

Data Centers and Their Energy Consumption: Frequently Asked Questions

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Summary

In its simplest form, a data center is a physical facility that houses and runs large computer systems. U.S. data center annual energy use in 2023 (not accounting for cryptocurrency) was approximately 176 terawatt-hours (TWh), approximately 4.4% of U.S. annual electricity consumption that year, according to a report by Lawrence Berkeley National Laboratory. A data center typically contains multiple computer servers, data storage devices, and network equipment that can provide information technology (IT) infrastructure service for organizations to store, manage, process, and transmit large amounts of data. Some projections show that data center energy consumption could double or triple by 2028.

Roughly one-half or greater of the electric power demand of data centers stems directly from the operation of electronic IT equipment. Much of the rest is for cooling. The operation of the IT equipment raises the temperature of the ambient room air, necessitating a cooling strategy. Centralized cooling resources are of two types: (1) those moving chilled air through large ductwork; or (2) those moving chilled water in a piped *cooling loop* that exchanges heat with the environment. An alternative

Contents

- [Introduction](#)
- [What is a data center?](#)
- [What do data centers look like?](#)
- [How have data centers been defined in federal law and guidance?](#)
- [What are the energy requirements of data centers?](#)
- [Why are data centers energy-intensive?](#)
- [What equipment uses energy in a data center?](#)
- [What contributes to the need for cooling in data centers?](#)
- [How are data centers typically cooled?](#)
- [What are some](#)

to these centralized systems is room-scale air conditioners. One type, called computer room air conditioners (CRACs), is common in smaller data centers. Exchanging the heat with the environment can happen faster with methods that directly consume water. The source of the water can be the local water utility and can also be on-site reservoirs or other colocated water resources. A study by the International Energy Agency estimates, for illustration, that a 100 megawatt U.S. data center may consume roughly 2 million liters (roughly 530,000 gallons) per day, averaged across the various cooling strategies, with 725,000 liters (roughly 190,000 gallons) per day consumed on site, or a little less than 40%.

Currently, there are no legally binding energy standards that apply explicitly to operation of data centers in the private sector. For use within the federal government, the U.S. Department of Energy has published guidance on how to optimize energy use in federal data centers. Another nonbinding program, ENERGY STAR, certifies data centers with a focus on the building and infrastructure. Since 2012 the Department of Energy has regulated the energy efficiency of CRACs, one type of cooling strategy.

The federal government has made some efforts to gather data using information collection methods suitable for later scale-up. In general, before a federal agency can begin collecting information on data centers, the agency must go through a months-long approval process under the Paperwork Reduction Act of 1995. A 2021 report by the U.S. Energy Information Administration on a pilot study of energy use in data centers surveyed 50 facilities and received 9 responses. Other options may include using data from private firms that maintain data sets that are able to provide direct or proxy information on data centers.

In 2023, a letter from five Senators and three Representatives urged the U.S. Environmental Protection Agency to use its authority under Section 114 of the Clean Air Act to implement a "mandatory disclosure regime" on cryptocurrency mining facilities. In the 119th Congress, [S. 1475](#), the Clean Cloud Act of 2025, introduced in the Senate and referred to the Committee on Public Works, would amend the Clean Air Act (42 U.S.C. §§7401 et seq.) to provide the U.S. Environmental Protection Agency and the U.S. Energy Information Administration with

[additional data center cooling strategies?](#)

- [What are some potential concerns about water consumption by data centers?](#)
- [Which, if any, federal regulations cover the energy consumption of data centers?](#)
- [How do data centers affect electricity prices?](#)
- [How can policymakers address electricity affordability concerns?](#)
- [Are there reports on the actual energy use of U.S. data centers?](#)
- [What statutory and administrative procedures apply to information collection in general?](#)
- [When collecting information about energy, what are specific considerations?](#)

Figures

- [Figure 1. Notional Power Draws of IT Equipment and Infrastructure](#)

authority to collect data and information on annual electricity consumption of data centers and cryptocurrency mining facilities.

Introduction

According to estimates produced by Lawrence Berkeley National Laboratory (LBNL), U.S. data center annual energy use in 2023 (not accounting for cryptocurrency) was approximately 176 terawatt-hours (TWh), approximately 4.4% of U.S. annual electricity consumption that year.¹ Some projections show that data center energy consumption could double or triple by 2028.² Data centers provide information technology (IT) infrastructure services for processing large amounts of data, such as for the rapidly growing field of artificial intelligence (AI). Roughly one-half or greater of the electric power demand of data centers stems directly from the operation of IT equipment. Much of the rest is for cooling.

What is a data center?

In its simplest form, a data center is a physical facility that houses and runs large computer systems. A data center typically contains multiple computer servers, data storage devices, and network equipment that can provide IT infrastructure service for organizations to store, manage, process, and transmit large amounts of data. An increasing number of private and public entities have used data centers to support their expanding IT needs, particularly as data volumes continue to grow.

Types of data centers vary based on their ownership or intended purposes. For example, a large company may choose to build, own, and operate an on-premises data center (also known as an "enterprise data center") to house and manage its own IT infrastructure.³ Other organizations, especially those lacking the space, staff, or IT resources, often choose to rent a space, equipment, or services within a colocation data center (also known as a "managed data center") owned and operated by a third-party company.⁴ Some online service providers operate geographically distributed and interconnected data centers and allow multiple users to remotely access computing resources such as data processing chips, software, data storage, networks, and applications hosted by these data centers, which are called "cloud data centers."⁵ Cloud computing service providers may also operate and maintain smaller data centers physically located closer to end users (called "edge data centers") to reduce network latency and data communication delay, speed up content distribution, optimize real-time, data-intensive workloads, and improve application performance and user experience.⁶

The increasing demand for data storage and processing capacities, especially for intensive

computational tasks such as AI development and deployment, has led to construction and operation of "hyperscale data centers" notable for their size.⁷ According to industry analysts, to be considered a hyperscale data center, a facility should contain at least 5,000 computer servers and a large scale of network equipment and occupy at least 10,000 square feet of physical space, with an electric power rating, sometimes referred to as *power draw*, exceeding 100 megawatts (MW; one megawatt is equal to 1 million watts).⁸ Roughly 100 MW of electric power is sufficient to support the electricity needs of 80,000 U.S. households.⁹

What do data centers look like?

Data centers have architectural configurations ranging from closets, to larger rooms within a single enterprise, to dedicated standalone structures serving the needs of multiple customers or tenants, known as *colocation*. *Colocation centers* are touted for their flexibility in allowing customers to specify exactly the amount of hardware and software resources they require. The largest, or "hyperscale," facilities occupy whole buildings or groups of buildings. When reporting on the number of data centers, some analysts only count whole-building data centers, which would include the hyperscale and colocation centers. The majority of computer servers are found in these latter two types of centers—74% in 2023, according to LBNL.¹⁰

How have data centers been defined in federal law and guidance?

The term *data center* has been defined in federal laws and guidance in the context of energy consumption and federal use of data centers. For instance, Section 453(a)(1) of the Energy Independence and Security Act of 2007 ([P.L. 110-140](#)) defines a data center as "any facility that primarily contains electronic equipment used to process, store, and transmit digital information, which may be (A) a free-standing structure; or (B) a facility within a larger structure, that uses environmental control equipment to maintain the proper conditions for the operation of electronic equipment."¹¹

In its guidance memorandum for federal agencies to implement the Federal Data Center Enhancement Act of 2023 (Division D, Title LIII, of [P.L. 118-31](#)), the Office of Management and Budget (OMB) specified that an agency data center covered in the memorandum (1) is composed of certain types of permanent structures and operates in a fixed location; (2) houses IT equipment, including servers and other high-performance computing devices, or data storage devices; and (3) hosts information and information systems accessed by other systems or by users on other devices.¹²

What are the energy requirements of data centers?

The Department of Energy (DOE) examined the nationwide energy consumption of data centers in response to direction by Congress in the Energy Act of 2020 (Section 1003 of Division Z, [P.L. 116-260](#)). The study, performed by LBNL, found that U.S. data center annual energy use in 2023 (not accounting for cryptocurrency) was approximately 176 terawatt-hours (TWh), approximately 4.4% of U.S. annual electricity consumption that year.¹³ An analysis by the Electric Power Research Institute (EPRI) similarly estimated that data centers consumed 4% of U.S. electricity in 2023.¹⁴ In a separate analysis, in 2024, EPRI estimated that AI consumed 10% to 20% of data center energy.¹⁵

Why are data centers energy-intensive?

Roughly one-half or greater of the electric power demand of data centers stems directly from the operation of electronic IT equipment.¹⁶ Much of the rest is for cooling. The core hardware components of a data center include computer servers, which contain computing chips (e.g., central processing unit [CPU] and graphics processing unit [GPU]), memory chips, data storage drives, and network routers and switches.¹⁷ Data from a major CPU chip manufacturer show that its data center-level CPU series in early 2025 had an average thermal design power (TDP) rating between 150 watts (W) and 350W.¹⁸ An advanced data center-level GPU can have a maximum TDP rating between 350W and 700W.¹⁹ The computing chips of CPU and GPU typically consume the most electrical power inside a server, as discussed further in "[What contributes to the need for cooling in data centers?](#)" According to an industry report published in November 2024, computing power and server systems account for roughly 40% of electricity consumption in a data center, while network and data storage equipment use about 10%.²⁰

Each piece of the electronic IT equipment generates heat as it operates. Many chipsets incorporate a safety mechanism called "thermal throttling" that reduces the chip performance to prevent overheating and protect the hardware.²¹ Data centers require cooling systems to help dissipate the heat and maintain optimal performance and overall system stability. The cooling systems could account for another 38% to 40% of electricity consumption in a data center.²² (See [Figure 1](#).)

While general-purpose workloads typically require only CPUs, GPUs are typically considered better than CPUs for handling computation-intensive processes such as AI training.²³ Under full workload conditions, a GPU performing AI training tasks may operate near its maximum capacity and draw power close to its maximum TDP over extended periods of time.

The development and deployment of state-of-the-art, large AI models may require multiple GPUs to work concurrently by distributing large volumes of data and computational tasks across the computing chips (known as "parallel computing").²⁴ A study released in December 2024 observed that, when training a large AI model using a computer system with eight

advanced GPUs for eight hours, the GPUs were near full utilization most of the time (an average of 93%) and the median amount of electrical power consumed by the chips was 7.92 kilowatts (kW; one kilowatt is equal to 1,000 watts), with a total energy consumption of 62 kilowatt-hours (kWh).²⁵

Cutting-edge chip technologies support high-speed GPU-to-GPU data communication among hundreds of GPUs across multiple servers, enabling the creation of a massive data processing cluster to support large-scale AI training but also further increasing these data centers' energy consumption. A report released in April 2025 estimated that training a specific large AI model required a total power draw of 25.3 MW and that the power required to train these models could double annually.²⁶ The report stated that "[t]he rising power consumption of AI models reflects the trend of training on increasingly larger datasets."²⁷ Another study released in May 2025 estimated that training another large AI model consumed 50 gigawatt-hours (GWh; one gigawatt-hour is equal to 1 million kilowatt-hours) of energy, "enough to power San Francisco for three days."²⁸

Multiple industry reports indicate that data processing demands of AI and related remote computing services have spurred new construction and upgrades of data centers. The computing resources hosted by these centers would, in turn, lead to increased power demand. For example, one report estimated that the computing capacity (measured by the amount of electrical power consumed by IT equipment) of data centers under construction in North America at the end of 2024 reached a record-high 6,350 MW, more than double the figure from a year earlier.²⁹ Another report indicated that new hyperscale data centers have been built with capacities from 100 MW to 1,000 MW each, "roughly equivalent to the load from 80,000 to 800,000 homes."³⁰

What equipment uses energy in a data center?

Data centers in whole building structures contain energy-consuming IT equipment, cooling and air handling equipment, and backup power supplies.³¹ The latter may include uninterruptible power supplies, backup diesel generators, and natural-gas-powered generators.³² Backup strategies involving batteries consume electricity while improving the quality of the electricity by evening out the highs and lows of the electric voltage.

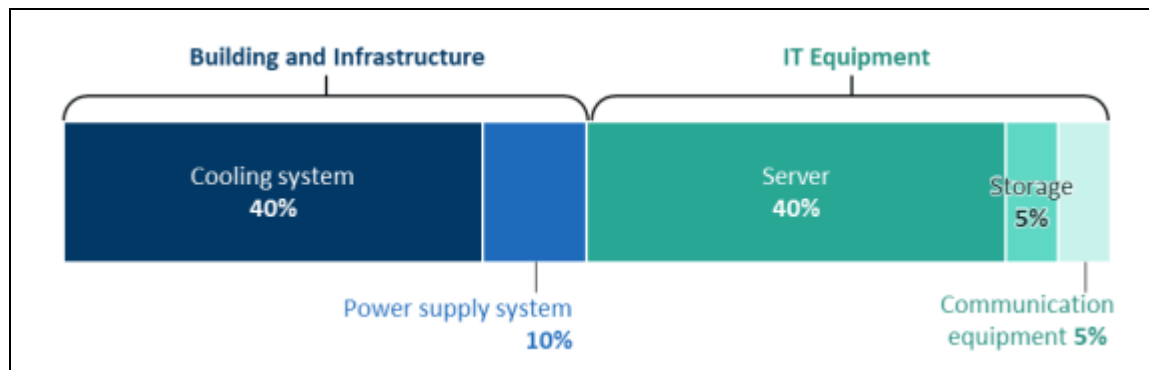
For a small data center within an office or research building, the mix of energy consumption could be roughly 50% attributable to IT physical machines and 50% attributable to cooling and power supply, according to a large industrial and energy equipment maker.³³ (See [Figure 1](#).) In addition, data centers include appliances and equipment for human occupants, not depicted in the figure. Overall, the energy use within data centers is not well described nationally, as elaborated further in ["Are there reports on the actual energy use of U.S. data centers?"](#) An expression or metric sometimes used to describe the energy performance of

data centers is *power usage effectiveness* (PUE), which is the ratio of all the power used by the data center to the power used by just the IT equipment.³⁴ For the example just discussed, the PUE would be two (2).

Discussion of IT equipment rapidly invokes terms descriptive of nonphysical entities such as clouds, virtual machines, architectures, nodes, and protocols not directly associated with a real-world energy-consuming process. Understanding the energy consumption necessitates discussing hardware (i.e., physical machines) to which energy consumption can be assigned, described below in "[What contributes to the need for cooling in data centers?](#)"

Figure 1. Notional Power Draws of IT Equipment and Infrastructure

Illustrative case with PUE = 2, consistent with data centers of <150 square feet floor space



Source: CRS, adapted from ABB, *HVAC Motors: Motors in Data Centers*, <https://new.abb.com/motors-generators/nema-low-voltage-ac-motors/hvac-motors>.

Notes: PUE = power usage effectiveness, the ratio of all power used by a data center to that used by the information technology (IT) equipment (i.e., by servers, data storage, and communication). The depicted PUE of 2 is typical of a small data center (i.e., one having less than 150 square feet of floor space), as reported in A. Shehabi et al., *2024 United States Data Center Energy Usage Report*, Lawrence Berkeley National Laboratory (LBNL), LBNL-2001637, December 2024, p. 47.

What contributes to the need for cooling in data centers?

From an electrical engineer's perspective, as computer chips of various types perform their function, the impedance of the electrical pathways generates heat, both on and between chips.³⁵ The majority of heat arises dynamically while the processors are performing useful functions. Heat-generating activities from computation take place related to, or in support of, CPU/GPU activity. Generally speaking, the energy consumption of a server scales according to the number of CPUs or GPUs.³⁶ On-chip (i.e., on the physical CPU/GPU) energy consumption includes dynamic losses associated with the basic concept of operation of a transistor, known as *switching*.³⁷ Further losses occur associated with computing chips when they access on-chip SRAM (static random access memory) and networking functions. Additional losses on-chip are due to control functions ("clock"), power, and leakage current.³⁸ Off-chip energy can be lost when electricity moves between the computing chip (CPU/GPU)

and a separate memory chip. The time needed for very large transmission of data between separate chips, as in the last example, is known as the *memory wall* or *memory bottleneck*.

Unlike in a desktop computer, the activity rates of chips in a data center can be extremely high, and this activity rate increases the cooling needs as the hot equipment raises the temperature of the ambient air. The more common cooling strategies treat and condition this ambient air by lowering its temperature and humidity.

Historically the amount of computing power per watt has improved significantly. The move to multi-core processing at the turn of the millennium lowered the heat produced for the same amount of computing power.³⁹ According to Nvidia, as reported in October 2024, the prior 10 years had seen a 4,000-fold improvement in its GPU's computational performance per watt of power.⁴⁰ More conservatively, the International Energy Agency estimates the change in AI GPU performance per watt to have improved 100-fold or greater between 2008 and 2023.⁴¹

How are data centers typically cooled?

The operation of the IT equipment raises the temperature of the ambient room air, necessitating a cooling strategy. Generally speaking, the cooling strategies for IT equipment differ from cooling needed for personal comfort, with computer servers tolerant of higher temperatures but requiring lower humidity.⁴² Federal guidelines and research advise using large centralized cooling resources for data centers.⁴³ There are two types of centralized cooling resources: (1) those moving air through large ductwork to deliver chilled air and remove warm air; or (2) those moving water or other heat transfer fluid through a piped *cooling loop* that exchanges heat with the environment. The centralized cooling resources achieve higher efficiency at the larger scale. Those of the first type, which moves air, can improve their energy efficiency by utilizing variable speed fans.⁴⁴ Though less common, these methods can, if required, be used to heat the interior of the data center using air-ducted or looped strategies (i.e., strategies that use heat transfer fluids).

An alternative to these centralized systems is room-scale air conditioners. One type, called computer room air conditioners (CRACs), is common in smaller data centers.⁴⁵ With CRACs, the air is looped and filtered within the room but the heat is sent outside the building using refrigerant or other fluid.⁴⁶

The above methods rely on a sequence in which computing equipment first heats the room air, after which the cooling system accepts heat from the room air, either moving a heated fluid outside, where the heat is returned to the environment, or removing the air itself and replacing it with cooled return air. Exchanging the heat with the environment can happen faster with methods that involve water.

What are some additional data center cooling strategies?

High-performance computing (HPC)^{[47](#)} equipment has necessitated cooling methods that are thermodynamically closer to the chips and intercept the energy before it has substantially raised the room air temperature. These *direct liquid cooling* technologies can address the higher power of HPC.

Another option that may be used during shoulder season (i.e., spring and fall in temperate climates) or winter, known as *free cooling*, imports water chilled passively by environmental conditions. Compared with methods involving conventional *mechanical cooling* that use powered compressors, free cooling is relatively inexpensive. Optimizing the cooling of the data center will generally involve some combination of methods.

Facilities with substantial cooling needs sometimes employ thermal storage. The National Institutes of Health, for example, has a large chilled water storage facility at its Bethesda, MD, campus.^{[48](#)} The thermal storage system operates by drawing down the chilled water reservoir during periods of intense cooling requirements and replenishing the reservoir during off-peak hours.

What are some potential concerns about water consumption by data centers?

A study by the International Energy Agency estimates, for illustration, that a 100 MW U.S. data center may consume roughly 2 million liters (roughly 530,000 gallons) per day, averaged across the various cooling strategies, with 725,000 liters (roughly 190,000 gallons) per day consumed on site, or a little less than 40%.^{[49](#)}

Of the various cooling strategies to return heat to the environment, those that include cooling towers accelerate the rate of heat transfer by spraying water onto surfaces in the cooling tower. The water evaporates to provide cooling and must constantly be replenished. According to one vendor, water-cooled systems may use as little as one-half the electric power of air-cooled systems.^{[50](#)} The source of the cooling water can be the local water utility. A city in Oregon reported that nearly 30% of the city's water consumption was attributable to Google data centers, which had tripled water consumption over a five-year period.^{[51](#)} The source of water can also be on-site reservoirs or other colocated water resources.^{[52](#)} Data centers of smaller size within an office building might only incrementally increase direct water use.

There are two principal sources of water demand from cooling towers. One of the sources of demand is the sprayed-on cooling water just noted. Another operation, known as *blowdown*, uses water to flush out hard scale that can build up on surfaces in the cooling tower when sprayed-on water evaporates and leaves behind solid material.^{[53](#)} By one estimate, most of the wastewater produced at a data center is from blowdown.^{[54](#)}

Which, if any, federal regulations cover the energy consumption of data centers?

DOE has published guidance on how to optimize energy use in data centers used by the federal government.^{[55](#)} Currently there are no legally binding energy standards that apply explicitly to operation of data centers in the private sector.^{[56](#)} The ENERGY STAR program, a voluntary labeling program, certifies data centers with a focus on the energy efficiency of data centers' buildings and infrastructure.^{[57](#)} ENERGY STAR uses a calculation method that effectively removes the consumption of the IT equipment, attributing energy use only to that of a *powered shell* (the building and its electricity).^{[58](#)} ENERGY STAR gives a rating based on the performance of the powered shell of the building and rates this against that of similar buildings. The program has certified nearly 300 data centers, with all but one having greater than 10,000 square feet total floor area.^{[59](#)}

ENERGY STAR also certifies products found in data centers such as enterprise scale servers, uninterruptible power supplies, memory storage, and networking equipment.^{[60](#)}

Since 2012, DOE has regulated the energy efficiency of CRACs.^{[61](#)} The regulatory program is authorized by the Energy Policy and Conservation Act, as amended (EPCA; 42 U.S.C. §§6291 et seq.). The standards apply to units at the time they are shipped by manufacturers; the manufacturer is responsible for compliance.^{[62](#)}

How do data centers affect electricity prices?

The price (rate) that customers pay for electricity is determined primarily by two factors: the cost of producing electricity (generation) and the cost of delivering electricity to customers through the grid (transmission and distribution).^{[63](#)} Utility regulators at the state or local level approve rates that reflect a utility's cost for these components. Rates typically change every few years in response to shifts in utility costs over time. For example, if a utility invests in a new power plant or in upgrades to the grid, rates might need to change to reflect those capital investments. Utility sales also affect rates. When sales increase, a utility earns more revenue; conversely, when sales decrease, a utility earns less revenue. If a utility's revenue is less than its costs, rates might need to increase to compensate. Similarly, if a utility's revenue exceeds its costs, regulators might lower rates.

Data center electricity demand could potentially affect electricity rates if that demand led to a meaningful change in the local utility's costs or sales (or both). If a utility built new infrastructure to accommodate data center demand, the utility might raise rates to recover the cost. Alternatively, if a utility had sufficient existing infrastructure to accommodate data center demand, the increased sales might lead the utility to reduce rates.

Researchers at LBNL led an analysis providing insights on the extent to which data centers and other drivers have affected retail electricity prices.⁶⁴ Their analysis focused on the years 2019 through 2025. They found that the main driver behind increases in electricity prices during this period was utility investments in grid infrastructure, mostly in response to aging infrastructure and resilience needs. Other key drivers included natural gas prices, recovery from natural disasters (e.g., storms, wildfires), and state energy and environmental policies. In other words, this analysis did not identify data centers as major influencers of electricity prices in most areas of the country between 2019 and 2025.

The LBNL analysis further investigated the relationship between electricity demand growth (including demand growth due to data centers) and prices. The analysis found that states with the largest data center demand growth generally saw electricity price decreases between 2019 and 2025, though some states with relatively large data center growth saw price increases or little change.⁶⁵ One explanation for this finding may be that increased demand in some states allowed utility costs to be spread over a larger sales volume, putting downward pressure on rates. Whether that relationship holds in those states moving forward remains to be seen.

How can policymakers address electricity affordability concerns?

Electricity consumers typically notice their monthly bill, not their electricity rate. Customers' electricity bills are determined primarily as the product of electricity rates and electricity consumption. Some policy options primarily impact rates while other options primarily impact consumption.

State and local utility regulators can use policies to attempt to isolate the rate impact of utility capital investment to data centers, thereby reducing any potential rate impacts for other customers.⁶⁶ This approach typically involves establishing new electricity customer classes for data centers or other large electricity consumers with similar demand profiles. The number of utilities with data center-specific policies is increasing as utility regulators around the country address affordability concerns associated with data center development.⁶⁷

Another set of policy options primarily impacting rates relates to infrastructure development. As noted in the previous section, areas of the country with grid constraints due to insufficient infrastructure are more likely to experience rate increases from new data center demand. Electricity infrastructure is subject to a combination of federal, state, and local permitting processes. Numerous proposals have been introduced in the 119th Congress with the goal of speeding the pace of infrastructure development. For additional discussion, see CRS Report R48762, [Data Center Energy Infrastructure: Federal Permit Requirements](#), by Paul W. Parfomak et al., and CRS Report R47627, [Electricity Transmission Permitting Reform: Issues and Legislative Proposals](#), by Ashley J. Lawson. Additionally, federal tax policy has

historically affected utility costs for new power plants, primarily by providing tax credits to developers of power plants with low greenhouse gas emissions. The 119th Congress modified this policy. For additional discussion, see CRS Insight IN12624, [IRA Tax Credit Repeal in the FY2025 Reconciliation Law: Part 1](#), by Nicholas E. Buffie.

Policies aimed at increasing energy conservation and energy efficiency can reduce energy consumption, thereby lowering consumers' bills without necessarily affecting electricity rates. Federal policy has historically promoted energy efficiency improvements through grant programs and tax credits. States and utilities also frequently adopt policies promoting efficiency and conservation. For additional discussion of selected federal programs, see CRS Report R46418, [The Weatherization Assistance Program Formula](#), by Corrie E. Clark and Lynn J. Cunningham, and CRS Insight IN12625, [IRA Tax Credit Repeal in the FY2025 Reconciliation Law: Part 2](#), by Nicholas E. Buffie.⁶⁸

One consideration about these policies is the time period over which they can affect customers' bills. Energy efficiency and conservation tend to have immediate impacts—electricity consumption decreases as soon as an efficiency or conservation measure is in place. Policies focused on infrastructure, in contrast, could take several years to affect rates because of the time it takes to develop new electricity infrastructure.

Are there reports on the actual energy use of U.S. data centers?

Owing to recent interest in the energy use of data centers, the federal government has begun data collection to assess data centers' scope and scale and, ultimately, their impacts on energy demand and natural resources. Congress, through oversight and legislative activity, has shown interest in the results of data collection and in expanding the federal government's authority to collect the data.⁶⁹ As noted, the federal government has made some efforts to gather data using information collection methods suitable for later scale-up.⁷⁰ The Energy Information Administration (EIA) has conducted two data collection activities, but these were limited by sample size or were curtailed. A 2021 EIA pilot study of energy use in data centers surveyed 50 facilities and received 9 responses; other responses either were not received, were incomplete, or were not facilities matching the criteria for data centers. EIA noted significant obstacles to collecting the data.⁷¹ EIA focused on facilities of greater than 50,000 square feet as most likely to be whole-building data centers.⁷²

In 2024, EIA attempted to collect information focused on cryptocurrency mining data centers. EIA began its survey with emergency approval under a provision of the Paperwork Reduction Act of 1995 (PRA).⁷³ The collection was challenged in the U.S. District Court for the Western District of Texas by a trade association focused on blockchain and cryptocurrency technologies and a Bitcoin mining company. These plaintiffs made several allegations against the government, including that the PRA's emergency approval provision was

improperly used by EIA, that OMB's conditions for approving the collection violated the PRA,⁷⁴ and that OMB violated the Administrative Procedure Act (5 U.S.C. §551 et seq.) by arbitrarily and capriciously approving an information collection that did not follow the PRA's procedures.⁷⁵ The court issued a temporary restraining order, noting the allegations of harm made by plaintiffs, including the legal penalties for not responding to the EIA survey,⁷⁶ the costs of complying with the survey, and the disclosure of proprietary information requested by EIA through the survey.⁷⁷ Following the temporary restraining order, EIA, OMB, and plaintiffs reached and filed an agreement with the district court, resulting in an end to EIA's data collection and EIA agreeing to destroy any data collected up to that point.⁷⁸

[S. 1475](#), the Clean Cloud Act of 2025, introduced in the Senate and referred to the Committee on Environment and Public Works, would amend the Clean Air Act (42 U.S.C. §§7401 et seq.) to provide the U.S. Environmental Protection Agency (EPA) and EIA with authority to collect data and information on annual energy consumption of the data center or cryptocurrency mining facility, the provider of the electricity, any power purchase agreements, and related topics.

In 2023, a letter from five Senators and three Representatives urged EPA to use its authority under Section 114 of the Clean Air Act to implement a "mandatory disclosure regime" on cryptocurrency mining facilities.⁷⁹ The letter asserted that some such facilities would emit greater than the 25,000-ton threshold of carbon dioxide equivalent of greenhouse gases per year necessary to invoke Section 114, an authority that allows EPA to request information from emission source categories for regulatory development or enforcement and for other purposes.⁸⁰

What statutory and administrative procedures apply to information collection in general?

When an executive branch agency collects information or data from the public, the agency typically must comply with the Paperwork Reduction Act of 1995.⁸¹ The PRA governs the *collection of information*.⁸² The purpose of the PRA is to balance the government's need for information with the burden imposed on the public to produce and supply that information.⁸³ Information collections include, but are not limited to, reporting or recordkeeping requirements, surveys, public disclosure requirements, and collections that use an electronic or paper form.⁸⁴

Before an agency can collect information from the public, the PRA requires approval by OMB.⁸⁵ OMB's approval is required regardless of whether the agency's information collection is mandatory (e.g., required by law) or voluntary.⁸⁶ Information collections conducted in association with a rule are also subject to OMB's approval.⁸⁷

The process for obtaining approval of an information collection—known in practice as the

clearance process—includes two public notice-and-comment periods. The first period is 60 days,⁸⁸ during which time agencies are required to solicit the public's input on certain topics, including the *practical utility*, or usefulness, of the information to the agency,⁸⁹ and the accuracy of the agency's *burden* estimate, or the amount of time and resources that is expected to be expended by the public to generate, provide, or maintain the information for or to an agency.⁹⁰ A subsequent notice-and-comment period of at least 30 days occurs when the agency submits the information collection request to OMB for approval.⁹¹

After receiving the information collection request from the agency and after the 30-day public comment period has lapsed, OMB has up to another 30 days to make a decision on whether to approve the information collection.⁹² Thus, under the PRA, an agency is expected to spend at least 90 days and up to 120 days going through the clearance process. In practice, the total amount of time spent by an agency is often much longer because internal agency processes extend the timeline beyond what is specified in statute.

OMB can approve an information collection for no more than three years.⁹³ When approval of an information collection expires, an agency that wants to continue collecting the information must go through the clearance process again and obtain OMB's approval.⁹⁴

As mentioned above, EIA obtained approval from OMB to collect data on cryptocurrency mining data centers under the PRA's emergency authorization provision, which was challenged in U.S. district court.⁹⁵ This provision of the PRA permits an agency in certain specified circumstances to seek OMB's approval to conduct an information collection on a temporary basis (not to exceed 180 days) without complying with the processes usually required under the PRA.⁹⁶ In the district court case brought against EIA, the plaintiffs alleged that EIA's burden estimate was underestimated and that EIA failed to take steps to minimize burden by not consulting with the public as required by OMB in its regulations implementing the PRA.⁹⁷

When collecting information about energy, what are specific considerations?

There may be additional considerations beyond the PRA when it comes to the collection of information on data centers' energy use. For example, the Energy Supply and Environmental Coordination Act of 1974 (ESECA; [P.L. 93-319](#)) includes an enforcement provision that imposes civil monetary penalties on business entities that do not report *energy information* sought under the information collection authorities of the Federal Energy Administrator.⁹⁸ The possibility of these civil monetary policies were part of the case brought against EIA when it attempted to survey cryptomining facilities in 2024, as discussed above.⁹⁹ The administrator's information collection authority contained in ESECA is "in addition to, independent of, not limited by, and not in limitation of, any other authority of the Federal

Energy Administrator." Thus, while providing information is anticipated to impose some cost under the PRA because of its conceptualization of paperwork burden, additional costs are also possible for those that might be subject to reporting energy information under ESECA. Other laws establishing an agency's information collection authority might also have an enforcement mechanism, which might be viewed as increasing the stakes around collecting information in these circumstances.

In developing legislation addressing the collection of information about energy usage, Congress may also give further consideration to which entities would be providing information. For example, private firms maintain data sets that can provide direct or proxy information on data centers. Cushman & Wakefield, a real estate firm with a specialty in data centers, and Baxtel, a real estate and marketing firm that provides specialized services for data center owners, issue reports on the population of data centers and their electric power requirements in the United States. Obtaining data from these private firms may be one option.

Another option may be to obtain data from primary sources. While EIA previously attempted to collect data directly from cryptomining facilities, the Clean Cloud Act of 2025 would require the collection of information from three different sources: data centers, cryptomining facilities, and the electric utilities that serve data centers and cryptomining facilities. Academic research has found differences in the accuracy and reliability of data centers' energy consumption estimates because of differences in the methods used by the different sources of the estimates.¹⁰⁰ The authors of the study find that these estimates are then used by others in subsequent research, and the authors argue that these data quality issues could undermine the research that subsequently uses these estimates.¹⁰¹

One possible policy implication that follows from the aforementioned study is that how information is collected could have consequences for the subsequent uses of that information, including the extent to which it can be used as an authoritative source to inform federal energy policy or regulation. In other words, how statute directs the collection of information on data centers' energy use, or how an agency designs its collection of information on such energy use, may influence the extent to which such collected data can then be used to reliably serve certain purposes. The data, for example, may be not be generalizable, may be incomplete (e.g., certain information is missing or underreported), inaccurate (e.g., certain information is underestimated or overestimated), or otherwise limited in its usefulness because of circumstances that occurred during data collection.

The use of data collected by federal agencies on energy use is not necessarily without consequence or significance. The Clean Cloud Act of 2025 would establish that the information collected under it shall be used for fee setting. Additionally, compliance with a certain provision of the Clean Cloud Act of 2025 is to be monitored by the EPA, in conjunction with EIA, using "the best available data," including the information collected

under the bill.

The Clean Cloud Act of 2025 would also require certain data collected under it to be made publicly available. Some researchers argue that it is insufficient and possibly ineffective for policymakers to establish data policy regimes that are primarily concerned with information disclosure (e.g., making certain data from regulated entities publicly available in databases, repositories, or similar searchable publications and websites).¹⁰² Instead, it is argued that policymakers should focus on the broader goals of a "data stewardship" regime. Data stewardship would aim to maximize data quality and usability—alongside information disclosure and making data publicly available—by ensuring the reliability, accuracy, and fairness of data collected, so that the data can serve regulatory needs and the various ends and goals of stakeholders and data users.¹⁰³

Another potential consideration is that the Information Quality Act (IQA) required OMB to develop government-wide guidelines for information and data quality.¹⁰⁴ In implementing the IQA, OMB acknowledged that certain information developed or made publicly available by agencies should be held to a higher quality standard because it is more important and influential, and that increasing data quality has costs and benefits.¹⁰⁵

Mari Lee prepared the graphic.

Footnotes

1. A. Shehabi et al., *2024 United States Data Center Energy Usage Report*, Lawrence Berkeley National Laboratory (LBNL), LBNL-2001637, December 2024, p. 5. While cryptocurrency is one type of service supported by data centers, not all studies of energy consumption of data centers touch on energy usage related to cryptocurrency. The report noted that its calculations assumed that data centers would operate consistently with how they were commissioned and designed but that results may differ.
2. Shehabi et al., *2024 United States Data Center Energy Usage Report* (LBNL report), p. 6. Does not include energy use related to cryptocurrency.
3. Equinix, "What Is a Data Center? What Are Different Types of Data Centers?," August 1, 2024, <https://blog.equinix.com/blog/2022/10/13/what-is-a-data-center-what-are-different-types-of-data-centers/>.
4. Stephanie Susnjara and Ian Smalley, "What Is a Data Center?," IBM, September 4, 2024, <https://www.ibm.com/think/topics/data-centers>.
5. Cisco, "What Is a Data Center?," <https://www.cisco.com/c/en/us/solutions/data-center-virtualization/what-is-a-data-center.html#~infrastructure-evolution>.
6. Susnjara and Smalley, "What Is a Data Center?"

7. Phill Powell and Ian Smalley, "What Is a Hyperscale Data Center?," IBM, March 21, 2024, <https://www.ibm.com/think/topics/hyperscale-data-center>.
8. Powell and Smalley, "What Is a Hyperscale Data Center?" See also VIAVI Solutions, "What Is a Hyperscale Data Center?," <https://www.viavisolutions.com/en-us/resources/learning-center/what-hyperscale-data-center>.
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10. Shehabi et al., *2024 United States Data Center Energy Usage Report* (LBNL report), p. 37.
11. 42 U.S.C. §17112(a)(1).
12. Office of Management and Budget (OMB), *Implementation Guidance for the Federal Data Center Enhancement Act*, M-25-03, January 14, 2025, p. 2, https://bidenwhitehouse.archives.gov/wp-content/uploads/2025/01/M-25-03_Implementation-Guidance-for-the-Federal-Data-Center-Enhancement-Act.pdf.
13. Shehabi et al., *2024 United States Data Center Energy Usage Report* (LBNL report), p. 5.
14. See Figure ES-1 of Electric Power Research Institute (EPRI), *Powering Data Centers: U.S. Energy System and Emissions Impacts of Growing Loads*, October 2024, p. 3, <https://www.epri.com/research/products/000000003002031198>.
15. EPRI, *Powering Data Centers*, p. 7.
16. Shehabi et al., *2024 United States Data Center Energy Usage Report* (LBNL report), p. 47.
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18. Intel, "Intel Xeon 6 Processors," <https://www.intel.com/content/www/us/en/products/details/processors/xeon.html>. Intel defines *thermal design power* (TDP) as "the average power, in watts, the processor dissipates when operating at Base Frequency with all cores active, under an Intel-defined, high-complexity workload." Intel, "11th Gen Intel® Core™ Mobile Processor Technical Specifications," <https://edc.intel.com/preview/content/www/us/en/products/performance/benchmarks/11th-gen-intel-core-mobile-processor-technical-specifications/>.

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25. Latif et al., "Empirical Measurements of AI Training Power Demand on a GPU-Accelerated Node," p. 10.
26. Nestor Maslej et al., *The Artificial Intelligence Index Report 2025*, Institute for Human-Centered Artificial Intelligence, Stanford University, April 2025, p. 72, <https://hai.stanford.edu/ai-index/2025-ai-index-report>.
27. Maslej et al., *AI Index Report 2025*, p. 72.
28. James O'Donnell and Casey Crownhart, "We Did the Math on AI's Energy Footprint. Here's The Story You Haven't Heard," *MIT Technology Review*, May 20, 2025.
29. CBRE, "North America Data Center Trends H2 2024: Surging Demand Drives Record New Data Center Development," February 26, 2025, <https://www.cbre.com/insights/reports/north-america-data-center-trends-h2-2024>.
30. EPRI, *Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption*, May 28, 2024, p. 2.
31. These non-IT components may be termed "infrastructure" for purpose of energy tracking. A. Shehabi et al., "Data Center Growth in the United States: Decoupling the Demand for Services from Electricity Use," *Environmental Research Letters*, vol. 13 (2018), p. 124030. Whole-building data centers are described elsewhere in the present

report.

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33. ABB, *HVAC Motors: Motors in Data Centers*, <https://new.abb.com/motors-generators/nema-low-voltage-ac-motors/hvac-motors>.
34. The Green Grid, *PUE: A Comprehensive Examination of the Metric*, White Paper #49, 2012; and N. Casale, "Data Centers: Where and How Should PUE Be Improved?," *ASHRAE Journal*, vol. 63, no. 6 (June 2021).
35. Servers, named after today's client-server architecture, may include chips for computing, memory, and networking.
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Equipment: Certain Categories of Commercial Air Conditioning and Heating Equipment, August 2019, p. 2-1.

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50. ABB, *HVAC Motors: Motors in Data Centers*, <https://ibtinc.com/wp-content/uploads/2024/05/Brochure-Motors-in-data-centers.pdf>.
51. M. Rogoway, "Google's Water Use Is Soaring in The Dalles, Records Show, with Two More Data Centers to Come," *Oregonian*, February 22, 2023. The city agreed to report "total of all water meter readings" for the operator of the data center. Data released by the city in 2025 shows total water disposition was 355 million gallons attributed to Google of the city's 1.232 billion gallons (i.e., 29% was attributed to Google). April Ehrlich, "The Dalles' Mayor Called OPB's Data Center Story Inaccurate. Here Are the Facts," Oregon Public Broadcasting (OPB), January 23, 2026.
52. R. Miller, "Alligator Patrols Google's Data Center," *DataCenter Knowledge*, December 13, 2012, <https://www.datacenterknowledge.com/hyperscalers/alligator-patrols-google-s-data-center>.
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54. DOE FEMP, "Best Management Practice #10: Cooling Tower Management," <https://www.energy.gov/femp/best-management-practice-10-cooling-tower-management>.
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57. For further information on ENERGY STAR, see CRS In Focus IF10753, [ENERGY STAR Program](#), by Corrie E. Clark.
58. ENERGY STAR, *Data Center Estimates in the United States and Canada*, August 2023, p. 1, https://www.energystar.gov/sites/default/files/tools/Data_Center_Estimates_August_2018_EN%20-%20508%20Blue.pdf. The whole-building certification by ENERGY STAR's computation tool, Portfolio Manager, takes account of electricity and natural gas used on site and calculates an energy use intensity (energy per floor area) that includes the energy needed to generate and deliver the electricity and to deliver the natural gas.
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66. Such retail rate policies are outside federal jurisdiction, pursuant to the Federal Power Act (16 U.S.C. §§791 *et seq.*). For additional discussion, see CRS In Focus IF11411, [The Legal Framework of the Federal Power Act](#), by Adam Vann.
67. See, for example, Natalie Mims Frick and Long Lam, "Large Loads: Interconnection, Tariff Designs, and State Actions," LBNL and the Brattle Group, September 2025, <https://www.brattle.com/wp-content/uploads/2025/09/Large-Loads-Interconnection-Tariff-Designs-and-State-Actions.pdf>; and Smart Electric Power Alliance and NC Clean Energy Technology Center, "Database of Emerging Large-Load Tariffs (DELTA)," <https://sepapower.org/large-load-tariffs-database/>.
68. CRS Insight IN12625, [IRA Tax Credit Repeal in the FY2025 Reconciliation Law: Part 2](#), by Nicholas E. Buffie.
69. See, for example, [S. 1475](#), Clean Cloud Act of 2025; [H.R. 6984](#), Data Center Transparency Act; [H.R. 7858](#), Data Center Community Impact Act; and Letter from Sens. Warren, Whitehouse, Markey, Merkley, and Durbin and Reps. Huffman, Tlaib, and Porter to Michael Regan, Administrator, U.S. Environmental Protection Agency, and Jennifer Granholm, Secretary, Department of Energy, February 6, 2023. In the 118th Congress, see [S. 3732](#), Artificial Intelligence Environmental Impacts Act of 2024.
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71. EIA, *2018 CBECS Data Center Pilot*, p. 2.
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73. 44 U.S.C. §3507(j).
74. The role of OMB in approving an agency's information collection, including surveys, is discussed below in "[What statutory and administrative procedures apply to information collection in general?](#)"
75. Verified Complaint for Declaratory and Injunctive Relief, Tex. Blockchain Council v. Dep't of Energy, No. 6:24-cv-99 (W.D. Tex., February 22, 2024), ECF No. 1.
76. Plaintiffs cited 15 U.S.C. §797(a-b) in their complaint as the legal authority for the possible imposition of these penalties, and cited to 10 C.F.R. §207.7(c)(1) for the maximum civil penalty amount that could be imposed for a violation. At the time of the complaint, the maximum penalty was \$12,937 per violation (see 89 *Federal Register* 1027). The amount is adjusted for inflation pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990 ([P.L. 101-410](#)), as amended by the Federal Civil Penalties Inflation Adjustment Act Improvements Act of 2015 ([P.L. 114-74](#), Title VII, §701 (129 Stat. 599)).

- [77.](#) Order Granting Plaintiffs' Motion for Temporary Restraining Order, Tex. Blockchain Council v. Dep't of Energy, No. 6:24-cv-99 (W.D. Tex., February 23, 2024), ECF No. 13.
- [78.](#) Notice of Agreement, Tex. Blockchain Council v. Dep't of Energy, No. 6:24-cv-99 (W.D. Tex., March 1, 2024), ECF No. 24.
- [79.](#) Letter from Sens. Warren, Whitehouse, Markey, Merkley, and Durbin and Reps. Huffman, Tlaib, and Porter to Michael Regan, Administrator, U.S. Environmental Protection Agency, and Jennifer Granholm, Secretary, Department of Energy, February 6, 2023.
- [80.](#) 42 U.S.C. §7414.
- [81.](#) [P.L. 104-13](#); codified at 44 U.S.C. §§3501-3521.
- [82.](#) A *collection of information* "means the obtaining, causing to be obtained, soliciting, or requiring the disclosure to third parties or the public, of facts or opinions by or for an agency, regardless of form or format, calling for either (i) answers to identical questions posed to, or identical reporting or recordkeeping requirements imposed on, ten or more persons, other than agencies, instrumentalities, or employees of the United States; or (ii) answers to questions posed to agencies, instrumentalities, or employees of the United States which are to be used for general statistical purpose" (44 U.S.C. §3502(3)). For a more complete overview of the Paperwork Reduction Act's (PRA's) information collection requirements, see CRS In Focus IF11837, [The Paperwork Reduction Act and Federal Collections of Information: A Brief Overview](#), by Maeve P. Carey and Natalie R. Ortiz.
- [83.](#) 44 U.S.C. §3501.
- [84.](#) 5 C.F.R. §1320.3(c)(1).
- [85.](#) 44 U.S.C. §3507(a)(2).
- [86.](#) 5 C.F.R. §1320.3(c).
- [87.](#) 44 U.S.C. §3507(d). See also 5 C.F.R. §1320.11 and §1320.12.
- [88.](#) 44 U.S.C. §3506(c)(2)(A).
- [89.](#) 44 U.S.C. §3502(11).
- [90.](#) 44 U.S.C. §3502(2). For a more complete discussion of burden under the PRA, see CRS In Focus IF12673, [Burden and the Paperwork Reduction Act: An Overview](#), by Natalie R. Ortiz.
- [91.](#) 44 U.S.C. §3507(b).
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- [93.](#) 44 U.S.C. §3507(g).
- [94.](#) Memorandum from Cass R. Sunstein, Administrator, Office of Information and Regulatory Affairs, to the heads of executive departments and agencies, and

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- [95.](#) See footnote 73 and accompanying text.
- [96.](#) 44 U.S.C. §3507(j). While statute permits an agency to avoid the clearance process for emergency processing and authorization, OMB's regulations implementing the PRA state that an agency shall "set forth in the Federal Register" the notice typically required unless waived or modified (5 C.F.R. §1320.13(d)). While statute permits OMB to provide emergency authorization of an information collection for a maximum of 180 days, OMB's regulations state that its approval is valid for a maximum of 90 days (5 C.F.R. §1320.13(f)).
- [97.](#) See the requirements for consult at 5 C.F.R. §1320.13(c).
- [98.](#) 15 U.S.C. §797 ([P.L. 93-319](#), §12 (88 Stat. 264)). The functions of the Federal Energy Administrator were transferred to the U.S. Energy Information Administration when EIA was established in 1977. For additional information, see CRS Report R46524, [The U.S. Energy Information Administration](#), coordinated by Ashley J. Lawson.
- [99.](#) See footnote [73](#) and accompanying text.
- [100.](#) David Mytton and Masaō Ashtine, "Sources of Data Center Energy Estimates: A Comprehensive Review," *Joule*, vol. 6, no. 9 (September 2022), pp. 2032-2056.
- [101.](#) See also the discussion about data gaps and analytical errors in research on the environmental impacts of information technology (IT) in Jonathan Koomey and Eric Masanet, "Does Not Compute: Avoiding Pitfalls Assessing the Internet's Energy and Carbon Impacts," *Joule*, vol. 5 no. 7 (July 2021), p. 1626. These authors argue, "A recurrent theme is that well-intentioned research often overestimates IT's electricity use and climate impacts, sometimes by orders of magnitude. These results then become 'factoids' that spread quickly as people share them and the media report them" (p. 1625).
- [102.](#) Nathan Cortez, "Regulation by Database," *University of Colorado Law Review*, vol. 89, no. 1 (2018), pp. 28-37. Hereinafter cited as "Cortez, "Regulation by Database."
- [103.](#) Cortez, "Regulation by Database," pp. 69-91.
- [104.](#) [P.L. 106-554](#), Appendix C, §515 (114 Stat. 2763A-153).
- [105.](#) OMB, "Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies; Republication," 67 *Federal Register* 8452-8453, February 22, 2002, <https://www.federalregister.gov/documents/2002/02/22/R2-59/guidelines-for-ensuring-and-maximizing-the-quality-objectivity-utility-and-integrity-of-information>.

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