustainable digital future.

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