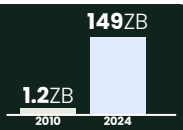
Big Data, Data Centers, and their Environmental Impacts

EXPLOSIVE GROWTH OF DATA

New data created, captured, copied, and consumed globally has risen from 1.2 ZB in 2010 to 149 ZB in 2024



20–43%

Data is **growing** at a compound annual growth rate of **20–43% in the U.S.** (27% globally), with **doubling** of data creation occurring **every two years** within many of the largest organizations

100 million+ servers now operate worldwide

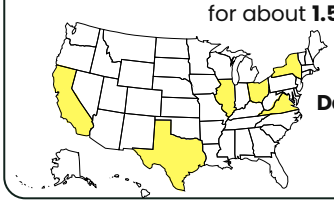
Drivers include cloud adoption, mobile devices, streaming, e-commerce, and AI

RAPIDLY RISING ENERGY CONSUMPTION

Energy consumption by US data centers grew from 60 TWh (2016) to 366 TWh (2025)

The electrical load is projected to **triple** again by 2028, reaching **6.7–12% of U.S. electricity consumption**

On a global scale, data centers were estimated to account for about **1.5%** of electricity consumption in 2024 and projected to be about **3%** in 2030



Data center impact on national electricity consumption is geographically concentrated — VA, CA, TX, OH, IL, NY

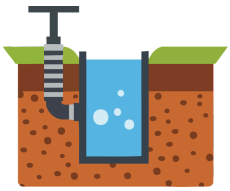
WATER DEMAND & INFRASTRUCTURE IMPACTS

Water is consumed at two points in data center operation:

1) in cooling of data centers and the servers within them
2) in generating the electricity that data centers consume

Average data center uses **450,000 gallons/day**

Hyperscale centers can use millions of gallons/day



Data centers primarily draw upon potable water from municipal or regional water utilities which can **strain existing infrastructure** or **require expensive upgrades.**

AI AS A MAJOR NEW LOAD DRIVER

AI is reported to require more energy than traditional internet uses, tapping potentially hundreds or thousands of servers in far flung locations to generate answers

AI training clusters can each **require 10,000 watts.**

AI applications accounted for 10-20% of data center power consumption in 2024 and **by 2028, AI may represent over half of data center electricity use** **50%**

A **Chat GPT query** requires **10-12% more energy than a Google search**, while the least efficient image generation model consumes over **500 times the power** as the most efficient model.

COOLING TECHNOLOGY SHIFTS

While **evaporative cooling dominates data center operations,** it demands substantial water use and produces contaminated runoff that can exceed standard municipal treatment capabilities.

NEWER COOLING TECHNOLOGIES EMERGING

Direct-to-Chip Liquid Cooling

- Liquid-cooled plates placed directly on processors
- Heat carried away through circulating coolant
- Reduces both energy and water use compared to air cooling

Immersion Cooling

- Servers submerged in non-conductive cooling fluids
- Highest cooling efficiency and lower energy use
- Eliminates need for traditional cooling water

COST & INFRASTRUCTURE TRADEOFFS

- Liquid cooling systems are significantly more expensive
- Immersion cooling can cost ~50%+ more than direct-to-chip systems
- Advanced systems (boiling fluids) increase costs further

ENVIRONMENTAL & SAFETY RISKS

- Risk of fluid leaks or spills
- Some cooling fluids contain hydrocarbon oils or PFAS chemicals
- Requires biocontainment and spill protection systems
- Some fluids are flammable, adding fire safety concerns

DOVETAIL PARTNERS

Read the Report
*data sources can be found in the report

February 2026

Reducing Environmental Impacts of Data Centers

DATA CENTERS ARE HERE TO STAY

Why they matter

Create **jobs**, **economic growth**, and **tax revenue**

Enable **cloud services, streaming, global connectivity**, and **secure data storage**

The Challenge

Extremely **high energy** and **water use**

Can **strain local utilities** and **infrastructure**

Contribute to **higher electricity costs** and **water stress**

WHO CAN REDUCE THE IMPACT?

Everyone plays a role

Businesses & large organizations

Local governments

Individual users

Reducing data center impacts requires action at every level.

IMPACT-REDUCING STRATEGIES

BUSINESSES & LARGE ORGANIZATIONS

Choose sustainable data center providers

- Powered by **renewable energy**
- **High energy efficiency** (PUE close to 1.0)
- **Low water use** (lower WUE)
- Uses advanced cooling, energy, and water-saving technology
- Transparent & independently monitored water and power use

Improve data storage practices

- Use **tiered data retention**
- Delete outdated, duplicate, or unnecessary data
- Move rarely used data to **lower-energy storage (tape or cold storage)**
- **Compress files** to reduce storage needs

LOCAL GOVERNMENT UNITS

Key questions for data center proposals

- What is the **scale** and **purpose** (AI? crypto mining?)
- Expected **annual energy** and **water use**
- Will **renewable energy** be used?
- What **cooling technology** will be employed?
- Water sources, wastewater volume, and discharge plans
- Energy & water efficiency measures
- Commitment to **transparent, independent monitoring**
- Backup power plans (generators, batteries)
- Spill containment (for liquid cooling)
- Noise mitigation plans

INDIVIDUALS

Everyday choices matter

- Streaming uses energy beyond your home—**turn it off** when not in use
- **HD streaming = 8× more carbon emissions** than standard definition
- Downloading frequently viewed content uses **~75% less energy** than re-streaming
- Open browser tabs continuously consume data and energy
- Cloud storage consumes **24/7 energy and water**—more than local storage

Reduce digital waste

- Think before uploading files or sharing with multiple recipients
- **Compress files** before emailing or storing
- Don't automatically include entire email threads when replying

Big Picture Takeaway

Smarter data use + better policies + sustainable infrastructure = lower environmental impact

DOVETAIL PARTNERS

Read the Report

*data sources can be found in the report

February 2026