Is Our Online Computing a Sustainability Problem?

Digital Sustainability Checklist

July 2025

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What is the Problem with Going Online?

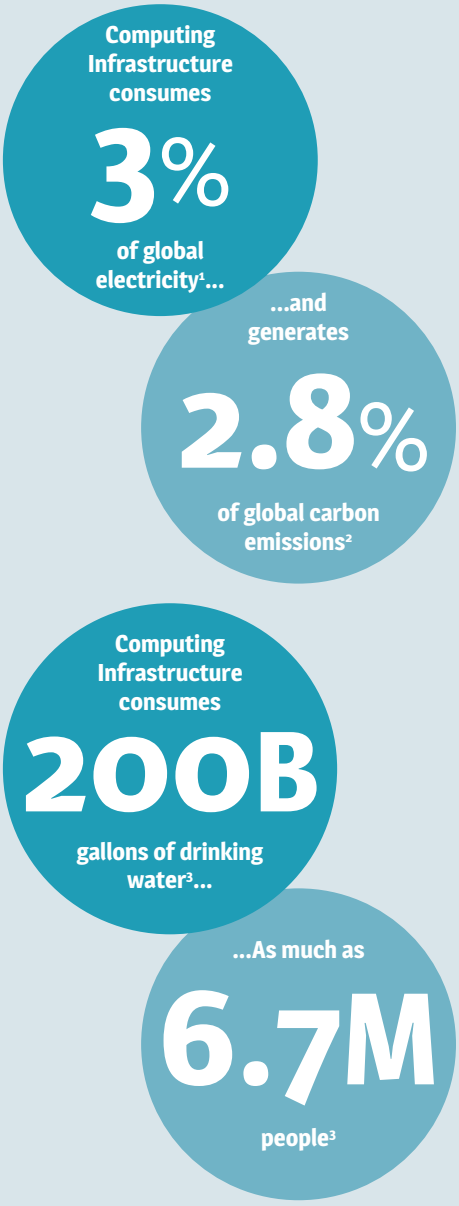
Our world's online computing activity is imposing significant impacts: 3% of the world's power,[1] 2.8% of greenhouse gas (GHG) emissions,[2] and the water of 6.7 million people.[3] **We face environmental and business risks, yet we lack awareness of the connection between the environment and online computing.**

The data centers that make our computing happen consume vast amounts of power and emit greenhouse gases from power generation, with chemicals that are unhealthy to breathe and cause climate impacts. Data center cooling systems use up considerable but unquantified amounts of water. They affect the water supplies of nearby communities and create power grid concerns while climate and e-waste problems worsen.

Despite significant investments in low-carbon energy and continuous efficiency improvements, data center companies are expanding so fast that they are failing to meet their sustainability targets. Emerging shortages of power and water threaten to curtail data center capacity. **Without mitigation we will soon face hard choices to balance our need for cloud computing against our problems with power, water, carbon emissions, and pollution.**

This problem requires attention from those who can reverse it: the organizations that provide online applications for work and play. They don't yet have adequate awareness and operational visibility into the environmental impact of their technology operations. **With cloud computing spending projected to grow 20+% a year through 2030, the environmental consequences of inaction will only intensify**.[4]

Similarly, the public uses online applications such as streaming, AI chatbots, shopping, search, or social media. **There is little popular awareness of the real-world impacts of virtual activity.** This gap between growing usage and missing awareness creates an immense problem for effective action.



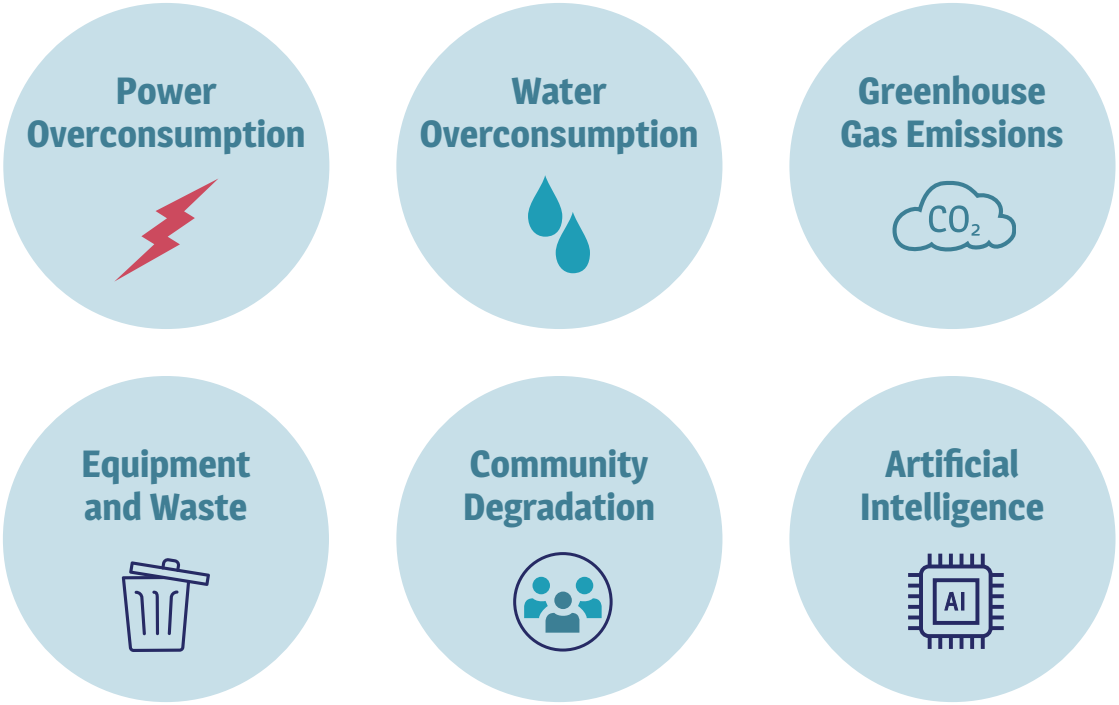
Cloud Sustainability Watch promotes an urgent transition to sustainable computing. For additional resources and *The Tech Professional's Guide to Sustainable Computing*, visit our website at https://cloud.sustainability.watch.

KEY ISSUES

Understanding the Problem

Online computing impacts resource capacities, the environment, and communities worldwide—creating a complex web of challenges. Understanding these issues and their implications is fundamental to developing effective cloud sustainability strategies.

The environmental impacts of cloud computing interconnect and the key issues are:



KEY ISSUES

Power Consumption and Greenhouse Gas Emissions

The online computing boom is straining global power infrastructure. Data centers already require more electricity than France, and In just 5 years their power appetite is expected to double.[1 5] In the US, data centers require the power capacity equivalent of six major cities combined: 4% of national power supply.[6]

Data centers use electricity to power and cool computers and networking equipment. The very largest data centers require power capacity equivalent to a city.[7] And since generating electricity is still mostly done with gas or coal, data centers indirectly cause GHG emissions. In fact, data centers will produce 2.5 billion tons of GHG emissions between 2023 and 2030.[8]

The troublesome squeeze on the electricity supply has caused utilities to build or extend fossil fuel power plants. In an alarming development, some data centers are building their own gas plants on-site. These trends highlight the conflict between our dependence on cloud computing and the necessity for digital climate action.

Solutions require a concerted response. We must ask cloud providers to continue improving their energy efficiency while advocating for more clean power.

The carbon footprint of online computing is the same as the global shipping industry.[9]

US data center power consumption

4%

of US electricity[6]...

...the same as

6

major cities[6]

Data center carbon emissions 2023-2030

2.5B

tons[8]...

...the same as

40%

...of all US annual emissions in a year[8]

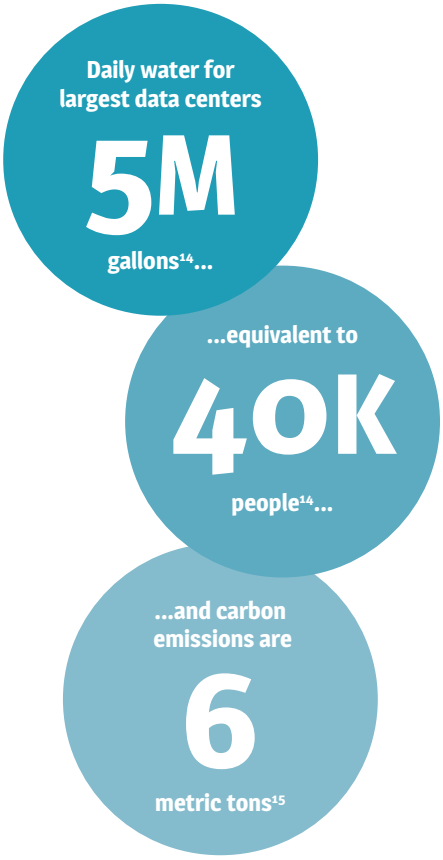
KEY ISSUES

Water Consumption and Greenhouse Gas Emissions

Few people realize that their online computing contributes to water shortages. Data centers draw hundreds of thousands and even millions of gallons of water to cool equipment.[10] The power plants that supply them also consume vast amounts of water for cooling.[11] What's more, transporting and processing water requires power, so there are additional indirect carbon emissions.

This water is more often drawn from wells and streams than from municipal supplies and frequently released untreated into groundwater. And since data center siting decisions prioritize low land cost and clean power availability, many are built in dry, sunny locations with water supply problems.

Not surprisingly, **data centers now rank as the 10th largest industrial water consumer in the US.**[12] Analysts and community advocates are pressuring data center companies to fully disclose their water consumption.[13] Yet because data centers draw opposition from communities where they are built, these companies are unwilling to disclose their water use. If local communities or data center customers want to find out how much water a data center is using, they usually won't succeed.



The water-stressed American Southwest is home to 20% of US data centers.[16]

KEY ISSUES

Equipment, Waste, and Carbon Emissions

Data centers and IT equipment have negative environmental impacts at the start and end of their lifecycles. Extracting, manufacturing, and transporting their parts and raw materials emits greenhouse gasses and consumes resources.

Manufacturing issues include equipment production, where one laptop produces 800 pounds of carbon emissions.[17] Microprocessor fabrication depletes water supplies, with each plant consuming 10 million gallons of water a day.[18] Extracting hazardous raw materials is another severe problem.

Facility construction claims large tracts of land and involves carbon-intensive materials such as cement and steel. Similarly, constructing connections for power and water creates carbon emissions.

The damage continues during disposal and demolition. Data centers create 4% of the world's e-waste and rapid equipment turnover increases the heavy metals dumped in the soil and water.[19] Decommissioning data centers at the end of their 20-year lifespan contributes even more to the waste stream, as discarded materials typically go to landfills rather than reclamation facilities.[20]

Each data center's steel and concrete construction emits an enormous amount of greenhouse gas during its manufacture and use.

43%
Data centers with no e-waste policy[21]

Technology equipment recycled
22%[22]

Carbon emissions from manufacturing one laptop
800
pounds[17]...

...Same as flying
900
miles[17]

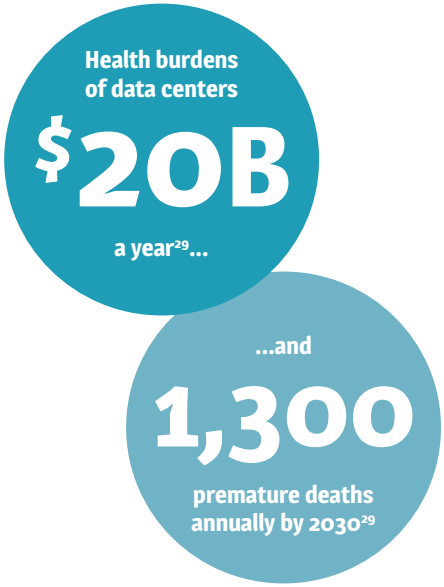
KEY ISSUES

Community Degradation

Increasingly, data centers' enormous resource demands are colliding with community needs. **Communities are objecting to water overconsumption, unsightly buildings, transmission lines, and power problems.**[28] Recently, studies have calculated the costs of data center air pollution, with startling conclusions that the health burdens cost billions.[29]

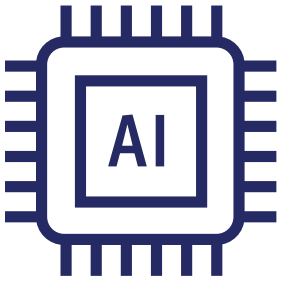
Public opposition has impeded or stopped data center growth in many places. Governments and utilities in data center-heavy regions are limiting new development, and more jurisdictions require data centers to comply with efficiency and environmental rules.[30]

In response, data center operators seek locations with less resistance and more available resources. Municipalities often agree to negotiate in secret, delivering undisclosed power and water discounts or tax credits. **The public rarely learns the details until resource consumption problems arise.** Given the substantial local impact of data centers, regulators and the public must be able to transparently make the trade-offs between meeting demand for online services and protecting communities.



Ireland's data centers consume more electricity than the country's residences.[18]

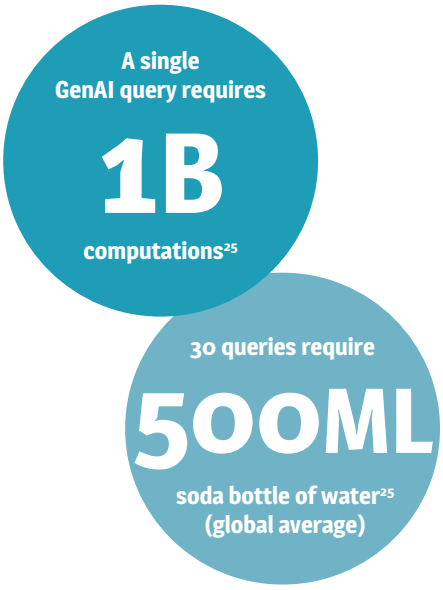
KEY ISSUES



Generative AI Ups the Ante

Generative artificial intelligence (GenAI) breaks paradigms in its resource consumption. **GenAI's resource requirements are so high that data centers have to add 10x more power capacity, specialized cooling systems, and significant water supplies.** This is because its advanced reasoning operates on unimaginably large models and creates new data for every query.

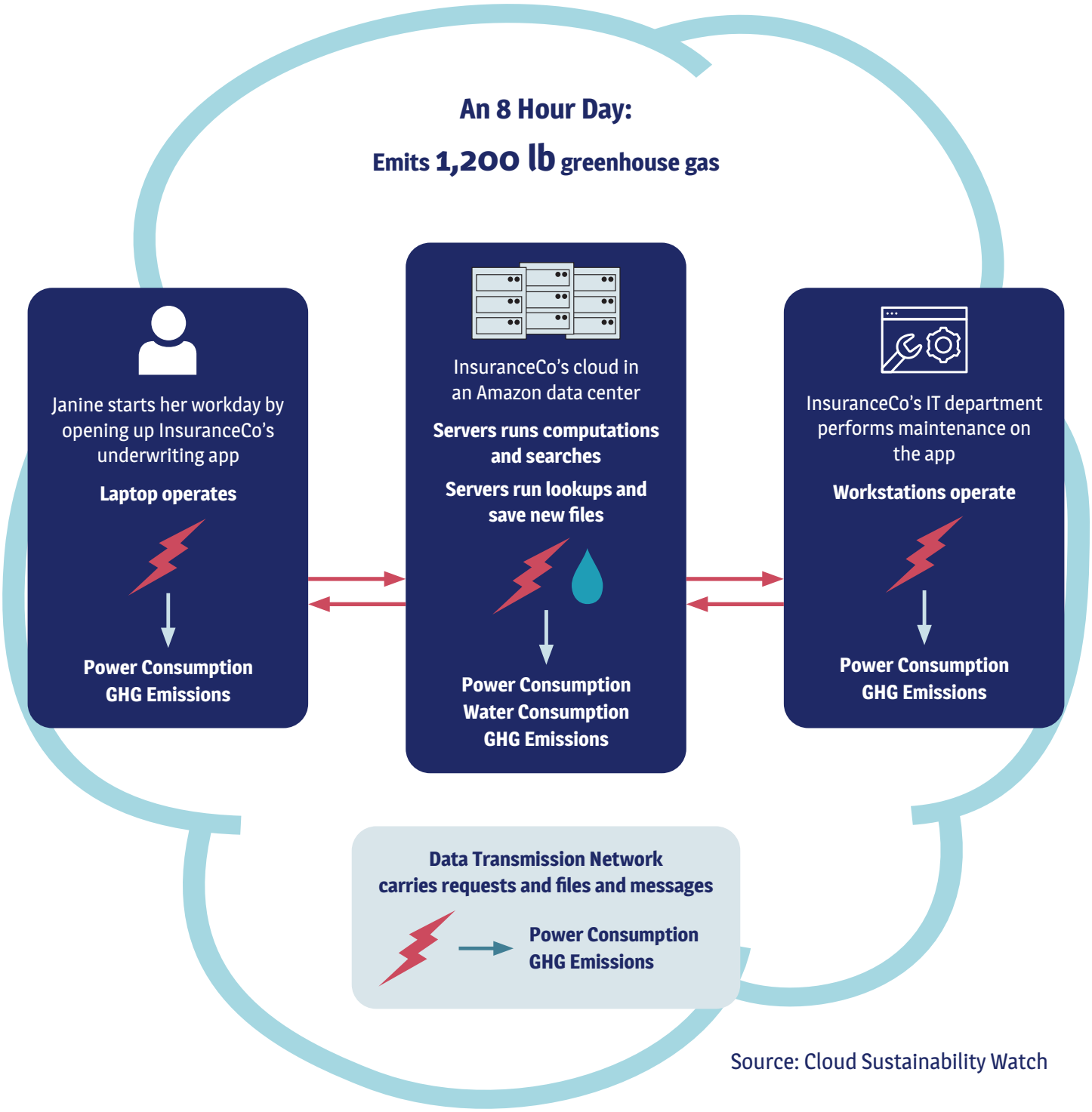
An enormous rush is underway to take advantage of GenAI's potential to make money and reshape business functions, driving forecasted growth rates above 50% a year through 2030.[23] **Without intervention, AI could be solely responsible for as much as 2% of global GHG emissions by 2035.**[24] Its water consumption will have a similar impact. GenAI's negative consequences will cause havoc unless technology leaders carefully evaluate why and how they deploy GenAI projects.



Each rack of GenAI servers requires power capacity equivalent to a house.[26]

How It All Works

The Surprising Impact of One Workday at InsuranceCo



Source: Cloud Sustainability Watch

Sustainability Progress

Clean Power

The big tech companies have pledged net-zero emissions by 2030 and claim many 100% low-carbon power for data centers. These claims are not as good as they seem. Even though the top 5 have clean power purchases that are larger than the power supply of many countries, their data centers use power from the grid.[32] And their carbon emissions are escalating due to new data center build-out and the power industry's reliance on fossil fuels.[33]

Power Conservation

Between 2010 and 2018, US data centers increased their power consumption by 6% while their workloads went up 500%.[34] The big tech companies have the world's most power- and water-efficient data centers.[35] They have dedicated teams and wide-scale monitoring to ensure their IT and cooling equipment isn't underused or wasting power.[36] [37] Nevertheless, they are building and expanding their data center fleets to meet escalating demand.[38]

Water Conservation

The big tech companies are investing in replacing fresh water with waste-water or coolants, and they are starting to eliminate water use with zero-water systems.[39] They have also committed to being "water positive" and replenishing more water than they use by 2030.[40] These murky commitments mix water conservation with "water replenishment" projects that do not directly return potable water to communities near their data centers.[41]

Greener Facilities

In a shift toward reducing carbon emissions and materials waste, tech companies report using low-carbon cement and steel for their new data center construction.[42] They do not specify how extensive their plans are for using green materials, especially regarding older data center retrofits. Refurbishment and retrofitting to extend lifetimes are likely to become more commonplace as finding and building new facilities becomes more difficult.

Circular Lifecycles for Equipment

Manufacturers are addressing their e-waste by designing products for repair, refurbishment, and recycling. Some IT equipment manufacturers are utilizing reused materials, and some are taking back used equipment to remake into the latest models. Analysts predict that within a few years 80% of IT equipment manufacturers will have programs such as take-back and recycling/reuse in place.[43]

Digital Sustainability Checklist

In the face of mounting environmental and community consequences, many people are becoming concerned about computing sustainability and want to take action.

Start Today

You can take digital climate action starting now. Begin with the small steps such as using Google search without AI instead of Chat-GPT. Send an email at work asking about the sustainability programs in IT. Talk to a friend. Then get more ambitious by modifying your website or blog to sustainable web design and writing a letter to your senator asking for environmental requirements for AI products and services.

The more people who take action and ask for sustainable computing services, the more we can reduce our collective impact on the environment. **And as you do more and learn more, please share your insights and any tools and websites you discover with us at Cloud Sustainability Watch https://cloud.sustainability.watch.**

Start with Conversations

Talk to your friends about this problem and ask their opinions. Exchange interesting ideas for mitigating the harms of online computing and decide if it makes sense to ask at your office about sustainable computing. Above all, understand that the size of your impact is either magnified or minimized by the cloud sustainability choices of technical teams at Netflix, TikTok, etc., or even your company's IT team.

Ask at work: "Do we measure the carbon emissions of our computing operations?"

☑ Digital Sustainability Checklist

Advocate at Your Company

Technology teams at companies, nonprofits, and governments are increasingly interested in digital sustainability. Their power to reduce the negative impacts of online computing is enormous. You can greatly amplify your own impact by raising awareness and interest in sustainable computing where you work. Consider these ideas:

- ☐ Ask your company's technology teams if they are exploring sustainable computing practices.
- ☐ Share the Cloud Sustainability Watch website. (https://cloud.sustainability.watch)
- ☐ Recommend the *Tech Professinal's Guide to Sustainable Computing* (free PDF on the Cloud Sustainability Watch website).
- ☐ Ask your company's webmaster if the hosting service is green. You can also ask what policy is in place for tracking the carbon emissions of the company website and its usage.

Green Your Website and Blog

Your blogs and webpages are a chance to take action as well as reduce your impact. Some sustainable web principles are:

- ☐ Adopt the the Worldwide Web Consortium's Web Sustainability Guidelines for your website. (https://w3c.github.io/sustainableweb-wsg)
- ☐ Ask your blogging hosting service about their sustainability programs.
- ☐ Minimize photo size and frequency to reduce data transmission.
- ☐ Compress photos, videos, and files.
- ☐ Link to videos and big files instead of embedding them to automatically load.

☑ Digital Sustainability Checklist (con't)

Use Cloud Services Thoughtfully at Work

There are more cloud services at work than you may realize. Here are some suggestions to use them more sustainably:

- ☐ Convert video meetings to phone or audio-only because conferences such as Zoom send 15MB of data per person per minute.
- ☐ Weed out old and duplicate documents and photos from your Google Drive, Apple iCloud, OneDrive, Dropbox, Box, etc.—and check for duplicates before uploading a file.
- ☐ Try the apps designed to automate cloud and file clean-up.
- ☐ Instead of transferring or emailing files, use share links or document collaboration tools like Google Docs or Microsoft Teams.
- ☐ Weed out old emails and especially attachments that are no longer needed.

Use Cloud Services Thoughtfully at Home

Here are some suggestions for using cloud services sustainably at home:

- ☐ Delete old email accounts and archive key items instead.
- ☐ Only back up what you need and turn off file syncing for unused devices.
- ☐ Create written social media posts instead of videos or photos.
- ☐ Talk by phone instead of video conference.
- ☐ Consider using at-home gaming systems instead of online streaming gaming.
- ☐ Try a smartphone app for managing and reducing stored photos, videos, and documents.

☑ Digital Sustainability Checklist (con't)

Use AI Efficiently

There are many ways you can use chatbots and generative AI services with less impact. Here are recommendations:

- ☐ Don't ask chatbots to generate images or videos because the power demand is exponentially higher than text exchanges—search for images elsewhere.
- ☐ Take a Prompt Engineering class on how to structure and word AI/chatbot queries that get the information you want in a single shot.
- ☐ Be thoughtful about why and how often you use chatbots and AI services.
- ☐ Save the outputs and responses from chatbot/AI queries so you don't have to repeat a query.
- ☐ Take advantage of offline features as more of them become available.

Choose AI Chatbots Carefully

The well-known AI chatbots like Chat-GPT, Gemini, and Copilot are monumental software behemoths that expend large swathes of data center capacity and power. Here are recommendations for selecting AI tools with better sustainability:

- ☐ Use tools tailored for your job, such as editing, research, etc., instead of a large general-purpose chatbot.
- ☐ As "green" AI chatbots become more common, investigate them. Ones to consider could be EcosiaChat (Germany) or ViroGPT (US), which claim to offset emissions by funding carbon reduction projects.
- ☐ If you or someone you know is building an AI application, consult the AI Energy Score Leaderboard to find the most power-efficient model for your needs. There is a 61,848x difference in power efficiency between the highest and the lowest models.
- ☐ If you are technical, consider downloading a GenAI model that can run on your home computer to reduce power and water consumption as well as data transmission impacts. They are becoming available.

☑ Digital Sustainability Checklist (con't)

Advocate for Change

We are all citizens who should advocate for policies to reduce the environmental impact of AI and online computing. We encourage everyone to urge elected officials to adopt the vision of digital sustainability from the UN Environmental Program:

- ☐ Governments should encourage companies to green their data centers with low power and water requirements, low-impact materials, equipment recycling, and clean power purchases.
- ☐ Countries should establish standardized measurements for the environmental impact of AI and online computing.
- ☐ Regulators should develop requirements for disclosure of direct environmental consequences of online and AI-based products and services.
- ☐ Tech companies should make AI and online computing algorithms more efficient with lower energy and water demands while running on reused or recyclable equipment as much as possible.

Conclusion

Remember that our online activity takes a toll on our resources, communities, and environment. It serves an important purpose, but like any heavy industry it needs to adjust to a world with limitations. Earth is only so big, and resources like fresh air and water and raw materials are not infinite. We can't let online computing grow to 10% or more of our electricity—to the point where we struggle to meet our other power needs.

Digital sustainability is getting started late because the problem was out of sight, and going online had a good environmental reputation as a replacement for travel and printing. Data centers used to be a smaller concern, but now they are getting attention—and we have to accelerate this trend by publicizing a rising environmental crunch. Share your concerns with friends, especially if they work in tech. Advocate for digital sustainability at work. And remember to adjust your online computing to mitigate your environmental impact. Every small step makes a difference.

About

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Join the Cloud Sustainability Watch community on our LinkedIn group.

About Cloud Sustainability Watch

Cloud Sustainability Watch is a volunteer campaign to reduce the environmental impact of cloud computing, artificial intelligence, and data centers. The world's online computing significantly contributes to global power consumption, water usage, and greenhouse gas emissions while disrupting communities. **The group's mission is to advocate for and enable technology leaders to improve business results and reduce climate damage by adopting sustainable cloud computing practices and technologies.**

About the Author

Susannah Hill is co-founder of Cloud Sustainability Watch. She consults with climate tech companies on cloud computing sustainability and is a data center Accredited Sustainability Advisor. Susannah is the author of *Is Our Online Computing a Sustainability Problem?* and *The Tech Professional's Guide to Sustainable Computing.*

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Endnotes

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