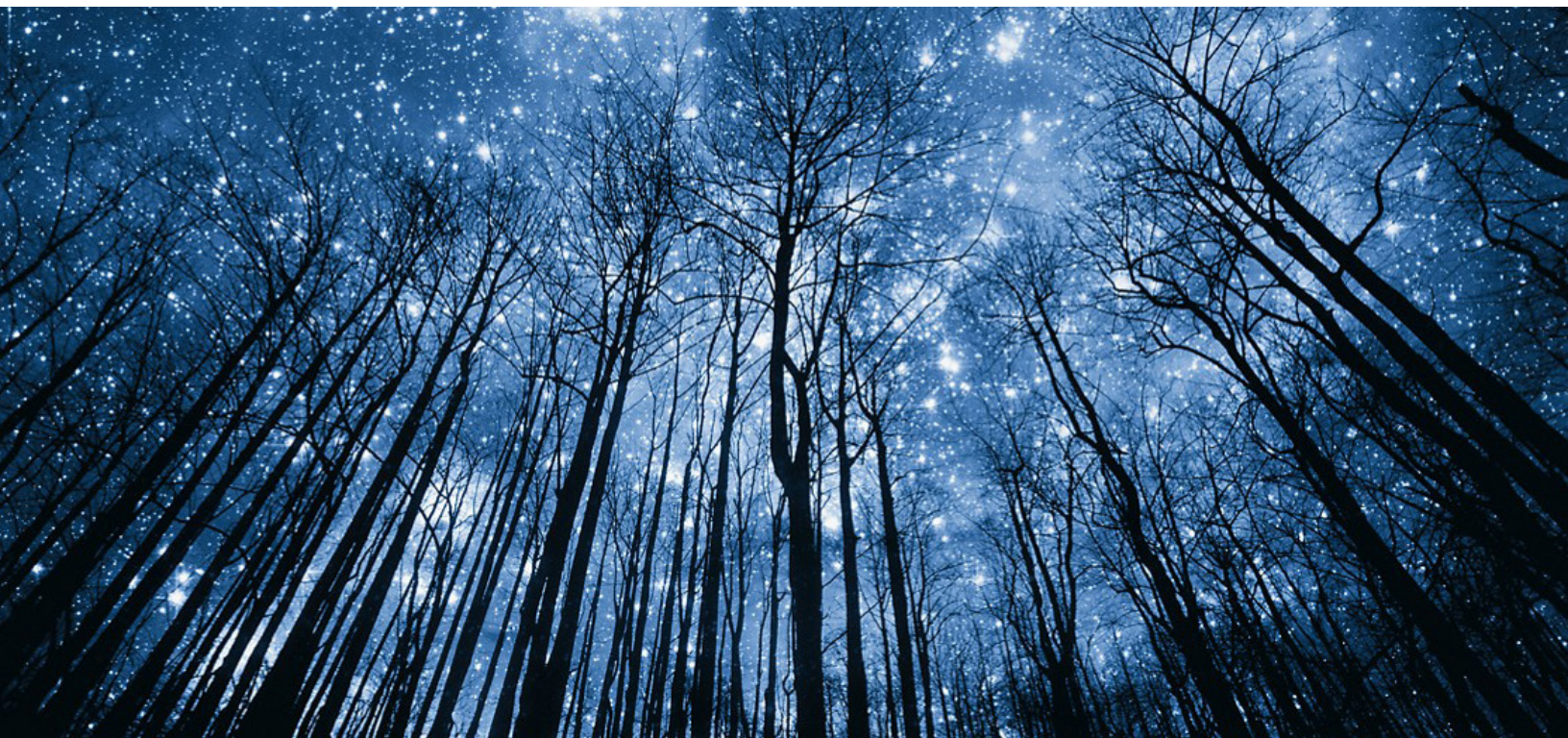# SUSTAINABLE IT AND CLOUD

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Table of Contents

Contents

Abstract

Sustainable IT in a broader aspect explains the sustainability of the environment in a positive way and the efforts behind doing so. We currently live in an era where IT and its retrospect- production, use and disposal of technology have created major challenges when it comes to sustainability of environment. We are all vaguely aware of how IT affects resources. In the office, desktops, laptops, servers, and other equipment rely on constant energy sources. But it is not just the consumption of resources—these devices are responsible for significant Green House Gas emissions.

Addressing the post-pandemic recovery, Sustainable IT is a critical element. Organizations are looking for an architecture with an informed strategy, engaged employees and leadership and most importantly, a sustainable software architecture. This would result in a greener footprint along with potential of unleashing smart technologies to drive environmental innovations and sustainability performance improvement. Cloud infrastructure could be widely considered as a key solution to environmental concern related to carbon emissions and energy consumption. Cloud computing offers prospective solutions where customers or end users share a sizable, centrally managed pool of storage and computing resources as opposed to controlling and owning their own systems. Because of its virtual nature, it could be leveraged as the solution to overcome this challenge.

Cloud infrastructure in its native form requires no additional hardware or equipment to run and has minimal resource requirement as compared to traditional setups, thus having the potential to overcome this challenge and make IT truly Sustainable. For instance: There are cloud-based solution which can fully eliminate the need of deploying a modern data center and managing several hardware and equipment, reducing the overall cost of ownership, and leaving a greener footprint on our environment.

Introduction

Our planet is a self-sufficient system with interacting physical, chemical, biological, and human elements. The environment's condition is determined by these interactions. We are living in the Anthropocene, also known as the human era, and we can see how human activity is altering the earth's layers. The soil is now filled with plastics, E-waste, and various chemicals, and there is a buildup of greenhouse gases that contribute to global warming, ozone layer depletion, ocean acidification, rainforest clearing, and a decline in terrestrial biodiversity. The environmental issues of today are caused by both a lack of development and by unforeseen effects of some types of economic development. To reduce the impact on our environment, we need to find ways that make development sustainable.

History of Sustainable Development

The World Commission on Economic Development (Brundtland Commission) of the United Nations introduced the ideas of sustainable development and sustainability in 1987. But almost three decades later, essential concepts of the forward-thinking thinkers who created the Commission's report, "Our Common Future," also known as the 'Brundtland Report' have been forgotten. The sustainability of the firm is now off course. Brundtland's "initial principles" might be reviewed to reorient businesses and managers.

According to the Brundtland study, environmental resources and restrictions were not appropriately considered while making development decisions. If the world's developing economies followed the same route to development as had happened in North America and Europe, their research predicted an environmental and social calamity. According to the report, industrialized countries needed to minimize their demands on resources and ecological repercussions, while emerging countries needed to discover new development avenues to avoid a crisis.

Today, most people agree that the Brundtland report's predictions came true. Extreme climate events, resource scarcity, weakened habitats, and stressed ecosystems are all present on our globe, coupled with widespread poverty, rising inequality, and stresses brought on by migration.

Offering a Solution: Brundtland Report

We can better meet our issues by delving into Brundtland's definition of sustainable development. Brundtland asserts that "social development"—the health, prosperity, and education of a group or society—is the essential component of development. By generating income and indirectly by supporting health and education, economic development promotes social development.

Sustainable development is a specific kind of social development that takes place within the environmental constraints or carrying capacity of the planet. The carrying capacity of a region as well as the effects of human activity must be understood.

At local, national, regional, and global scales, development must be sustainable. Additionally, the context—the ecological, economic, social, and institutional characteristics of a place—determines what is sustainable. (As stated in the Brundtland report, there is no one sustainable development strategy.)

Even though the Brundtland Report did not specifically address business-related issues, its guiding principles recommend taking the right steps.

Naturally, commercial things come first. Social and economic progress are inextricably linked. Businesses' job is to develop ways to make money, to be competitive, efficient, and effective, as well as to meet demands, while avoiding environmental damage that goes beyond what the ecosystem can sustain.

The sustainability of locations or systems, such as an energy or nutrition system, is the focus of sustainable development. Solitary attention on a company's sustainability is insufficient. But because their production and consuming activities have an impact on those areas and systems, corporations play a significant role in systems. Additionally, it is crucial to consider both the advantages that business produces and the value that it destroys from a systems perspective.

For long-term solutions to materialize, all of the actors participating in the locations and systems that are the focus of sustainability must be involved. According to Brundtland, sustainability is too complex for any one organization to handle on its own. Therefore, businesses must learn how to collaborate with new

and varied people and groups while also learning, inventing, and developing together. Companies occasionally take the lead, but more frequently they follow. They must however provide by:

1. Assisting in creating a future vision that is more sustainable
2. Sharing information and understanding of the current system, including its shortcomings and reform potential.
3. Working on future-focused paths includes identifying, creating, evaluating, and putting improvements into practice. Innovative technology, goods, services, business structures, and methods of operation will all be part of the pathways.

Thus, the most transparent innovation system imaginable is sustainable development. It is a multi-actor design approach for social innovation that offers new prospects for businesses that can rise to the challenge of competitiveness within the parameters of sustainability.

Losing Sight of Brundtland's Principles

Businesses today are aware of the strategic challenge posed by sustainable development, but many do not appear to know how to properly address it.

Many popular strategies ignore the fundamental fact that sustainability is a complicated, systems problem. For instance, "Shared Value Creation" and "Base of the Pyramid" both put business at the center of the process, and neither is overly concerned with carrying capacity or environmental restrictions.

Importance of Sustainability

The term "sustainability" encompasses a variety of practices, such as reducing our reliance on energy sources, limiting our emissions of greenhouse gases, and altering our shopping and transportation habits. When making decisions about your company's ethics and responsibility, sustainability must be considered, from your ecological footprint to your global business practices.

The business expense follows: The energy you use to run your IT infrastructure alone accounts for a sizeable portion of your overall costs. Companies in non-tech industries tend to be more wasteful than technology companies, despite their

reliance on technology. This is since non-tech businesses may not be as aware of the sustainability benefits of innovative technology.

Importantly, even while boosting your company's sustainable initiatives might not lead to lower costs for business processes, acting responsibly toward the environment is becoming increasingly crucial.

Unfortunately, Sustainable IT is not a priority for most organizations; only 43% of executives are even aware of their organization's IT footprint. While half of businesses have a sustainability strategy for the entire company, only 18% have a comprehensive one with clearly defined objectives and timelines. In addition, 53% lack the knowledge and 49% lack the tools to implement solutions. This leaves only 6% with the significant performance opportunities that come with being highly mature in terms of sustainable IT, such as higher ESG scores, improved brand image, and increased customer satisfaction.

IT is currently the most frequently used piece of office hardware and has a significant impact on our planet's sustainability. After the pandemic, remote working and learning have become commonplace, and as a result, laptops and other portable IT devices are in high demand.

Consequently, corporations and educational institutions are demanding more IT hardware. With 8 hours of use each day, a laptop can emit up to 88 kg of carbon dioxide annually if we consider the environmental impact over a longer period. Due to this growing demand, each new laptop generates 316 kilograms of carbon dioxide, 190,000 gallons of water, and 1.2 tons of resources that need to be mined from the ground. As a result, the IT sector both significantly contributes to economic growth and is among the top producers of carbon dioxide.

In addition, we have data centers. Data centers are an integral part of the IT industry. To, store, process, and distribute data and applications, an organization's shared IT operations and hardware are centralized in a data center. Data centers are essential to the continuity of everyday operations because they store the most important and proprietary assets of a business. As a result, all organization's top objectives include ensuring the security and dependability of data centers and the information they house.

Data centers may consume up to 400 terawatt-hours (TWh), or 2% of the world's electrical demand, according to experts. This produces a significant amount of greenhouse gases; according to some estimates, data centers are responsible for up to 3% of the world's carbon emissions, which is roughly equivalent to the output of the airline sector globally.

Electricity usage (TWh) of Data Centers 2020-2030
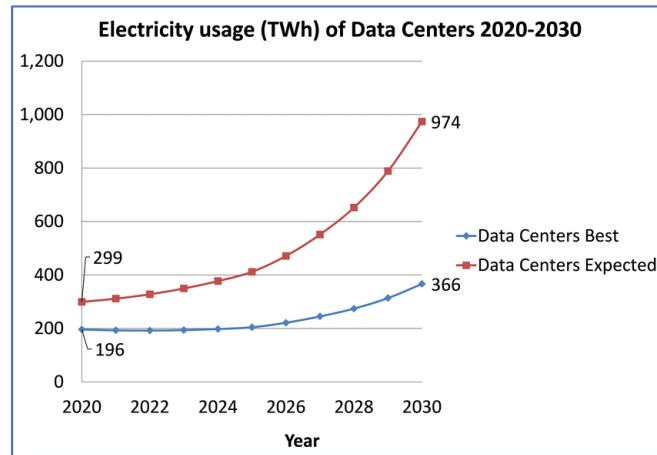
Is that however the only cause of emissions? Unfortunately, no.

One of the main causes of the carbon emissions from data centers is the construction of the buildings themselves. Before the first server is ever installed, conventional building methods and materials produce a significant amount of pollution, including greenhouse emissions.

Businesses can drastically lower the embodied carbon footprint of their data centers by streamlining the design and building process. Because of this, there is a larger emphasis on the embodied carbon of these facilities, which examines all the CO_2 released throughout the production and installation of building materials on the construction site. It involves gathering raw materials by mining or harvesting, moving them, processing them, producing them, shipping them to the project, and building things.

A large amount of cement, which contains a significant amount of embodied carbon, is used in data centers. 1.25 tons of CO_2 are produced for every ton of cement produced. Another resource-intensive product is steel, which needs to be mined, refined, and supplied to steel mills where enormous blast furnaces combine and melt raw ingredients to create the adaptable alloy.

The procedure leaves behind a huge carbon impact. Then there is the large machinery used on construction sites, such as cranes, graders, dump trucks, and earthmovers, all of which use fossil fuels. Therefore, even if a data center is powered by solar or wind, by the time it goes online, it will have had a major environmental impact.

What can be done to mitigate this?

There are several techniques to lessen the carbon footprint of a data center facility. The most straightforward choice may be to renovate existing structures, as doing so can cut their carbon emissions by almost 78% when compared to building new. Another tactic is to use building materials with lower carbon footprints.

By 2030, the use of new concrete types that absorb waste CO_2 could help to reduce carbon dioxide emissions by 500 MT yearly. Additionally, companies should think about buying resources locally rather than having them delivered from far-off parts of the nation or the world because exporting finished items and raw materials can generate substantial amounts of waste carbon.

Even with reduced or eliminated embodied carbon, the battle has just begun. This is because cooling systems, servers, and hard drives have extraordinarily high energy needs. Once a data center is in use, operators must seek for ways to reduce their reliance on fossil fuels. They must first determine their facilities' power consumption efficacy before they can evaluate how well their facilities use electricity (PUE). A data center's numerous servers generate a lot of heat, necessitating the need of power-hungry cooling equipment.

Businesses are looking for alternative ways to lower the temperature, such as using outside air, lakes, or the ocean, to keep their important equipment from overheating. Although having the capacity to utilize them is crucial, having the option to turn them off significantly lowers consumption. Finally, many data center owners strive to power their structures using renewable energy sources like geothermal, hydropower, wind, and solar.

Data centers aim for net-zero by 2050

Thousands of companies throughout the world have made the commitment to achieve net-zero status by 2050, which would mean that their emissions would be equal to the amount of greenhouse gases removed from the atmosphere. Some people aim for a GHG emission level of zero, which means they will have none. This necessitates the growth of battery storage technology, renewable energy sources, and carbon capture and sequestration technologies.

Major participants in the data center industry are wholly dedicated to sustainability and minimizing their carbon footprint. They are looking at all possibilities to simultaneously become net-zero and carbon-neutral. By utilizing innovative plans, novel construction sites, renewable energy sources, and eco-friendly building materials, they will achieve these objectives. These elements working together can cut down on the facilities' operating costs. These companies must share their best practices to simplify others' employment. The world will be able to continue, and the environment will gain.

Measures data centers can take

The data center sector can take several actions to lessen its environmental impact and lower the risks associated with water scarcity. First, the sector may keep enhancing its energy efficiency. Lower energy requirements per compute instance will result from the ongoing transition to more energy-efficient hyperscale and colocation data centers.

Further PUE improvements, software and hardware innovations, and reduced energy consumption can all help to lower environmental externalities. For instance, Google has claimed quarterly PUE of as low as 1.07 for some of their data centers.

With one study finding a PUE of less than 1.04, liquid immersion cooling systems hold out hope for additional PUE decreases. There is little chance of recovering low-grade heat (i.e., heat from unstable or low-temperature sources) from data centers for space or water heating.

However, strategies like organic Rankine cycle and absorption cooling are promising methods for producing power from waste heat. Second, the data

center sector can invest in renewable energy sources like solar and wind. Water and carbon footprints are reduced by directly coupling data center buildings to wind and solar energy sources.

Data centers' water and carbon footprints can be decreased by purchasing renewable energy certificates from electricity suppliers, although this is not a guarantee. The overall environmental effect of all energy users is reduced by these expenditures, though, as they gradually transition the electrical system toward renewable energy sources.

Data center workloads can be moved across data centers to match the area of the grid where renewable electricity supply is greater than the demand for electricity at that moment.

Third, strategically positioning new data centers can greatly lessen their environmental impact. Due to lower ambient temperatures, climatic conditions might make some regions more favorable and hence require less cooling. Lower cooling demands result in less water usage, both direct and indirect, and greenhouse gas emissions from operating data centers. Since most data centers get their electricity from the grid, the type of power plants that provide that electricity has a significant impact on how environmentally friendly a data center is.

The real estate choices may contribute to decreasing the environmental footprint of data centers in a sector that is heavily reliant on technological innovation.

How companies can and have adapted themselves to become sustainable?

The "Better Leadership, Better World" report by Unilever identifies key leadership initiatives that are essential to the growth of a sustainable business in accordance with the United Nations' Global Goals.

Below is a list of some of them:

Connect with the need: The teams advocating for sustainability projects in large corporations must develop and monitor metrics that resonate with the priorities of internal stakeholders, such as how they will be empowered to improve

sustainability in the company. The following are a few options for dealing with business units:

- Units of operations: Educate them on the ways in which sustainability efforts will reduce costs or improve efficiency.
- Procurement or sourcing teams: assure these teams that sustainability initiatives will reduce supply disruption risks, increase productivity, or reduce costs.
- Human resources: Marketing and corporate affairs teams: demonstrate to HR how sustainability initiatives will assist in recruiting and retaining talent. aid them in comprehending how sustainability efforts will enhance the brand's value or boost its operating license.

Rebuild social trust: Business trust has been low ever since the global economy crashed in 2008. To regain the trust of society, as well as that of their customers, employees, and the communities in which they operate, business leaders must work together. Additionally, they must update their operating license.

To maintain long-term success in regaining societal trust in the company, it must collaborate with governments, employees, customers, and civil society, make a positive contribution to the community, and then openly communicate their ongoing interactions with society.

Make sustainability a core value: There are typically three methods for integrating sustainability into an existing business: assimilation, mobilization, and transition. The transition method is the most effective for long-term integration. The transition approach focuses not only on reshaping policies, procedures, and attitudes toward sustainability principles, but also on maintaining aspects of the company's current mindset. The majority of this was accomplished through widespread recruitment, communication, and training, which ensured widespread adoption.

Do some research: Companies that only have a passing interest in sustainability will pursue the mainstream eco-friendly strategies that are popular at the time. In most cases, this will be incorporated into their marketing strategy with the intention of expanding consumer base and brand equity.

However, rather than being an integral part of an in-depth strategy for sustainability, these activities typically focus more on lip service to the idea of sustainability. Rather than attempting to apply all sustainability concepts to a company, the crucial action is to focus on specific sustainability topics. This necessitates a firm determination regarding the issues that the business considers to be of the utmost importance to it and the development of a plan to specifically implement those issues.

Innovate: If every aspect of the business is viewed through the lens of sustainability, it may be necessary to alter business strategies. The need to change the business to be more sustainable will lead to latest ideas.

These are some:

- Enabling board members and business leaders to focus on sustainability and drive execution; Strategically planning and developing products or services that produce sustainable outcomes.
- Marketing products or services that entice consumers to choose sustainable options.
- Applying sustainable development goals to leadership development strategies   Incorporate diverse leadership Sustainable businesses look to the Sustainable Development Goals (SDGs) as a guide for becoming more sustainable.

Establish a comprehensive, long-term vision: Be aware that sustainability is more than just a token response to satisfy customers. Sustainable businesses set well-researched and attainable goals. Contributing to feeding programs, expanding education opportunities within and outside the organization, or launching sustainability initiatives throughout the supply chain are all examples of goals.
To put it succinctly, increased transparency brings with it increased accountability. These are essential for successfully implementing corporate sustainability programs because they drive change and enhance outcomes.

Accept rivals as partners: When a major player in a sector declares their commitment to sustainability, it encourages others in that sector to do the same. Sustainable businesses encourage this kind of competition not only because it has a positive effect on the environment but also because it forces them to keep developing new ways to be sustainable.

Leaders collaborate with competitors and non-profits who share their goals to develop novel ideas that might be out of reach for a single business. Leaders who are aware of their rivals' methods should adopt important aspects of their strategies as their own.

Emulating global giants has already led to net-zero greenhouse gas emissions and a carbon-neutral cloud for businesses of all sizes. However, individuals and businesses can begin modestly: Utilize natural light in the workplace, use tap water rather than plastic bottles, recycle waste, and the majority of these things are already taking place at work; How much more can sustainability-focused thinking continue to accomplish?

The ability of business to effect change that improves the world is enormous. The business world is well-positioned to effect the necessary change on a large scale due to its unparalleled powers of ideation, production, and distribution.

How cloud model helps in becoming sustainable?

Cloud service providers are always looking for new ways to not only make their service safer and more adaptable, but also to use renewable energy to power their data centers. The cloud excels at staying ahead of technological developments, which also reduces your carbon footprint when compared to a local system.

Reduction in electricity consumption: Traditional data hardware systems use a lot of electricity because engineers have to do a lot of maintenance and upkeep on them. Add in cooling fans and uninterruptible power supplies, and the system uses a lot of electricity. Energy consumption can be reduced by up to 87% for businesses that simply want to move basic software like email.

Reduces Greenhouse Gas Emissions (GHG): Compared to traditional local servers, cloud computing reduces GHG emissions from data centers. Carbon emissions were reduced by 95%, according to a survey customer in the United States, as compared to businesses with on-premises servers, according to one study.
Any business cannot easily measure and cut carbon emissions but moving to a cloud-based computing ecosystem is a terrific way to fight climate change and make less of an impact on the environment.

Increased Utilization Rate: Companies that continue to use their own private data centers find it difficult to scale their IT systems in response to demand. As a result, engineers are forced to acquire additional equipment in anticipation of a rise or fall in usage, which results in a utilization rate that is not optimal. By moving to a cloud service, businesses are able to adjust how quickly or slowly they scale their operations in response to demand, which results in higher utilization rates and improved productivity.

Businesses can make a significant contribution to the global effort to combat climate change in a variety of ways, one of which is by upgrading their IT systems. Not only will cloud sustainability assist businesses in reducing their carbon footprint, but it will also be a far more user-friendly system than a local data center.
This new paradigm relies heavily on the cloud.

The cloud's architecture has the potential to cut down on carbon emissions and make it easier to conduct sustainable research and innovation. In addition, scientists are able to identify and discover new methods for bringing about lasting social and economic change thanks to massive data analysis supported by a web of data networks in the cloud.

In creating a sustainable future, a common maxim is to only consume what is necessary; This is built into the cloud's design. There is little waste when computing resources are provided on demand. The cloud's sustainability business case is straightforward: It reduces the hardware, compute power, and power/cooling footprint on-premises.

A cloud platform can provide innovative features in addition to lowering a company's carbon footprint. The only platform that can provide digital models and support analytics that would be impossible with traditional on-premises servers is the cloud, which is able to integrate and analyze massive amounts of data.

Conclusion

 Cloud infrastructure may be widely regarded as a crucial remedy for environmental issues involving carbon emissions and energy use. In contrast to managing and owning their own systems, cloud computing provides potential solutions where customers or end users share a big, centrally controlled pool of storage and processing resources. It could be used as a tool to overcome this obstacle due to its virtual nature.

In its natural state, cloud infrastructure uses less resources than traditional setups and does not require any additional gear or equipment to function, which has the ability to solve this problem and make IT genuinely sustainable.

Glossary

ESG: Environmental, social and Governance
What is an ESG Score?
An ESG score is an objective measurement or evaluation of a given company, fund, or security's performance with respect to Environmental, Social, and Governance (ESG) issues.

 IT: Information technology

GHG: Green House Gases

References

https://www.missioncloud.com/blog/5-reasons-why-the-cloud-is-environmentally-friendly

https://docs.aws.amazon.com/wellarchitected/latest/sustainability-pillar/sustainability-through-the-cloud.html

https://www.capgemini.com/wp-content/uploads/2021/05/Sustainable-IT_Report.pdf

https://www.google.com/about/datacenters/efficiency/

https://energydigital.com/technology-and-ai/how-data-centers-can-reduce-their-carbon-footprint

https://www.climatiq.io/blog/measure-greenhouse-gas-emissions-carbon-data-centres-cloud-computing

https://www.climateneutralgroup.com/en/news/carbon-emissions-of-data-centers/

https://www.forbes.com/sites/forbestechcouncil/2021/05/03/renewable-energy-alone-cant-address-data-centers-adverse-environmental-impact/?sh=557269285ddc

https://iopscience.iop.org/article/10.1088/1748-9326/abfba1

https://council.science/wp-content/uploads/2017/05/SDGs-Guide-to-Interactions.pdf

https://oi-files-d8-prod.s3.eu-west-2.amazonaws.com/s3fs-public/file_attachments/dp-a-safe-and-just-space-for-humanity-130212-en_5.pdf