A No Brainer: How AI's Energy and Water Footprints Threaten Climate Progress

Science fiction's portrayal of artificial intelligence (AI) usually focuses on the existential threat posed by an increasingly cognizant and often combative robot consciousness. In reality, the threats posed by AI will not manifest in a flashy highway chase scene or spaceship mutiny. Instead, AI already poses a significant threat to our climate goals due to its enormous energy and water footprints.

Energy demand from AI servers and data centers in the U.S. is expected to increase up to threefold between 2023 and 2028.[1] By 2028, AI in the U.S. could:

- Consume around 300 terawatt-hours (TWh) of energy annually[2] — enough electricity to power over 28 million American households.[3]
- Require as much as 720 billion gallons of water annually just to cool AI servers — equal to over 1 million Olympic-size swimming pools, or enough water to meet the indoor needs of 18.5 million American households.[4]

These high energy and water demands will have serious environmental repercussions, especially as many AI servers and data centers are located in areas already experiencing water shortages.[5] The water and energy demands have also already derailed many of Big Tech's plans for carbon neutrality. The industry is trying to cover up these shortcomings with false climate solutions rather than meaningfully addressing the resource problems caused by AI and related data centers.[6]

As part of the Trump administration's tech policy, tech companies plan to invest up to $500 billion into AI, with little regard for the vast resources needed. Tech leaders are queuing up to line their pockets with the spoils, while oil and gas giants line up to supply the power.[7] Meanwhile, the added energy and water demand from AI and data centers is expected to increase customer bills, as utilities will need to build out infrastructure to supply growing AI needs.[8] AI backers are promoting the technology as an environmental tool for fighting climate change while sweeping its energy and water needs under the rug.

AI's Water Footprint

At the heart of AI's resource dependency is its enormous thirst for water. AI servers and data centers rely on fresh water to cool onsite servers, consuming up to 2.4 gallons of water per kilowatt-hour of energy used.[9] Producing electricity to power AI also consumes water, and this footprint is magnified when the electricity comes from fossil fuels.[10] To illustrate, OpenAI's GPT-4 uses as much as three 16.9oz bottles of water just to generate a 100-word email.[11]

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Given that AI-specific electricity demand in the U.S. may reach 300 TWh annually by 2028, just cooling the servers while using this much electricity would consume as much as 720 billion gallons of water.[12] This is equivalent to over 1 million Olympic-size swimming pools, or the recommended annual water use of 18.5 million American households.[13] And producing this much electricity comes with its own water footprint, one that will be amplified if energy comes from fossil fuel sources, as is often the case for data centers.

Data centers and AI servers must use clean, treated water to avoid blockages and the growth of bacteria in pipes.[14] In the case of Google's self-owned data centers, only 20 percent of the water withdrawn is discharged at the end of the cycle into wastewater treatment plants, with the rest of the water lost to evaporation.[15] Due to the buildup of bacteria and mineral salts during the cooling process, the cooling water needs constant replenishment with fresh water; it is reused only a few times before being dumped back into the sewer, where it then needs treatment before reuse.[16]

When seawater or reclaimed water is used for cooling, it must be purified before it is put into cooling systems, an energy- and water-intensive process in itself.[17] Further, water use in data centers lowers water levels and impacts fish and water ecosystems in the surrounding area.[18]

AI is magnifying Big Tech's water footprint

Based on company reports, Microsoft's annual company-wide water use increased 87 percent between 2020 and 2023, thanks in part to growth in the data center and AI sectors.[19] Reports from Google, Meta, and Microsoft estimate that, together, these companies withdrew 580 billion gallons of water in 2022 to provide power and cooling to data centers and AI servers. This is enough water to meet the annual needs of 15 million American households.[20]

In the Netherlands, a Microsoft data center significantly underestimated its water footprint. Local media uncovered that the company used over 22 million gallons of water in 2021, more than four times as much as Microsoft and the municipality told residents it would use.[21]

Major stresses on local water supplies

Due to the location of these massive data centers, they often deplete water needed by local residents and farmers. In 2021, 20 percent of all data centers in the U.S. drew water from moderately to highly stressed watersheds in the western part of the country.[22] As of 2023, nearly 80 percent of the water consumption of Google AI data centers in the U.S. came from drinking water sources.[23] In water-stressed Arizona, data centers withdraw massive amounts of water in areas where farmers fallowed fields and families went without tap water for most of 2023.[24]

Similarly, Google data centers in The Dalles, Oregon — a dry area that is usually off limits to new industrial water users — account for over 25 percent of total water consumption. [25] The company's The Dalles facility increased its water use nearly threefold between 2017 and 2022, and Google has plans to open two more data centers in the same area.[26] In Northern Virginia, potential data center buildout could almost double current water consumption levels, which would have profound impacts on local water availability.[27]

AI's Growing Carbon Footprint

In 2023, AI and data centers accounted for roughly 4 percent of U.S. electricity consumption, a share which is expected to increase up to threefold by 2028.[28] And while total U.S. electricity demand has been stable for two decades, the new data centers required for AI rollout will help increase total demand by 9 percent by 2028 and almost 20 percent by 2033, compared to 2024 levels.[29] Globally, the electricity consumption of data centers and AI servers is expected to more than double between 2022 and 2026, with total electricity demand expected to surpass 1,000 TWh.[30]

Electricity consumed by AI servers alone (the fastest growing energy users in data centers) could rise 150-fold over one decade, growing from 2 TWh in 2017 to 300 TWh in 2028.[31] This is enough electricity to power over 28 million American households for a year.[32] And all this added energy demand will increase greenhouse gas emissions. Global cumulative greenhouse gas emissions from data centers from 2025 through 2030 could equal 40 percent of the U.S.'s annual emissions — equivalent to the annual emissions of over 540 million gasoline-powered cars.[33]

The reason behind this massive growth in electricity demand and corresponding emissions is that AI is remarkably energy intensive. The graphic processing units (GPUs) used in AI systems like ChatGPT require more energy and give off more heat than the average microchip.[34] Simple ChatGPT text searches use nearly 10 times as much electricity as a Google search.[35] Creating images is thousands of times more energy intensive than text searches and can use as much electricity, per image created, as it takes to charge your cell phone.[36]

To further illustrate this extreme energy consumption:

- As of 2024, ChatGPT used over half a million kilowatts of electricity each day, equivalent to the daily power use of 180,000 U.S. households.[37]
- One Meta-owned data center consumes as much power as 7 million laptops running for eight hours each day.[38]
- Santa Clara, California's 50 data centers account for 60 percent of the city's electricity use, while receiving discounted rates on electricity compared to residential rates.[39]

This growth continues: in June 2024, the California utility Pacific Gas and Electric (PG&E) received 26 new applications for data centers that together would use 3.5 gigawatts (GW) of electricity, enough to power 1 out of every 8 California homes.[40]

Where will all this power come from?

Big Tech has brushed off the mind-boggling electricity requirements of AI and corresponding data centers, saying that they will be powered by renewable sources; yet the expansion has already extended the lives of fossil fuel plants.[41] A likely optimistic report suggested that renewables will cover only 40 percent of U.S. electricity demand from new data centers by 2030. The remainder would come from expanding fossil fuel sources, equivalent to nearly 16 million additional gasoline-powered cars on the road each year.[42]

At the same time, lawmakers in Texas are proposing new bills that would increase fees on renewable energy development and promote fossil fuel expansion.[43] With this additional reliance on

bygone fossil fuel infrastructure, electricity sector emissions in the U.S. could rise more than 56 percent between now and 2035, an unthinkable increase at this stage in the climate crisis.[44]

Coal: Confirming our worst fears, local officials and lawmakers have already begun working with Big Tech to support the industry's dirty power plans. In Salt Lake City, Utah, lawmakers and utility executives cut back investments in renewables in favor of extending the lives of soon-to-be decommissioned coal plants to power new data centers.[45] This has also occurred in Georgia and Virginia, where data center power demand will be met by coal plants that were expected to close down.[46] In Milwaukee, Wisconsin, where Microsoft is building a $3.3 billion data center, a local utility plans to cancel the retirement of coal units and to expand natural gas power as a direct result of rising data center energy demand.[47]

Natural gas: Perhaps the largest increase in fossil fuel use thanks to AI and data centers is from natural gas, for which over 220 production facilities are under development nationwide.[48] In Louisiana, where Meta is opening a 4-million-square-foot data center, a utility company is planning to open new natural gas plants for the first time in 50 years to power the data center.[49] Chevron and GE Vernova plan to build new gas generation plants to power data centers that could provide power to over 3 million homes.[50] Furthermore, utilities in Georgia, North Carolina, South Carolina, and Virginia plan to open a total of 20 GW of new natural gas generation plants by 2040, primarily due to data center demand.[51] All of this natural gas development for AI may represent a bubble that could leave us with even more stranded fossil fuel assets.[52]

Nuclear: In addition to delaying the transition from fossil fuels to renewables, data center energy demand has led energy companies to partner with Big Tech to revive old energy infrastructure, exemplified by the reopening of the Three Mile Island nuclear plant in Pennsylvania.[53] In addition, there are many examples of Big Tech investing in new advanced nuclear reactors to power data centers, even though the commercial viability of this technology has not yet been demonstrated.[54]

Similar to AI's need for clean water, the increasing electricity demand for AI and data centers is exacerbating electricity accessibility and affordability issues for families across the U.S. In Arizona, where thousands of residents are without electricity access, the state utility board passed an 8 percent rate hike to expand the power infrastructure needed by new data centers; meanwhile, it rejected a plan to bring electricity to underserved parts of the Navajo Nation.[55]

The increasing electricity demand for AI and data centers also increases and prolongs environmental injustices from air pollution. Predominately black neighborhoods in Randolph, Arizona and Memphis, Tennessee are facing increasing pollution from natural gas-powered turbines that is linked to asthma and lung cancer.[56] In the case of Memphis, Elon Musk's xAI is operating at least 18 turbines without any permits.[57]

AI as an "Environmental Tool" Increases Climate Change Drivers

Despite the clear issues posed by AI and data centers' water and energy use, Big Tech and some government agencies promote AI as an environmental tool rather than a harm. Ironically, Microsoft and other companies have used AI to optimize fossil fuel production, such as enhancing oil extraction.[58] AI has also been used to increase the output of coal-fired power plants.[59] The Department of Energy's (DOE) Water Power Technologies Office and Office of Critical and

Emerging Technologies are looking into AI and machine learning management of water and energy grid systems; meanwhile, the DOE acknowledges that it must "meet the challenge of powering AI itself"[60] — a much taller task than they let on.

While Big Tech and some government agencies tout AI and data centers as a net positive for the environment, these computing services are actively derailing Big Tech's goals for net zero carbon emissions.[61] Although net zero plans are often arbitrary pledges to promote a façade of sustainability, they illustrate how the rollout of AI and data centers moves us away from mitigating the worst effects of climate change.

Microsoft pledged to go carbon negative / water positive by 2030. But in 2022, AI rollout drove the company's largest nominal year-over-year increase in both water and electricity use, increasing Microsoft's total annual water and energy use for all purposes by one third.[62] As of 2024, Microsoft's total planet-warming emissions were around 30 percent higher than in 2020, making its 2030 carbon-negative plan harder to attain.[63] Similarly, Meta has reported that its 2024 emissions were 70 percent above 2019 levels, and Google's emissions surged nearly 50 percent from 2019 to 2023.[64]

While Big Tech's self-reported emissions are already cause for alarm, they may only tell part of the story. A 2024 report by *The Guardian* found that from 2020 to 2022, the real emissions from company-owned data centers of Apple, Google, Meta, and Microsoft were over seven times higher than officially reported.[65] Not surprisingly, to get around these increases in resource consumption, Big Tech is using carbon offsets and other false climate solutions to downplay its actual emissions.[66] It is clear that these tech oligopolies place profits and AI rollout above environmental concerns.

Conclusion and Recommendations

As Big Tech leaders line up to profit from policies enacted by the Trump administration, it is important to keep in mind the significant carbon and water footprints that accompany AI and data center development. For this reason, Food and Water Watch, along with hundreds of other organizations, is calling for a national data center moratorium until there is a regulatory framework in place that addresses the environmental harms of data centers and AI.

Moreover, the AI rollout must not revert electric utilities back to coal and other obsolete fossil fuel infrastructure, moves that we know Big Tech is already making in pursuit of quick and easy profits. We must also protect consumers from rising electric and water bills caused by the drastic increases in demand from AI. If AI is to truly help us advance, it must occur in ways that are aligned with protecting our environment and increasingly scarce natural resources.

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