What No One Knows About the Future of AI and Sustainability:
Assessing the Environmental Impacts of AI

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Abstract

In a world rapidly changing with the development of artificial intelligence, it can be difficult to accurately assess the environmental and political changes that come along with it, and where to begin with regulation. The purpose of this brief is to review the most common, and greatest concerns about AI's environmental impact, including water usage, and electricity usage in order to propose the most effective policy. This brief takes into account the social, political, and economic factors that affect this issue, to justify a policy that supports the increased implementation of clean energy to fuel AI sustainably.

Introduction

The Artificial Intelligence industry is booming. The next major wave of innovation, this technology will undoubtedly change our society drastically, the most pressing of which, may not be the most obvious. A common concern surrounding AI is the environmental impact. From energy consumption and water use, to political agendas, the commentary surrounding AI is not simple to understand nor mitigate. This poses an immense challenge to policymakers, as the issue of AI is undoubtedly nuanced, and yet the implications of its development are massive. The trajectory of AI's development could lead to the greatest innovations in human history, or an environmental crisis unlike ever before. This policy brief proposes a solution that works to mitigate the most pressing issues with AIs environmental impact focused on three factors: understanding the reality of AI's water and electricity use, assessing the political landscape, and addressing the necessary factors for long-term sustainability.

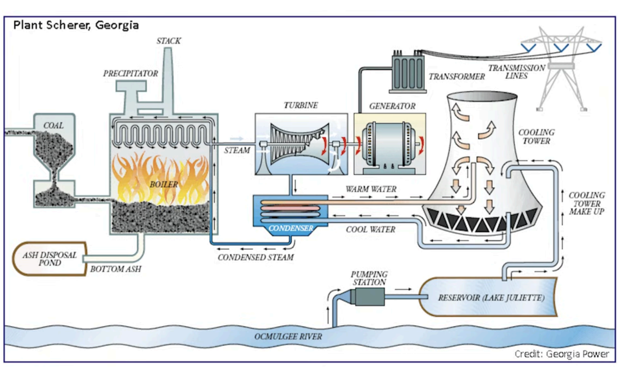
Why does the AI industry use water at all?

One of the most common environmental concerns regarding AI is its water use. Understanding the scope of water use in AI systems is incredibly important, and yet extremely difficult to measure. Morgan Stanley for instance, projects AI water use will be sitting around 1,086 Billion liters annually by 2028 (Moomoo, 2024). This may sound shocking, however CEO of open AI Sam Altman suggests that AI water use only adds up to about 0.00032 liters of water per query, or about 1/15 of a tablespoon (Vincent, 2025). This may sound confusing, as no matter how drastically you multiply 1/15 of a teaspoon, you get nowhere near a realistic number of queries that could be attributed to a global use of 1,086 billion liters of water per year. This does not mean however, that either statistic is untrue. The "water use per query" statistic is often easily manipulated. Sam Altman is referring to a single query, like the ones users send out when they initially prompt an AI with a question. The model used to process these queries, known as a Reasoning model, is not as simple as a single prompt. It prepares and sends other queries and evaluates the result until it feels confident it can send a response to the user. This means that a single query may prompt dozens of follow up queries, leading to an exponential multiplication of that initial 1/15 of a teaspoon.

Still, the water use attributed to queries alone is relatively insignificant when compared to the whole picture. The training for instance, accounts for about 50% of total AI water use (Strubell, 2024). The training of these models is continuous, meaning that even while users are engaging with the AI it is constantly creating newer and larger versions. To create these models, the system runs continuously on enormous clusters of GPUs, creating a massive energy pull. The statistic Sam Altman refers to does not include the training necessary for a query to be answered, therefore it is a massively skewed to the conservative estimate of AI's true water use. Microsoft, Google and Amazon alone are collectively spending more than 100 billion dollars a year on AI infrastructure. The Morgan Stanley prediction takes into account mostly the water use associated with the creation and maintenance of AI technology such as cooling, powering and building the systems.

When the computer chips used in AI data centers run, they get hot. In order to optimize efficiency, cooling these systems is imperative. Water was quickly found to be an effective solution, maximizing power output per dollar spent. Evaporative cooling is a common system, where clean water is turned into water vapor that takes the heat away. Other facilities recycle the same water over and over again or use non-potable water which is not drinkable and comes out of sewage treatment plants. Facilities like paper or steel pants use this type of non-potable water known as Industrial water. Most AI data centers however, rely on municipal water which is fresh drinking water. It is processed and delivered to these plants, which requires expensive infrastructure, and the same infrastructure that people rely on for their consumption.

Power plants are another component of AI water consumption. The need for water in this step of the AI industry is the generation of electricity to power data centers. Water is drawn through the thermoelectric power plants and turned into hot steam where it condenses through a turbine to generate electricity. The water



becomes very hot however, and requires more cold water to tame. Whether the plant is gas, coal, or nuclear, it is non-municipal water, taken from lakes, rivers, and oceans, and is either continuously recycled or used and returned to the environment. The water wasted from power plants adds up to only about 2-3% of total water used, meaning the main environmental impact of this method in terms of water is heat pollution. This occurs when large amounts of hot water are released into the environment, which can have devastating impacts on wildlife.

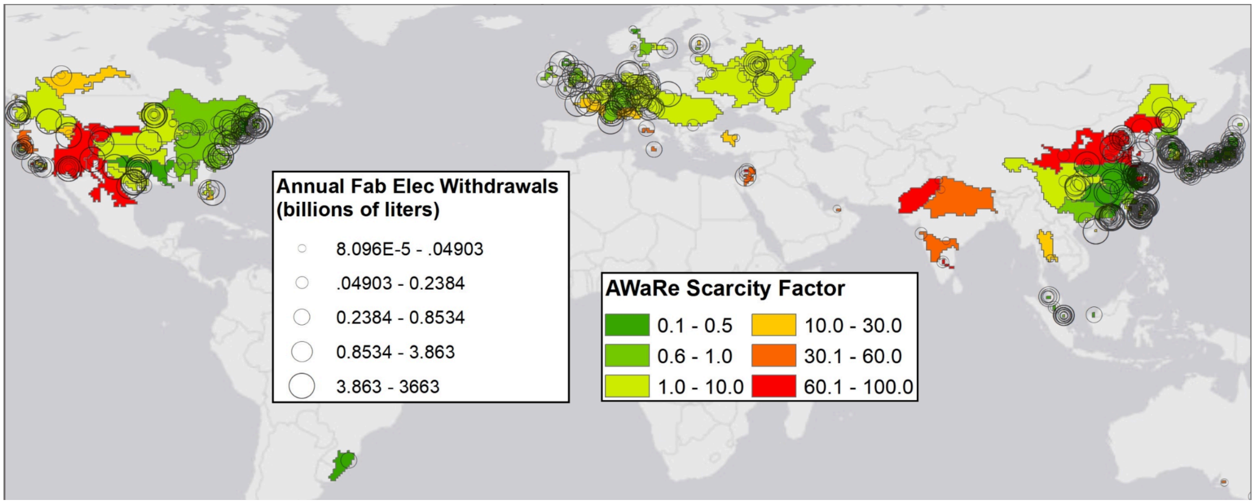
The final aspect of AI that requires a lot of water is in the production of semiconductors. The water necessary for cooling during the process of fabrication is ultraprocessed and distilled water. This is necessary because of the intricacy and scale of semiconductors. A single particle of dust can render a semiconductor unusable, so there are no impurities in the water used. In a survey of 28 semiconductor corporations around the globe, Harvard researchers found "Ultrapure water consumption was predicted to be 5.51 and 0.95 × 10^8 m^3 worldwide"(Qi, 2025). That is 95 billion liters of water that is not only being used, but ultra processed to accommodate fabrication. While AI only makes up about 18% of that production, its rapidly increasing production is likely to take on even more of the industry, with a 31.9% estimate by 2029(Qi, 2025).

AI Semiconductor Forecast

Semiconductor Intelligence

US$ billion	2024	2029	CAGR
Total Semiconductor	611	856	7%
AI ICs	110	273	20%
AI % of Total	18.0%	31.9%	

The way water is used is an incredibly important component of understanding AI's impact on the environment. While the uses of municipal water and industrial water have different implications, there is still not an infinite amount of water. Every place has a finite hydrological budget broken up into rivers, lakes, reservoirs, or aquifers. Many of these places have fully allocated their hydrological budget, meaning that the location of the industrial equipment for AI and the type of water used are incredibly important. The production of semiconductors for instance, pulls from a variety of water sources. The 28 semiconductor corporations surveyed on average distributed their water use across "Surface water intake, municipal water supply, groundwater withdrawal, third party supply, and external reclaimed water intake accounted for 47.0%, 35.3%, 8.5%, 5.8%, and 3.2% of total water use, respectively."(Qi, 2025). While diversification can be seen as an effective method, the places the water is drawn from is equally important as demonstrated in the graph below.

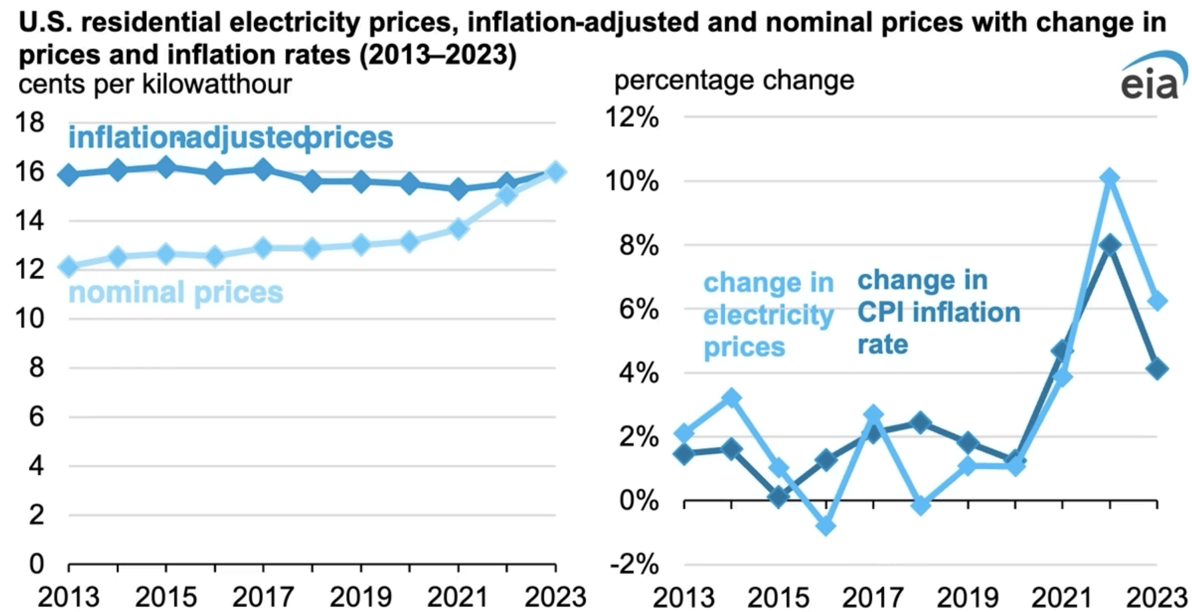


The fabrication of semiconductors uses water supplied from areas across the globe, however locations with less resources, or less room for semiconductor manufacturing in their hydrological budget may be put under immense stress. This can cause drought, famine, and loss of wildlife.

This exemplifies the importance of resource allocation. The water used in the entire process of AI can be estimated to about 260 billion gallons of water annually (Green, 2025). While this number is sure to grow, when compared to other industries, the true nature of AI water use is revealed. It takes between 600k and 1 million gallons of water per year to grow 1 acre of corn. The corn industry in the US alone used 20 trillion gallons of water per year (USDA). Corn is also not a resource humans themselves consume. Only about 1% of corn is consumed by humans. About 40% is used to make ethanol. 1 million gallons of water produces roughly 500 gallons of ethanol, which is mostly used to power vehicles. This demonstrates the necessity of context when discussing AI's environmental impact and shows that water may not actually be the largest issue.

If not water, then what?

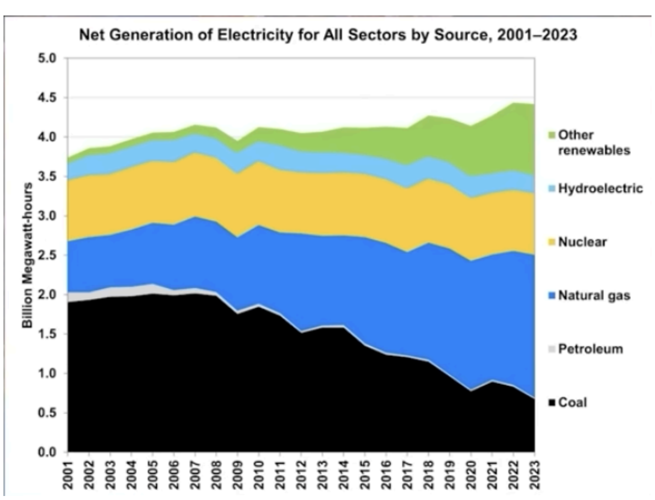
The issue of power allocation with the rise of AI is a considerable factor in its environmental implications. Historically, electricity has not experienced the same constraints as other necessary human resources like housing or food. This is due to the diversification and expansion of electricity capacity on the grid. This includes natural gas, solar, and wind technologies. There is also more demand, but supply has been able to keep up.



AI requires a new demand of the grid to power data centers. It is the first new electricity sector since nuclear power. Demand is also being converted from natural gas and gasoline to electricity from electric appliances and vehicles. This will lower the prices of natural gas and increase the demand for electricity. The immediate environmental impact of this is less significant, because industries are using electricity and therefore creating less pollution. This however raises questions about the future of supply and demand.

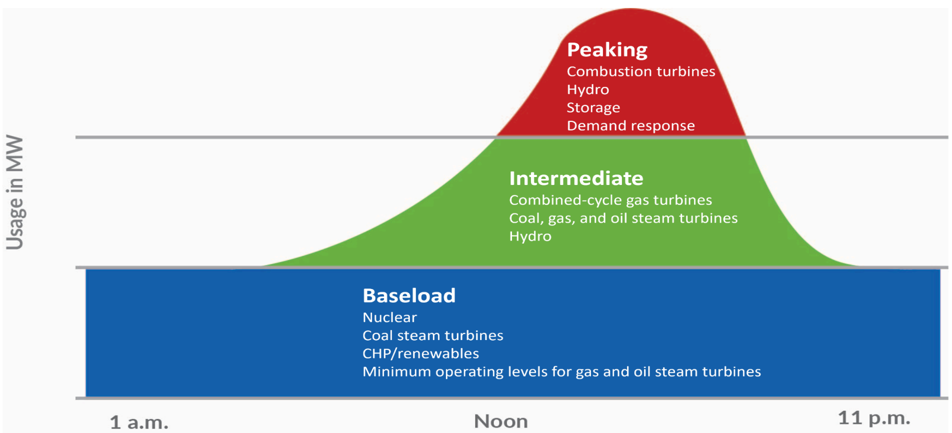
How big is renewable energy?

To get the whole picture, we must first evaluate the leading forms of clean energy and the grid as a whole. This graph from the Department of Energy shows the distribution of electricity over different sectors from 2001 to 2023. It shows that coal is rapidly declining in popularity, but also that renewable energy makes up roughly the same amount of the



grid that natural gas does. This illustrates the rise in renewable energies as a viable and important power source on the grid.

While renewable energy is increasing, it still faces issues in its use in the AI industry. Solar power for instance, is only available where sun is available, making it geographically dependent, and less efficient during certain months of the year. Power storage methods can help to offset this unreliability, but overall, it is a supplementary power, and cannot be used alone. Nuclear power however, is what is known as a baseload power. This means that it can generate electricity all day and night, regardless of conditions (Mueller, 2025). Seeing as AI models are used and trained continuously over days and months, a baseload power source like nuclear energy is a highly sought after, yet expensive method. The average power plant takes around 10 years to construct, which in the fast paced world of AI, may not be a quick enough turn around (CNBC, 2024). Many companies are concerned about turnaround as the difference between a leading and lagging model may mean mere months of training. This shows the complexity of fueling AI even with sustainability in mind.



Discussion of Current Policy

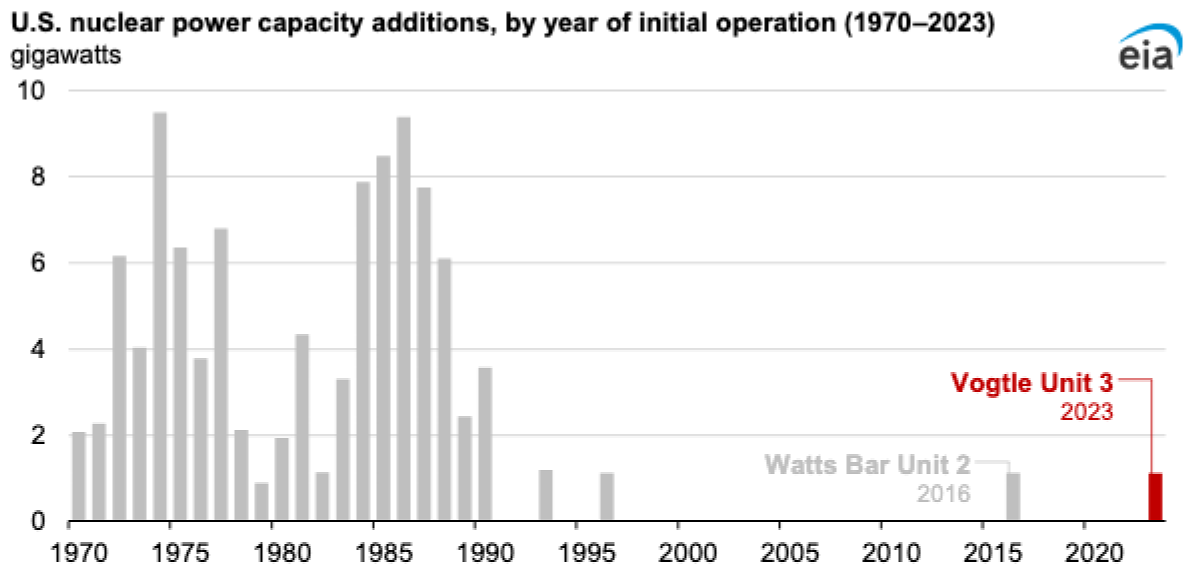
The Inflation Reduction Act of 2022 was a law passed by the Biden administration that worked to increase funding and subsidies for renewable energy initiatives. It was the single largest investment in climate and energy in American history, appropriating $11.7 billion for the LPO, increasing loan program authority by $100 billion, and appropriating $5 billion for the Energy Infrastructure Reinvestment Program (EIR) (USDE, 2021). This initiative was directly aimed at incentivising the creation and implementation of renewable energy. From the government subsidies on electric cars and solar panels at the consumer level, to multi-billion dollar stipends for the Loan Programs Office, the act allowed for a boom in renewables. This incentivising of renewable power could have completely redirected the development of AI, offsetting the costs of renewable power in the short term, while building industry and systems to support AI's immense and growing power draw in the long term.

The Loan Programs Office (LPO) specifically, is a government banking office that funds entrepreneurial pursuits, specifically focused on sustainability. It takes on "riskier" projects that traditional banks wouldn't, and often offers lower interest rates. This is because historically the government wanted to incentivise innovation, especially that which benefits the entire society (Crooks, 2025). The LPO would've been a key player in the innovation of energy technologies focused on offsetting AI power draws, however in 2024 DOGE cut LPO funding and staff, complicating their ability to process requests and allocate funding.

The implications of renewables was even further stifled by One Big Beautiful Bill Act, which is cutting funding and ending subsidies for renewable energy, while attempting to bring the prices of fossil fuels down to incentivise the continued reliance on these power sources. It incentivises this through the deregulation of natural gas exports. In the next year, natural gas exports are expected to double (Woodmack, 2025). This will have a massive effect on the natural gas prices in the US, and in the context of AI usage, make it more expensive for power plants to buy the natural gas that makes electricity for data centers and AI infrastructure.

The Environmental Protection Agency passed the Clean Air Act focused on the emissions standards for the construction of new AI data centers. This bill's goal however centers around "executing President Trump's directive through Administrator Zeldin's 'Powering the Great American Comeback' initiative"(EPA, 2025). This initiative directly reflects President Trump's desire to be the "AI capital of the world(EPA, 2025). The policy claims to present emissions requirements based upon both new and previous air pollution policy. However, it also "provides the framework under which sources may legally avoid requirements of CAA section 112 and title V."(EPA, 2025). This is a concerning clause as it blatantly defies the idea of abiding by government restrictions. This will become increasingly dangerous as the AI industry grows, leaving a greater environmental footprint.

On June 26, 2024, Congress passed the ADVANCE Act to facilitate US development of advanced nuclear reactors. This law boosted nuclear reactor deployment through regulatory reform. It argued that the current methods for reactor production were safer than ever before, and that the operation of these facilities was also safer. This allowed them to deregulate nuclear technology, meaning the bar to entry for designing and implementing a reactor was lowered. This was an effort to incentivise the implementation of nuclear power, and while the Trump administration is focused heavily on fossil fuels, this law has not been overturned, and continues to support investment into nuclear technologies. The act led directly to the creation of Vogtle Unit 3, the first active nuclear plant in the US since 2016. Plants like Vogtle, because of their baseload power, carry a much larger capacity for demanding power grid sectors like AI.



The United Nations International Atomic Energy Agency (IAEA) is another regulatory body focused on international policy to incentivise and regulate nuclear development. It prioritizes climate impact over potential human risks and works to educate the public on the reality and safety of current nuclear practices through their Atoms for Peace and Development program (IAEA).

Policy Recommendation

Option 1: No Change

Without any additional government regulations or accountability measures, AI infrastructure will continue to expand without guardrails, prioritizing economic efficiency and innovation over sustainability. Companies like Amazon and Google have however, made voluntary commitments to sustainability, promising carbon neutrality, and a transition to renewable energy (Calma, 2024). This might allow innovation to continue without overbearing government encroachment. Harsh regulations may also interfere with the speed of development, allowing other country's models to get ahead, taking an economic impact on the US, or encouraging companies to move their operations to countries without regulations. Given the rise in electricity costs from the exports of natural gas, and the increase of AI's power draw from local grids, the market may self-regulate, automatically turning toward renewable energy as the more cost-efficient solution to electricity price-spikes.

This is ultimately a risky option. Voluntary commitments carry no binding effect, and can be ignored in the care they are not convenient. AI is growing at such a rapid pace, that projections estimate its electricity needs will outpace what they can buy in clean energy (Calma, 2024). Many of those pledges cheat the system by buying credits instead of actually using clean power, so data centers might still pull from dirty grids while claiming offsets somewhere else. And without big investments in the grid, renewables will not catch up, leading to more fossil fuel use, maybe even revitalizing old coal plants, where modifying them to be nuclear plants would've been an option. Water is another issue, especially in areas where hydrological budgets are stretched thin, and this option does nothing to control that, leaving the power of crucial resource allocation in the hands of Tech entrepreneurs who have no care for the environmental impacts of their products.

Option 2: Government Intervention

Strictly enforced government policy presents the opportunity for clear, actionable guidelines. With strict environmental targets for AI companies, facility inspections, quarterly public transparency reports, and impact assessments could be enforced. A carbon tax of $50 to $100 per ton from AI operations that exceed emissions requirements or fines for failure to comply would be within the means of the government to enact. Long term goals would include the transition to 100% renewable energy for data centers by 2050, extra incentives for those that reach targets faster. Companies would no longer be able to buy renewable energy credits, and instead need power contracts for clean electricity. There would be caps on water use, with government oversight, ensuring sustainable hydrological budget allocation.

This creates real accountability, makes sure everyone plays by the same rules so no one cheats for an edge. It gives certainty that AI will not work against climate efforts, and with public reports, even large corporations can be held accountable. Federal rules would create a state-wide standard, to ensure no state is being taken advantage of.

The downsides to this policy however, are glaring. The current administration is on board with the current progression of AI infrastructure, meaning government incentive to enact policies increasing private company's cooperation with sustainability standards is unlikely. Relying on the government for checks on sustainability may actually increase corruption. Even if they did enforce impactful regulations, it may once again slow the development of AI models, posing an economic and technological stressor. Even a 2050 goal for transitions to clean energy might not even be possible with the current grid, forcing shutdowns or limits before renewables are ready.

Enforcing this would require an extensive budget and the creation of bodies within government bureaucracies dedicated to AI, which would both create thousands of jobs, and yet simultaneously be extremely tedious.

Option 3: Incentivised Sustainability

In order to tackle the multifaceted issue of AI sustainability, the solution must also be multifaceted. Working with policies that are already in place, like the ADVANCE Act, nuclear deregulation could present a unique economic opportunity for the future of AI. The government would give a $150 billion dollar fund to the LPO, to help subsidize the innovation of efficient nuclear power systems. AI companies would also be offered construction subsidies in return for their investment in nuclear power plants. Extra funding stipends would be given to companies who prioritize sustainable water use in their power plant construction, working with innovative Nuclear solutions such as NuScale modular plants, that can be built in as little as a ¼ of the timeframe of the average nuclear plant. Systems like these are cyclically beneficial, creating interdependence and innovation across industries that is not only more profitable long term, but better for the environment. Tech giants know that fossil fuels cannot keep up with AI in the long term, and with the OBBB Act, fossil fuels are already being allocated internationally, making them even more scarce. It not only works in the interest of these large companies to make the change, but the government as well. Despite the Trump administration's push for increased economic dependence on fossil fuels, the idea of a nuclear future is far more compelling, even for Trump. The administration emphasizes creating jobs for Americans, maintaining its status as a global superpower, and becoming the "AI Capital of the world". The incentivisation of nuclear energy would do all three of these things. This policy would create thousands of government jobs to oversee nuclear and LPO regulations, without creating entirely new bodies under existing bureaucracies. It would also

maintain the US's competition with its foreign counterparts such as China. In 2023 alone, China had exponentially more nuclear reactors under construction than any other country. While the US maintains the lead, they are quickly catching up, and utilizing a deregulation policy to make it happen. There is no way the US will achieve the coveted "AI capital of the world" status without joining the nuclear race.

Finally, the US could work with US UN ambassadors and its private AI industry leaders to utilize the Atoms for Peace and Development Program under the United Nations' IAEA. The initiative would work to connect developing nations with US industry leaders, developing nuclear technologies in technologically underrepresented countries. This would allow US industry leaders to diversify and expand the scope of their energy mix, utilizing available resources across the globe. This could lower the stress on US hydrological and electricity budgets, while creating industry and prosperity across the globe. While fear of corruption from large private companies may cause concern, The Atoms for Peace and Development Program would oversee these initiatives, implementing economic and geographical monitoring to assure the equitable use of resources.

The drawbacks of this proposal are that it is wildly expensive. Over 150 billion dollars would need to be directly allocated to subsidies and stipends, an idea that the current administration did not support in Biden's Inflation Reduction Act. This would need congressional approval, which competes with Congress's planned annual budgeting. Also, despite LPO investment in emerging technologies, it will likely take years to see results and turnover on sustainable energy. That being said, due to its massive economic opportunity and the president's push for AI industrialization, this policy provides a genuinely exciting vision of the AI future.

Conclusion

The most effective policy option is Option 3: Incentivised sustainability. This policy recommendation addresses a multitude of the facets that define the AI industry's battle with sustainability including the reality of AI's water use, the electricity crisis, and the government's motivations. While no policy will ever be perfect, and the volatility of this emerging industry is sure to continue, this policy allows for space to grow, change, and most importantly, create reliability in a system so focused on innovation. Whether AI fixes all of humanity's problems, or is the stepping stone for an entirely different technology altogether, the systems put in place by this policy will create longevity that will outlive administrations, crush fossil fuels, and change the world for the better.

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