DATA CENTER RESOURCE CONSUMPTION, POLICY PRIORITIES, AND REGULATORY INTERVENTION

by Owen Curtin

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> The perennial question is whether data infrastructure—the economies they support and the capital they generate—will materially benefit local people in any equitable way, especially balanced against visible damages to the environment.
>
> —Patrick Brodie, 2023[1]

Beverly Morris, a retired woman living outside Atlanta, Georgia, carries a bucket of water to the bathroom. The water pressure in her home is too low for the toilet to flush on its own. She fills the bucket from a five-gallon jug in her kitchen, skeptical of what flows from her own pipes.[2] Morris did not used to live this way. Back in 2016, when she bought the house, the pipes worked and water quality never crossed her mind. That was before Meta built a data center about 400 yards from her home. After the construction, Morris noticed the well feeding her house did not provide the same pressure. She also feared it was contaminated (though Meta tested the water quality and reported nothing abnormal).[3]

Some 600 miles north, in Loudoun County, Virginia—the most concentrated hub of data center development in the world[4]—there are reports that the level of groundwater pumping is unsustainable and increasing.[5] Roughly 2,000 miles southwest in Tucson, Arizona, residents voted down a resolution to sell land for development of a data center earlier last year.[6] Concerns over depleted groundwater and higher energy prices were the main drivers of the vote.

As artificial intelligence (AI) attracts unprecedented investment—with projections suggesting AI infrastructure spending could reach $1 trillion globally[7] by 2027—data centers have become the physical scaffolding of the digital economy. These warehouse-like facilities, packed with computers that support everything from cloud storage to generative AI models, are extraordinarily resource-intensive. A single large data center can consume as much electricity as a small city and use millions of gallons of water daily.[8]

The promises of tax revenue, jobs, and technological prestige make data centers attractive to local governments.[9] For many municipalities, the promise of consistent tax revenue from an industry with little overt pollution is an attractive prospect.[10] Partnerships with data centers ideally lower overall tax burdens on residents while ensuring the reliability of digital services.

However, data centers can inadvertently drive up electricity prices for residential ratepayers as utilities build new generation capacity to meet demand.[11] They can strain aging electrical grids designed for different use patterns.[12] Data centers also compete with residential users and agriculture for finite water resources, particularly in water-stressed regions. Meanwhile, operators of these facilities

1. Patrick Brodie, *Data Infrastructure Studies on an Unequal Planet*, 10 Big Data & Soc'y 20539517231182402 (2023), https://doi.org/10.1177/20539517231182402.
2. Michelle Fleury & Nathalie Jimenez, *"I Can't Drink the Water"—Life Next to a U.S. Data Centre*, BBC News (July 10, 2025), https://www.bbc.com/news/articles/cy8gy7lv448o.
3. *Id.*
4. Dakin Campbell et al., *Satellite Images Show How Data Centers Are Changing America's Landscape*, Bus. Insider (Oct. 17, 2025), https://www.businessinsider.com/satellite-images-show-how-data-centers-changing-american-landscape.
5. Norman K. Styer, *Loudoun Groundwater Study Raises Concerns About Long-Term Sustainability*, LoudounNow (Oct. 7, 2025), https://www.loudounnow.com/news/loudoun-groundwater-study-raises-concerns-about-long-term-sustainability/article_10638d19-8f5e-4c33-a316-e40ce5314d63.html.
6. J.D. Wallace, *Tucson City Council Votes to End Project Blue*, KOLD (Aug. 6, 2025), https://www.kold.com/2025/08/06/city-council-votes-end-project-blue/.
7. Bhargs Srivathsan et al., *AI Power: Expanding Data Center Capacity to Meet Growing Demand*, McKinsey & Co. (Oct. 29, 2024), https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights.
8. Nuoa Lei et al., *The Water Use of Data Center Workloads: A Review and Assessment of Key Determinants*, 219 Res., Conservation & Recycling 108310 (2025), https://www.sciencedirect.com/science/article/pii/S0921344925001892; Miguel Yañez-Barnuevo, *Data Center Energy Needs Could Upend Power Grids and Threaten the Climate*, Env't & Energy Study Inst. (Apr. 15, 2025), https://www.eesi.org/articles/view/data-center-energy-needs-are-upending-power-grids-and-threatening-the-climate.
9. Campbell et al., *supra* note 4.
10. Chloe Wiegand, Sustainable Data Centers for Smart City Development (May 2025) (B.S. thesis, Univ. of Arizona), https://repository.arizona.edu/handle/10150/677693.
11. Eliza Martin & Ari Peskoe, *Extracting Profits From the Public: How Utility Ratepayers Are Paying for Big Tech's Power*, Harv. Env't & Energy L. Program (2025), https://eelp.law.harvard.edu/wp-content/uploads/2025/03/Harvard-ELI-Extracting-Profits-from-the-Public.pdf; Rachel Reed, *How Data Centers May Lead to Higher Electricity Bills.* Harv. L. Today (Sept. 3, 2025), https://hls.harvard.edu/today/how-data-centers-may-lead-to-higher-electricity-bills/.
12. Lei et al., *supra* note 8.

can remain insulated from the price increases, which are instead absorbed by local communities.[13]

What makes this dynamic particularly pressing is its trajectory. The AI boom shows no signs of abating, and each new generation of AI models requires exponentially more computing power than the last.[14] As AI capabilities expand and become embedded in more services, the demand for data center capacity will only intensify. Yet, the legal frameworks governing these facilities remain rooted in an era when data centers were smaller, less numerous, and far less resource-intensive. Environmental impact assessments, if required, rarely account for cumulative effects across developments.[15]

Liability for environmental harm remains difficult to establish, particularly when impacts like groundwater depletion or grid instability emerge gradually and result from multiple contributing factors.[16] This ultimately manifests in stories like Beverly Morris', where regulatory failures leave affected people with neither recourse nor compensation. Without legal interventions that internalize the impacts for data center operators, negative effects will continue to fall on those with the fewest resources to challenge them.

While data centers are essential to the digital economy, new legal frameworks must be established that focus on precautionary measures to mitigate the harms of data center resource consumption. When precautionary measures cannot be applied, there should be more robust liability mechanisms that allow affected people to seek recourse. For either to be effective, there must also be new coalitions mobilized to hold data centers accountable.

I. Data Center Environmental Impacts

Before data centers can be regulated, their impact on local communities and ecologies must first be placed in context. One of the prominent concerns of data center development is related to consumption of water, which is used to cool the hardware that makes the digital economy run.[17] Water is also an essential component in semiconductor manufacturing,[18] making up a large portion of the total water footprint of data center hardware.[19] Water use in any individual data center varies widely by location, the types of hardware used, the data center's applications, and the facility's overall design.[20] In addition, while data centers are increasingly being built at "hyperscale"—that is, facilities with millions of square feet dedicated to running computers nonstop—roughly 40% of data servers are in smaller spaces, such as cabinets in office side rooms.[21]

A study from Lawrence Berkeley National Laboratory estimated that U.S. data centers directly consumed approximately 21.2 billion liters of water in 2014, and 66 billion liters (~17.4 billion gallons) in 2023.[22] That's roughly a 200% increase in consumption over just one decade. It is also equivalent to the water use of roughly 580,000 U.S. citizens over the course of one year.[23]

For perspective, the total water consumption in the United States in 2015 was 322 billion gallons per day.[24] Almost all of this water use comes from three sources: thermoelectric power generation (133 billion gallons per day), irrigation (118 billion gallons per day), and direct consumption by U.S. consumers (39.0 billion gallons per day).[25] Data centers, therefore, account for roughly 0.015% of total U.S. water usage[26]; however, this use is not distributed evenly across space, and its impacts are hyperlocal.

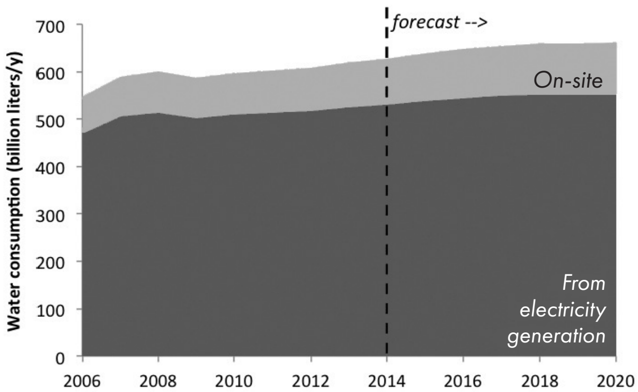
It is worth noting that there is an inverse relationship between the water consumption of a data center and its energy use as relates to cooling. This is because cooling technologies that use water tend to use less energy than those that cool data centers through air-cooled (HVAC) systems.[27] Generally speaking, a data center can reduce its water consumption for cooling by switching to air-cooled technologies, though this then increases its overall energy consumption.[28] Closed-loop systems that recycle water offer potential workarounds,[29] though the widespread application of these technologies is hard to verify due to the industry's lack of transparency. Regardless of the specific cooling techniques, water is an essential component for data centers.

Data centers consume water directly by cooling racks of computers,[30] but also indirectly through energy genera-

13. *Id.*; Martin & Peskoe, *supra* note 11.
14. Srivathsan et al., *supra* note 7.
15. Reed, *supra* note 11.
16. Makoto et al., *Legal Considerations for Data Center Development and Operation Project (1)—Structuring Issues*, Chambers & Partners (Aug. 3, 2025), https://chambers.com/articles/legal-considerations-for-data-center-development-and-operation-project-1-structuring-issues.
17. Melissa K. Scanlan et al., *Powering Progress or Peril? The Hidden Environmental Costs of Data Centers and AI*, 51 Rutgers Comput. & Tech. L.J. SE1 (2025), http://dx.doi.org/10.2139/ssrn.5560480.
18. Qi Wang et al., *Environmental Data and Facts in the Semiconductor Manufacturing Industry: An Unexpected High Water and Energy Consumption Situation*, 4 Water Cycle 47 (2023), https://www.sciencedirect.com/science/article/pii/S2666445323000041.
19. Christopher Gasson & Victor Smith, Watering the New Economy: Managing the Impacts of the AI Revolution (2026), https://amp.xylem.com/m/aa10f8022757c5e/original/Watering-the-New-Economy-DIGITAL-final.pdf.
20. Lei et al., *supra* note 8.
21. David Mytton, *Data Centre Water Consumption*, 4 npj Clean Water no. 11 (2021), https://doi.org/10.1038/s41545-021-00101-w.
22. Lei et al., *supra* note 8.
23. Cheryl A. Dieter et al., U.S. Geological Survey, Estimated Use of Water in the United States in 2015 at 5 (2018) (Circular No. 1441), https://doi.org/10.3133/cir1441 (reporting average domestic per-capita water use of 82 gallons per day). At that rate, 17.4 billion gallons per year—the approximate annual water consumption of U.S. data centers—equals the annual household water use of roughly 580,000 Americans. *See also* U.S. EPA, *WaterSense: Statistics and Facts*, https://www.epa.gov/watersense/statistics-and-facts (last updated Mar. 24, 2025).
24. Dieter et al., *supra* note 23.
25. Mytton, *supra* note 21; Dieter et al., *supra* note 23.
26. Data centers consume roughly 17.4 billion gallons annually, while total water consumption in the United States is 117.3 trillion gallons (322 billion gallons per day x 365 days); therefore, they account for roughly 0.015% of total water consumption (17.4 billion/117 trillion).
27. *Id.*
28. Yañez-Barnuevo, *supra* note 8.
29. Wesley Spindler et al., *Why Circular Water Solutions Are Key to Sustainable Data Centres*, World Econ. F. (Nov. 7, 2024), https://www.weforum.org/stories/2024/11/circular-water-solutions-sustainable-data-centres/.
30. Lei et al., *supra* note 8.

tion.[31] Water consumption related to data centers increases greatly when considering energy generation.[32] Comprehensive analyses suggest that the combined water consumption of cooling and energy generation for data centers was 560 billion liters in 2023.[33] Thus, the source of energy for a data center (and how much energy it consumes) greatly increases its water footprint (see Figure 1).

Figure 1: Direct Versus Indirect Water Consumption From U.S. Data Centers



Source: Arman Shehabi et al., United States Data Center Energy Usage Report, Lawrence Berkeley Nat'l Lab'y (2016), https://escholarship.org/uc/item/84p772fc.

This is especially true for data centers that rely heavily on fossil fuel-generated electricity, which generally requires more water than comparable renewable sources of electricity.[34] Water is also used for marginal activities such as cleaning and sewage.[35] Ultimately, when discussing the water consumption of data centers, it is important to consider the scale and thoroughness of analysis, as including energy-related consumption greatly impacts the figures.[36]

Beyond cumulative water use, there appears to be a general disconnect between data center development and ecological limits, as roughly two-thirds of new data centers under development in 2022 were located in high water-stress regions.[37] One prominent example of a data center impacting human and non-human access to water is the National Security Agency's (NSA's) Utah data facility.[38] The 1.2 million square-foot facility sits atop 250 acres of former sagebrush, with the capacity to store data at the rate of 20 terabytes—the equivalent of the Library of Congress—every minute.[39] Its location was determined by the typical calculus driving data center placement: available cheap land, proximity to airports and major roads, local tax breaks, cheap power, and lax utility connection rules.[40] The facility requires millions of gallons monthly, pulling from a combination of private wells and a local utility.[41] It is one of the few data centers whose water consumption is well-documented, especially at the site level.[42]

Water diverted to the facility has raised concerns amid ongoing conflicts around water allocation in the Great Salt Lake Basin. The Great Salt Lake is facing potential collapse amid decades of drought and major diversions of streams that used to feed the lake.[43] Increasingly, rain and snow melt are directed to agriculture, mining, and municipal uses in the region.[44] The collapse of the Great Salt Lake is an ecological,[45] economic,[46] and public health crisis for the region.[47] While the NSA's data center accounts for only a small fraction of total consumption impacting the lake, its presence highlights the importance of considering site-specific factors when assessing data center impacts.[48]

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31. Mytton, *supra* note 21.
32. Arman Shehabi et al., United States Data Center Energy Usage Report, Lawrence Berkeley Nat'l Lab'y (2016), https://escholarship.org/uc/item/84p772fc.
33. Davide D'Ambrosio et al., Energy and AI, Int'l Energy Agency, https://iea.blob.core.windows.net/assets/de9dea13-b07d-42c5-a398-d1b3ae17d866/EnergyandAI.pdf.
34. Jon Gorey, *Data Drain: The Land and Water Impacts of the AI Boom*, Lincoln Inst. Land Pol'y (Oct. 17, 2025), https://www.lincolninst.edu/publications/land-lines-magazine/articles/land-water-impacts-data-centers/.
35. Lei et al., *supra* note 8.
36. There are ongoing methodological disagreements about how to calculate water consumption figures, including from energy generation. Depending on how figures are calculated, the resulting water consumption number varies greatly. This represents a problem for policymakers and public discourse on the subject, as there is increased opportunity for misinformation and inaccurate information. Data center developers can address this issue by making their water consumption figures public. It is also important for policymakers to understand the difference between temporary water use (withdrawal) and permanent water use (consumption).
37. Leonardo Nicoletti et al., *AI Is Draining Water From Areas That Need It Most*, Bloomberg (May 8, 2025), https://www.bloomberg.com/graphics/2025-ai-impacts-data-centers-water-data/.
38. Mél Hogan, *Data Flows and Water Woes: The Utah Data Center*, 2 Big Data & Soc'y 2053951715592429 (2015), https://doi.org/10.1177/2053951715592429.
39. Rory Carroll, *Welcome to Utah, the NSA's Desert Home for Eavesdropping on America*, Guardian (June 14, 2023), https://www.theguardian.com/world/2013/jun/14/nsa-utah-data-facility.
40. Hogan, *supra* note 38.
41. *Id.*
42. Ben Winslow, *Bluffdale Releases Water Bill for NSA Data Center*, Fox13 (Apr. 25, 2014), https://www.fox13now.com/2014/04/25/bluffdale-releases-water-bill-for-nsa-data-center.
43. Jonathan Gilmour & Rebecca Kilberg, *Reducing Data Centers' Water Consumption in the Great Salt Lake Basin*, Aspen Pol'y Acad. (2024), https://aspenpolicyacademy.org/wp-content/uploads/Utah-Water-Executive-Summary-2024.pdf; Benajmin W. Abbott et al., *Emergency Measures Needed to Rescue Great Salt Lake From Ongoing Collapse*, BYU (2023), https://pws.byu.edu/GSL%20report%202023.
44. Sarah E. Null & Wayne A. Wurtsbaugh, *Water Development, Consumptive Water Uses, and Great Salt Lake*, *in* Great Salt Lake Biology: A Terminal Lake in a Time of Change 1-21 (Springer Cham 2020), https://link.springer.com/chapter/10.1007/978-3-030-40352-2_This1.
45. Leia Larsen, *The Great Salt Lake's Ecological Collapse Has Begun*, Salt Lake Trib. (Nov. 8, 2022), https://www.sltrib.com/news/environment/2022/11/08/great-salt-lakes-ecological/; Elisabeth Parker et al., *Great Salt Lake, Environmental Crises, and Securities Liability*, 55 ELR 10186 (Apr. 2025), https://www.elr.info/articles/elr-articles/great-salt-lake-environmental-crises-and-securities-liability.
46. Bioeconomics, Economic Significance of the Great Salt Lake to the State of Utah (2012), https://lf-public.deq.utah.gov/WebLink/ElectronicFile.aspx?docid=392799&eqdocs=DWQ-2012-006864.
47. Ali Soleimani et al., *Health Risk Assessment and Spatial Trend of Metals in Settled Dust of Surrounding Areas of Lake Urmia, NW Iran*, 104 Int'l J. Env't Analytical Chemistry 1172 (2024), https://www.tandfonline.com/doi/abs/10.1080/03067319.2022.2032013.
48. Jonathan Gilmour et al., *Great Salt Lake Basin Data Center Water Use*, Aspen Pol'y Acad. (2024), https://aspenpolicyacademy.org/wp-content/uploads/Utah-Water-Factsheet-2024.pdf.

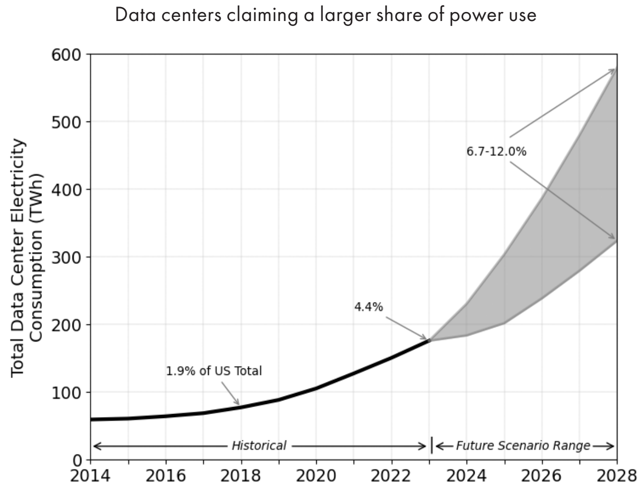
The NSA facility is not unique in prioritizing digital infrastructure over ecological concerns. This pattern is repeating across the country. For example, data centers are causing residential wells to go dry in Northern Virginia[49] and Douglas County, Georgia.[50] In some places, the expansion of existing facilities threatens to deplete underground aquifers, like in South Carolina[51] and Arizona.[52] The environmental impact of data centers does not stop at water, as their energy use poses another risk to communities and ecosystems.

The energy use of data centers is not only extensive but geographically concentrated in ways that strain local grids while obscuring broader impacts. The roughly 4,000 data centers across the United States consumed 183 terawatt-hours (TWh) of electricity in 2024, according to estimates from the International Energy Agency (IEA).[53] That's about 4% of the country's total electricity consumption, roughly equivalent to the annual electricity demand of all of Pakistan.[54]

While data center demand projections vary, the IEA estimates that this figure could grow by 133% to 426 TWh by 2030 (see Figure 2 for growth estimates).[55] It is also important to note that this demand is not evenly distributed. For example, data centers consumed about 26% of the total electricity supply of Virginia in 2023, highlighting the site-specific impacts of data centers on utilities.[56]

The carbon footprint of these facilities makes them a distinct contributor to greenhouse gas emissions and, compounded with their rising energy demands,[57] threatens to destabilize the national transition to renewable energy.[58] Data centers account for roughly half a percent of all greenhouse gas emissions in the United States annually.[59]

Figure 2. Estimated Range of Data Center Energy Demand



Source: Arman Shehabi et al., 2024 United States Data Center Energy Usage Report, Lawrence Berkeley Nat'l Lab'y (2024), https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf.

Beyond their direct carbon emissions, the energy demand from data centers is rising so quickly that utilities are racing to keep aging coal and gas-fired power plants online.[60] Coal power plants are notoriously toxic and produce more greenhouse gases than any other fuel source, while being the most expensive per unit of energy generated.[61] Some utilities are partnering directly with data center operators to reactivate nuclear plants, like the Three Mile Island nuclear plant in Middletown, Pennsylvania.[62]

Data centers require constant electricity, meaning they do not always match well with the intermittent generation of renewables like wind and solar.[63] This has made integrating data centers with existing renewable energy infrastructure difficult, though not impossible, as newer data centers can fluctuate their energy demand to match availability.[64] Ultimately, data center development currently favors established energy sources, which are predominantly fossil fuel-based. In addition, the speed of development is so great that many operators are using on-site natural gas turbines or even diesel generators as well as other technologies that can be built on timelines similar to data centers (just a few

49. Eli Tan & Dustin Chambers, *Their Water Taps Ran Dry When Meta Built Next Door*, N.Y. Times (July 14, 2025), https://www.nytimes.com/2025/07/14/technology/meta-data-center-water.html.
50. Marisa Mecke, *Data Centers Use a Lot of Water. Georgia Counties and Conservationists Are Looking for Solutions*, WABE (May 20, 2025), https://www.wabe.org/data-centers-use-a-lot-of-water-georgia-counties-and-conservationists-are-looking-for-solutions/.
51. *Google Agrees to Limit Groundwater Use From S.C. Aquifer*, S. Env't L. Ctr. (Dec. 16, 2019), https://www.selc.org/news/google-agrees-to-limit-groundwater-use-from-s-c-aquifer/.
52. Felicity Barringer, *Thirsty for Power and Water, AI-Crunching Data Centers Sprout Across the West*, Stan. Univ. Bill Lane Ctr. Am. W. (Apr. 8, 2025), https://andthewest.stanford.edu/2025/thirsty-for-power-and-water-ai-crunching-data-centers-sprout-across-the-west/.
53. Data Center Map, *USA Data Centers*, https://www.datacentermap.com/usa/ (last visited Mar. 4, 2026); Davide D'Ambrosio et al., IEA, Energy and AI (2025), https://iea.blob.core.windows.net/assets/de9dea13-b07d-42c5-a398-d1b3ae17d866/EnergyandAI.pdf.
54. Rebecca Leppert, *What We Know About Energy Use at U.S. Data Centers Amid the AI Boom*, Pew Rsch. Ctr. (Oct. 24, 2025), https://www.pewresearch.org/short-reads/2025/10/24/what-we-know-about-energy-use-at-us-data-centers-amid-the-ai-boom/.
55. *Id.*
56. *Id.*
57. Arman Shehabi et al., 2024 United States Data Center Energy Usage Report, Lawrence Berkeley Nat'l Lab'y (2024), https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf.
58. Terry Nguyen & Ben Green, What Happens When Data Centers Come to Town?, Ford Sch. Sci., Tech. & Pub. Pol'y (2025), https://stpp.fordschool.umich.edu/sites/stpp/files/2025-07/stpp-data-centers-2025.pdf.
59. Md Abu Bakar Siddik et al., *The Environmental Footprint of Data Centers in the United States*, 16 Env't Rsch. Letters 064017 (2021), DOI: 10.1088/1748-9326/abfba1.
60. Ariel Wittenberg, *Pollution From Coal Plants Was Dropping. Then Came Trump and AI.*, POLITICO (Nov. 27, 2025), https://www.politico.com/news/2025/11/27/ai-gives-coal-plants-a-lifeline-as-trump-makes-them-dirtier-00661839.
61. Muhammad E. Munawer, *Human Health and Environmental Impacts of Coal Combustion and Post-Combustion Wastes*, 17 J. Sustainable Mining 87 (2018), https://www.sciencedirect.com/science/article/pii/S2300396017300551.
62. Charlotte Mandler, *Three Mile Island Nuclear Plant Will Reopen to Power Microsoft Data Centers*, NPR (Sept. 20, 2024), https://www.npr.org/2024/09/20/nx-s1-5120581/three-mile-island-nuclear-power-plant-microsoft-ai.
63. Anup Agarwal et al., *Redesigning Data Centers for Renewable Energy*, *in* Proceedings of the 20th ACM Workshop on Hot Topics in Networks 45-52 (2021), https://dl.acm.org/doi/abs/10.1145/3484266.3487394.
64. *Id.*

years).[65] In aggregate, data center development is pushing the entire grid toward a longer and more entrenched reliance on fossil fuels.[66]

Last, rising energy demand from data centers is causing electricity rates for residential users to increase at unprecedented rates, forcing millions to subsidize the industry. Because building new energy generation is expensive and time-intensive, the rising energy demand from data centers is squeezing supply, causing prices across the country to rise faster than inflation.[67] The result is diffuse, nationwide cost-shifting, "when one class of utility customers externalizes the costs of its power supply, which are then paid by another class of customers."[68]

Because data center development tends to cluster in certain states with favorable tax incentives, there is a disproportionate impact on the cost of electricity for some communities.[69] Some parts of the country are seeing average electricity rates increase by more than 25% in a decade,[70] while rates for residential customers have climbed the fastest.[71] While the impacts of data centers are largely site-specific, as states compete for investment, they are inviting potentially negative impacts on their residents.

II. Sustainability and Context

While the scale of data center resource consumption is staggering, sustainable development that avoids negative ecological impacts ultimately depends on the geographic and environmental context in which facilities are sited. The environmental impacts of data centers are fundamentally hyperlocal, meaning that identical facilities consuming the same amounts of water and energy can have vastly different environmental consequences.[72] This spatial dimension is critical, but often overlooked in discussions that focus solely on aggregate consumption.

Greater attention should be paid to the sources of water for cooling and energy generation that enable data center operations. Water consumption is significant in that it may represent withdrawal from water sources (natural or man-made) that is fundamentally unsustainable and threatens long-term economic and ecological viability.[73] Water used for cooling by data centers in relatively wet regions—such as the Great Lakes or the forested regions of the Pacific Northwest—may be less concerning than equivalent water use by facilities in the arid Southwest. Nevertheless, about one-fifth of data centers in the United States are located in moderately to highly water-stressed areas, while half receive their energy fully or partially from power plants located within water-stressed regions.[74] This highlights a fundamental disconnect between where data centers are being built and the long-term viability of regional water resources.

Similarly, the carbon footprint of data center energy consumption is heavily dependent on the composition of the local electricity grid. Research on U.S. data centers found their average carbon intensity to be 548 grams of carbon dioxide equivalent per kilowatt-hour (gCO_2e/kWh), roughly 48% higher than the national average for all other economic activities.[75] However, this figure masks enormous geographic variation. Data centers in Virginia draw roughly 60% of their electricity from fossil fuel power plants due to their connection to the PJM Interconnection power grid, while only an estimated 12% of their energy comes from renewable sources.[76] In contrast, data centers located in regions with abundant hydroelectric power—such as Washington State and Oregon—can operate with substantially lower carbon footprints.[77] Whether this energy consumption ends up impacting residential ratepayers is also largely dependent on municipal and state-level utility regulations.[78] Therefore, the costs and benefits of data center resource use are influenced as much by local policy decisions as by market forces.

Assessing data center environmental impacts requires moving beyond total consumption figures. Context matters enormously. Evaluations must consider local water availability, regional electricity sources, climate conditions, the effects of clustering, and indirect impacts from power generation and land use change. Data centers are increasingly essential for the digital economy, but facilities that holistically prioritize sustainability should be encouraged; conversely, those that ignore or externalize ecological harms should face stricter permitting requirements and

65. Keith E. Herold & Reinhard Radermacher, *Integrated Power and Cooling Systems for Data Centers*, *in* Therm 2002: Eighth Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems 808-11 (IEEE 2002), https://ieeexplore.ieee.org/abstract/document/1012537/.
66. Evan Gorelick, *Why Don't Data Centers Use More Green Energy?*, N.Y. Times (Sept. 29, 2025), https://www.nytimes.com/2025/09/27/business/dealbook/why-dont-data-centers-use-more-green-energy.html.
67. Reed, *supra* note 11.
68. Chip Cannon & Porter Wiseman, *State Legislative and Regulatory Initiatives to Address Concerns Caused by the Surging Power Demand of Data Centers in the U.S.*, Hogan Lovells (Sept. 17, 2025), https://www.hoganlovells.com/en/publications/state-legislative-and-regulatory-initiatives-to-address-concerns-caused-by-the-surging-power-demand; Martin & Peskoe, *supra* note 11.
69. Josh Saul et al., *AI Data Centers Are Sending Power Bills Soaring*, Bloomberg (Sept. 29, 2025), https://www.bloomberg.com/graphics/2025-ai-data-centers-electricity-prices/.
70. Leppert, *supra* note 54.
71. Karin Kirk, *Home Electricity Bills Are Skyrocketing. For Data Centers, Not So Much.*, Yale Climate Connections (Jan. 5, 2026), https://yaleclimateconnections.org/2026/01/home-electricity-bills-are-skyrocketing-for-data-centers-not-so-much/.
72. Reid Lifset et al., *Local Environmental Impacts of Data Center Proliferation*, 55 ELR 10131 (Apr. 2025), https://www.elr.info/articles/elr-articles/local-environmental-impacts-data-center-proliferation.
73. Chris J. Perry et al., Water Consumption, Measurements and Sustainable Water Use 33, Glob. Comm'n on Econ. Water (2023), https://watercommission.org/wp-content/uploads/2023/03/Perry.pdf.
74. Siddik et al., *supra* note 59. Generally, the water used by data centers for cooling, and their indirect water use through power generation, is not consumed. Instead, much of this water is either reused or returned to water bodies like streams, rivers, lakes, or municipal systems. The percent of water consumption for these various activities varies widely by specific technology, and is therefore difficult to generalize.
75. Gianluca Guidi et al., *Environmental Burden of United States Data Centers in the Artificial Intelligence Era*, arXiv:2411.09786 (2024), https://arxiv.org/abs/2411.09786.
76. U.S. Energy Information Administration, *Virginia: Analysis*, https://www.eia.gov/states/VA/analysis (last updated Feb. 20, 2025).
77. Yañez-Barnuevo, *supra* note 8.
78. Martin & Peskoe, *supra* note 11.

bear the full cost of their environmental impacts. It is possible to accomplish these goals simultaneously, as a recent study modeling AI environmental impacts concluded that the Midwest and "windbelt" states would generally deliver the best combined carbon-and-water profile.[79]

That said, current regulatory frameworks largely ignore these contextual considerations. Instead, states compete to attract data center development through aggressive tax incentives and lax oversight—creating a race to the bottom that actively discourages the site-specific analysis necessary for sustainable development. Understanding how these hidden subsidies and regulatory gaps enable environmentally damaging projects is essential for crafting effective policy solutions.

III. Regulatory Gaps and Hidden Subsidies

Data center development is largely encouraged by state-level policies that provide generous tax incentives, even when such facilities may have broader negative impacts.[80] Numerous states across the political spectrum offer sales tax exemptions for data centers to purchase hardware like computers, cooling technology, generators, and other components.[81] In Virginia, the exemption saved companies nearly $1 billion in 2023.[82] There are also further municipal- and county-level incentives that give property tax exemptions to data centers and the equipment they purchase.[83]

This culminates in a relaxed regulatory environment where states compete to offer better deals to the deep pockets of tech-backed data center developers. It is also worth noting that there is no federal-level data center regulation (and in fact, there have been efforts to preempt state-level oversight).[84] This regulatory vacuum has allowed utilities to quietly negotiate special contracts with data centers that fundamentally break from traditional rate structures.

Some utilities' increasingly narrow focus on expanding to serve just a few tech companies breaks the mold of traditional utility rates, forcing the public to subsidize infrastructure designed exclusively for a handful of exceedingly wealthy corporations.[85] Utilities are often privileged when it comes to deciding what they disclose, including how they calculate the rates they assign to different customers.[86] The asymmetry of knowledge is further compounded by complicated regulatory processes, where the rates many utilities propose are approved by public utility commissions, which have been known to approve special contracts in short and conclusory order without comprehensive review.[87]

Similar to states lowering taxes to attract data center investment, utilities occasionally use special contracts to artificially lower the cost of electricity for these large consumers, and then raise rates for other customers to offset their losses. While it is difficult to say when and which utilities are engaged in these practices, in 2018, Duke Energy (one of the largest utilities in the country) was forced to disclose in court that it had offered a data center a $325-million discount (over a decade) and explicitly planned to make up for this shortfall by increasing rates for its other customers.[88] There is also increasing evidence to suggest that some utilities are creating data center-specific rate classes and other mechanisms to prevent cost-shifting.[89]

There is a broad culture of opacity across the data center industry that prevents external audits and scrutiny. Of the various states with subsidy programs for data centers, as of this writing only 11 disclose which companies receive those incentives, leaving the vast majority of taxpayer-funded benefits hidden from public view.[90] Data centers frequently employ nondisclosure agreements, project code names, and shell companies to conceal the firms behind new projects.[91]

The industry justifies this by claiming that energy consumption, water usage, and operational details constitute proprietary information that could compromise competitive advantage if disclosed. However, this serves to shield data center operators from public accountability, while simultaneously preventing researchers, policymakers, and affected communities from understanding the true costs of proposed or completed projects.[92] While all of these factors make the existing regulatory landscape favorable to data center extraction, this does not have to be the reality for development moving forward.

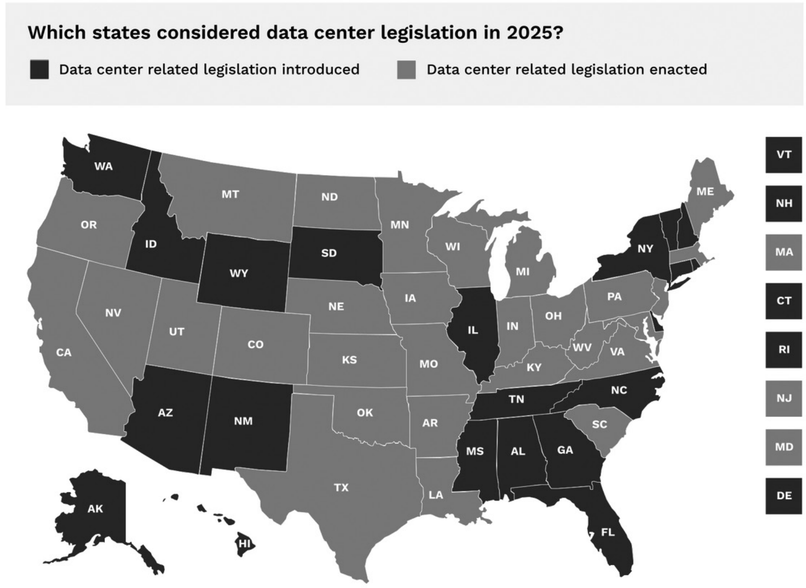
IV. Precautionary Frameworks and New Regulations

In response to growing concerns about data centers, several states have begun implementing targeted regulations, though the landscape remains fragmented. These emerg-

79. Tianqi Xiao et al., *Environmental Impact and Net-Zero Pathways for Sustainable Artificial Intelligence Servers in the USA*, 8 Nature Sustainability 1541 (2025), https://doi.org/10.1038/s41893-025-01681-y.
80. Grant Gutierrez et al., *Who Pays for the Cloud? The Hidden Costs of Rising Data Center Demand*, Carbon Direct (May 20, 2025), https://www.carbon-direct.com/insights/who-pays-for-the-cloud-the-hidden-costs-of-rising-data-center-demand.
81. Martin & Peskoe, *supra* note 11.
82. *Id.*
83. *Taxing the Digital Backbone: What You Need to Know About Data Centers*, PwC (July 25, 2025), https://www.pwc.com/us/en/services/tax/library/data-centers-tax.html.
84. *Accelerating Federal Permitting of Data Center Infrastructure*, White House (July 23, 2025), https://www.whitehouse.gov/presidential-actions/2025/07/accelerating-federal-permitting-of-data-center-infrastructure/.
85. Martin & Peskoe, *supra* note 11.
86. Aneil Kovvali & Joshua Macey, *Hidden Value Transfers in Public Utilities*, 171 Univ. Pa. L. Rev. 2129 (2023), https://doi.org/10.58112/uplr.171-7.8.
87. Martin & Peskoe, *supra* note 11.
88. *Id.*; Press Release, Sierra Club, Settlement Reached in Duke Energy Progress Rate Increase: Sierra Club Agreement Focused on Consumer Protection From Data Centers (Oct. 30, 2025), https://www.sierraclub.org/press-releases/2025/10/settlement-reached-duke-energy-progress-rate-increase.
89. Eric Brooks & Justin Stevens, *Adapting Utility Tariffs for Data Center Driven Load Growth*, Util. Dive (July 14, 2025), https://www.utilitydive.com/spons/adapting-utility-tariffs-for-data-center-driven-load-growth/752706/.
90. Kevin Hardy, *Most States Don't Disclose Which Companies Get Data Center Incentives, Report Finds*, Stateline (Nov. 12, 2025), https://stateline.org/2025/11/12/most-states-dont-disclose-which-companies-get-data-center-incentives-report-finds/.
91. Eli Tan, *A Rural Missouri Town Fights Big Tech, and Itself*, N.Y. Times (Oct. 29, 2024), https://www.nytimes.com/2024/10/29/technology/data-center-peculiar-missouri.html.
92. Can Hankendi et al., *Why Transparency Matters for Sustainable Data Centers and Carbon-Neutral Artificial Intelligence (AI)*, 28 iScience 113705 (2025), https://www.cell.com/iscience/fulltext/S2589-0042(25)01966-2.

ing policies can be grouped into four main categories: utility rate reforms that prevent cost-shifting; mandatory reporting requirements for energy and water consumption; stricter environmental review processes; and modified tax incentive structures tied to job creation and sustainability standards. The spatial distribution of these regulations varies widely, though almost every state has introduced or passed some kind of legislation (see Figure 3). For a more comprehensive list of regulations and their general qualities, see Table 1.

Figure 3: Visualization of States With Data Center Regulation



Source: Morgan Scarboro, *Here's What You Need to Know About Data Center Policy Trends*, MULTISTATE (Nov. 4, 2025), https://www.multistate.us/insider/2025/11/4/heres-what-you-need-to-know-about-data-center-policy-trends.

This patchwork approach continues to exacerbate dynamics where some states tighten restrictions while others actively expand incentives to attract data center development, potentially undermining the effectiveness of protective regulations. For there to be more comprehensive regulations around data centers, there must be agreed-upon principles of harm prevention built into laws that apply across jurisdictions. There must also be comprehensive oversight during permitting stages for data centers that include environmental reviews, centered on principles of environmental justice, to ensure there are no adverse socioenvironmental consequences.

Addressing water use requires encouraging data center developers to build in areas with low water stress and/or to use technologies that are water-efficient and ideally closed-loop. Innovative cooling systems can reduce freshwater use by up to 75%, while nascent technologies can virtually eliminate evaporative water use altogether.[93] Regulatory frameworks should mandate efficiency standards that incentivize these systems, as they are currently too expensive to be adopted at scale without incentives.[94] There should also be provisions that prohibit cost-shifting of water infrastructure expenses to other ratepayers and require comprehensive environmental reviews demonstrating minimal impact on aquifers and watersheds, particularly in water-stressed regions.

Energy is currently the most expensive bottleneck in data center development, and encouraging sustainable implementation can create lasting benefits beyond powering the digital economy.[95] Germany's Energy Efficiency Act offers a road map, requiring data center operators to use renewable energy for at least 50% of consumption now, and increasing this share to 100% by 2027.[96] Policies should incentivize on-site renewable energy development and require long-term power purchase agreements of 10-15 years with utilities to encourage sustained clean energy investment, while preventing cost-shifting across ratepayer classes.[97] Minimum purchase requirements can also be included to prevent potential bailouts by ratepayers in the event of stranded assets, should developers fail to make good on their proposed data center projects.[98] Beyond renewable energy requirements, there should be tax incentives or outright requirements for standardized power use efficiency (PUE).

Finally, transparency requirements must be increased across all levels of data center development. Regulations should standardize reporting for electricity consumption, carbon emissions, water consumption, and associated public health impacts. These reports would ideally be uniform or use the same metrics for accounting, such that state officials can obtain a clear picture of data center impacts needed to inform policy interventions.[99] For example, Germany requires data center operators to publish information about energy consumption, PUE values, and the percentage of energy reused annually, with this information then being stored in a centralized register for reference.[100]

Similar registries in the United States could go a long way in unifying policy toward data centers. Regulations

93. Wesley Spindler et al., *Data Centres Use Vast Amounts of Water—Here's How We Advance Water Circularity*, WORLD ECON. F. (Nov. 18, 2025), https://www.weforum.org/stories/2025/11/data-centres-and-water-circularity/.
94. *Id.*
95. U.S. Department of Energy, *Clean Energy Resources to Meet Data Center Electricity Demand*, https://www.energy.gov/gdo/clean-energy-resources-meet-data-center-electricity-demand (last visited Feb. 23, 2026).
96. Rostyslav Telyatnykov et al., *Data Center Requirements Under the New German Energy Efficiency Act*, WHITE & CASE (Oct. 25, 2023), https://www.whitecase.com/insight-alert/data-center-requirements-under-new-german-energy-efficiency-act; Kai Ebert et al., *AI, Climate, and Regulation: From Data Centers to the AI Act*, ARXIV:2410.06681 (2024), https://doi.org/10.48550/arXiv.2410.06681.
97. Reed, *supra* note 11.
98. Makoto et al., *supra* note 16.
99. NGUYEN & GREEN, *supra* note 58.
100. Telyatnykov et al., *supra* note 96.

Table 1. Examples of State-Level Data Center Regulations (2024-2025)

State	Legislation	Type of regulation	Key provisions
Michigan	H.B. 906	Incentive modification	Increased minimum job creation requirements; introduced electricity and water efficiency standards; increased utility rates
Ohio	H.B. 15/S.B. 2	Utility partnership & ratepayer protection	Requires data centers to jointly fund utility infrastructure; establishes 15-year power purchase agreements with minimum payments; provides tax exemptions for renewable energy development
Georgia	S.B. 34	Ratepayer protection	Would prevent rate increases for non-data center customers based on demand created by data centers
Connecticut	S.B. 1292	Transparency & reporting	Requires energy and water consumption reporting
Georgia	H.B. 528	Transparency & reporting	Requires energy and water consumption reporting
Indiana	S.B. 135	Transparency, reporting & siting	Requires energy and water consumption reporting; changed siting regulations to include environmental reviews and resource use assessments
Illinois	S.B. 2181	Transparency & reporting	Requires energy and water consumption reporting
Minnesota	H.F. 2928	Clean energy requirement	Would have required 100% carbon-free energy by 2031 for data centers
Virginia	S.B. 285	Environmental review	Changed siting regulations to include environmental reviews and resource use assessments before permit approval
Tennessee	H.B. 0946	Environmental review	Changed siting regulations to include environmental reviews and resource use assessments before permit approval
Maryland	Recent legislation	Expedited approval	Defines data centers as "critical infrastructure," enabling expedited environmental reviews and waiving permitting requirements for diesel-powered backup generators
Colorado	Recent legislation	Incentive expansion	Created a new utility class, making electricity cheaper for data centers above 40 megawatt-hour minimum; actively recruiting the largest data center campuses
Arizona	Ongoing policy	Incentive expansion	Expanding data center tax incentives to attract development

Source: Tim Bernard, *Through 300+ Bills, US Lawmakers Juggle Data Center Priorities*, Tech Pol'y Press (Sept. 12, 2025), https://www.techpolicy.press/through-300-bills-us-lawmakers-juggle-data-center-priorities/. For more information, see Tech Policy Press, *Data Center Legislation*, https://airtable.com/app0Q9DIlf-Gf2oXcE/shrEBr4v7X9nt5LN9/tblnGh3R8Wp2QLW8i (last visited Feb. 23, 2026).

should require the disclosure of power purchase agreement parameters for large facilities, including expected water and energy use at the permitting stage (with identification of the water source), and annual or bi-annual consumption reports that are accessible to both regulators and community members (see Table 2).

V. Retrospective Frameworks and the Polluter-Pays Principle

While the previous part addressed proactive regulations to prevent future harms, the polluter-pays principle (PPP) offers a potential mechanism for addressing the externalities of existing data centers and filling gaps where regulations do not apply. The PPP is a legal doctrine stipulating that those who generate environmental harms should bear the costs of managing and remedying that harm.[101] The PPP has been successfully incorporated into environmental regulations in the European Union and underlies major U.S. pollution control laws, including the Clean Air Act, the Clean Water Act, and Superfund cleanup requirements.[102]

Despite its theoretical appeal, the PPP has not been systematically applied to data centers because their rapid proliferation has outpaced legislation, with many existing statutes designed for manufacturing facilities or power plants.[103] Many data centers occupy an ambiguous position in environmental law because they generate substantial ecological impacts but produce no traditional "pollution" in the form of discharges or hazardous waste.[104] Water and

101. William J. Baumol & Wallace E. Oates, The Theory of Environmental Policy (Cambridge Univ. Press, 2d ed. 1988).

102. Mizan R. Khan, *Polluter-Pays-Principle: The Cardinal Instrument for Addressing Climate Change*, 4 Laws 638 (2015), https://doi.org/10.3390/laws4030638.

103. Shannon Heckt, *Virginia Doesn't Have Statewide Data Center Regulations. Localities Are Making Their Own Rules*, Va. Mercury (June 20, 2025), https://virginiamercury.com/2025/06/20/virginia-doesnt-have-statewide-data-center-regulations; Martin C. Offutt et al., Congressional Research Service, R48646, Data Centers and Their Energy Consumption: Frequently Asked Questions (Jan. 23, 2026), https://www.congress.gov/crs-product/R48646#.

104. Offutt et al., *supra* note 103.

Table 2. Principles for New Data Center Regulations

Category	Key principles
Permitting & environmental review	• Expedited permitting for facilities with high efficiency and clean energy • Comprehensive environmental impact assessments required before approval • Evaluation of water stress, air quality, and environmental justice impacts
Water use compliance	• Mandatory efficiency standards (WUE targets) • Incentives for closed-loop cooling systems • Groundwater impact assessments required • No cost-shifting to other ratepayers
Energy use compliance	• Mandatory efficiency standards (PUE targets) • Clean energy requirements (phased renewable mandates) • Long-term power purchase agreements (10-15 years minimum) • No cost-shifting to other ratepayers
Transparency & reporting	• Disclosure of power purchase agreement terms • Public reporting of energy and water sources at the permitting stage • Annual/bi-annual consumption reports • Standardized metrics (PUE, WUE) for comparability

energy consumption are treated as matters of utility regulation and contract law rather than environmental harm, even when consumption occurs at scales that deplete finite resources. To apply existing polluter-pay standards to data centers, legal frameworks must be updated to recognize that resource extraction at this scale constitutes environmental harm.

Establishing liability also presents substantial logistical challenges. The PPP is most effective when environmental harm is discrete, measurable, and clearly attributable to a specific polluter—conditions that do not always pertain to a data center.[105] For example, if a community wanted to sue a data center for depleting an underground aquifer, if multiple parties are drawing from the same aquifer, establishing which user is responsible for what share of depletion becomes a complex apportionment issue. While this can be overcome with more progressive application of the PPP,[106] the current precedent is likely not enough to ensure that the damages caused by data centers are rectified promptly. The PPP also intrinsically favors institutional positionality and wealth, placing the burden of proof on under-resourced plaintiffs as they battle corporations with well-paid lawyers.[107]

Common-law doctrines, including nuisance, trespass, and negligence, provide frameworks for bringing actions against polluters where natural resources or property have been damaged.[108] While nuisance law may work reasonably well for small-scale local disputes, it will likely prove to be an inefficient and imprecise means of implementing the PPP for large-scale pollution problems.[109] These mechanisms operate retroactively such that courts can only intervene and calculate damages after harm has been done; they do nothing to undo the harm.[110] Applying the PPP or other common-law doctrines to data centers requires detailed evidence of what data centers consume and the consequences of that consumption. Therefore, the effectiveness of liability claims against data centers first requires more robust, transparent disclosures from their operators.

Ultimately, preventing damages before they occur through proactive permitting, environmental review, mandatory efficiency standards, and consistent documentation represents a more effective regulatory approach than pursuing retrospective liability claims.[111] The PPP remains an important backstop for addressing existing harms and filling regulatory gaps, but its limitations underscore why comprehensive prospective regulation is likely the best tool for managing data center impacts.

VI. Conclusion

Data centers powering AI development impose severe environmental costs, while operators avoid accountability through regulatory gaps and hidden subsidies. U.S. data centers guzzle billions of gallons of water each year and consume an increasing percentage of the nation's electricity. These impacts are not distributed evenly, as data centers cluster in rural communities and raise utility rates. Currently, there is no federal oversight, with

105. Khan, *supra* note 102.
106. Fausto Corvino, *The Forward-Looking Polluter Pays Principle for a Just Climate Transition*, Critical Rev. Int'l Soc. & Pol. Phil. 1 (2023), https://doi.org/10.1080/13698230.2023.2243729.
107. *Id.*
108. Sean Farmer, *The Stone in the Cloud: Planning the Resource Demands of Data Centre Industry Through Land Use Law*, 56 Univ. B.C. L. Rev. no. 3 (2023), https://heinonline.org/HOL/Page?handle=hein.journals/ubclr56&id=451&collection=journals&index=.
109. Anthony Shin, *The Hum That Never Sleeps: Haymarket, Data Centers, and the Fight for Quiet and Water*, Shin L., https://shinlawoffice.com/the-hum-that-never-sleeps-haymarket-data-centers-and-the-fight-for-quiet-and-water/.
110. Khan, *supra* note 102.
111. Gus Bauman et al., *Shifts in NEPA Affecting Data Center Development*, 40 Nat. Res. & Env't 57 (2025), https://www.americanbar.org/groups/environment_energy_resources/resources/natural-resources-environment/2025-fall/shifts-nepa-affecting-data-center-development/.

environmental reviews ignoring cumulative impacts and industry opacity preventing accountability. Without legal frameworks that change these norms, harm will continue falling on under-resourced communities. Ultimately, the problem requires both precautionary regulations and new liability mechanisms.

Solutions must center on new regulations that pull broad public support by defending access to finite resources and keeping prices stable for consumers. This can best be accomplished through mandatory efficiency standards, renewable energy requirements, transparent consumption reporting, and stronger polluter-pays liabilities. These aspirations are also actionable. States can end tax exemptions unless data centers meet sustainability standards; the U.S. Congress can create a national registry of data centers that tracks resource use; public utility commissions can prohibit cost-shifting contracts; and municipalities can require comprehensive environmental impact assessments before permitting. Most poignantly, this all requires reconceptualizing environmental statutes such that resource extraction can be understood as actionable harm.

More broadly, holding data centers accountable requires questioning unfettered technological progress built on extraction. It requires a paradigm shift in how we talk about the future: who and what we value for our future. It means rejecting realities like Beverly Morris', where livelihoods are shattered by industries next door. It is a future where residents do not watch their wells run dry, or wonder if their water is safe to drink. It is a digital future that values the physical world.