Unique Randomness Generative Art
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Data of Data Center's Water Usages

Water withdrawal in data centers involves removing water from natural sources to cool servers and equipment. The primary methods include once-through cooling, which uses large volumes of water and releases it back into the environment at a higher temperature, and closed-loop cooling, which recirculates water within the facility with minimal loss but requires make-up water for evaporation.

Water withdrawal in data centers, primarily for cooling purposes, can have significant negative environmental impacts. Once-through cooling systems, which draw and discharge large volumes of water, can alter local water temperatures and negatively affect aquatic ecosystems. Additionally, both once-through and closed-loop systems contribute to water scarcity by consuming a substantial amount of water. The thermal pollution from once-through systems can also lead to decreased oxygen levels in water bodies, harming fish and other marine life. As awareness of these impacts grows, data centers are increasingly moving towards more sustainable practices, including the use of recycled water and air-cooling technologies that reduce or eliminate the need for water withdrawal.

For my project, I compiled a dataset on water withdrawal by large data centers, sourced from company reports and statistics websites that focus on reporting water usage. This dataset includes values representing the annual water usage of different data centers. I found this data by reviewing annual sustainability reports published by the companies and extracting relevant statistics from websites dedicated to environmental data tracking in the tech sector.

What makes this data particularly intriguing is the sheer volume of water usage by these large companies, which puts into stark perspective the significant amount of resources they consume. Additionally, there is a unique aspect to each data center's water usage, which varies widely due to factors like the surrounding environment and the specific cooling technologies employed. This variability not only highlights the randomness in water management practices across companies but also underscores the challenges and opportunities for improving sustainability within the tech industry. Each data center's approach reflects its operational

demands and environmental strategies, providing a rich dataset for analyzing how water management practices can be optimized. I formatted the data into a CSV file with columns for identifiers, dates, and water usage amounts, allowing for comprehensive analysis and the development of targeted strategies to enhance water conservation efforts.

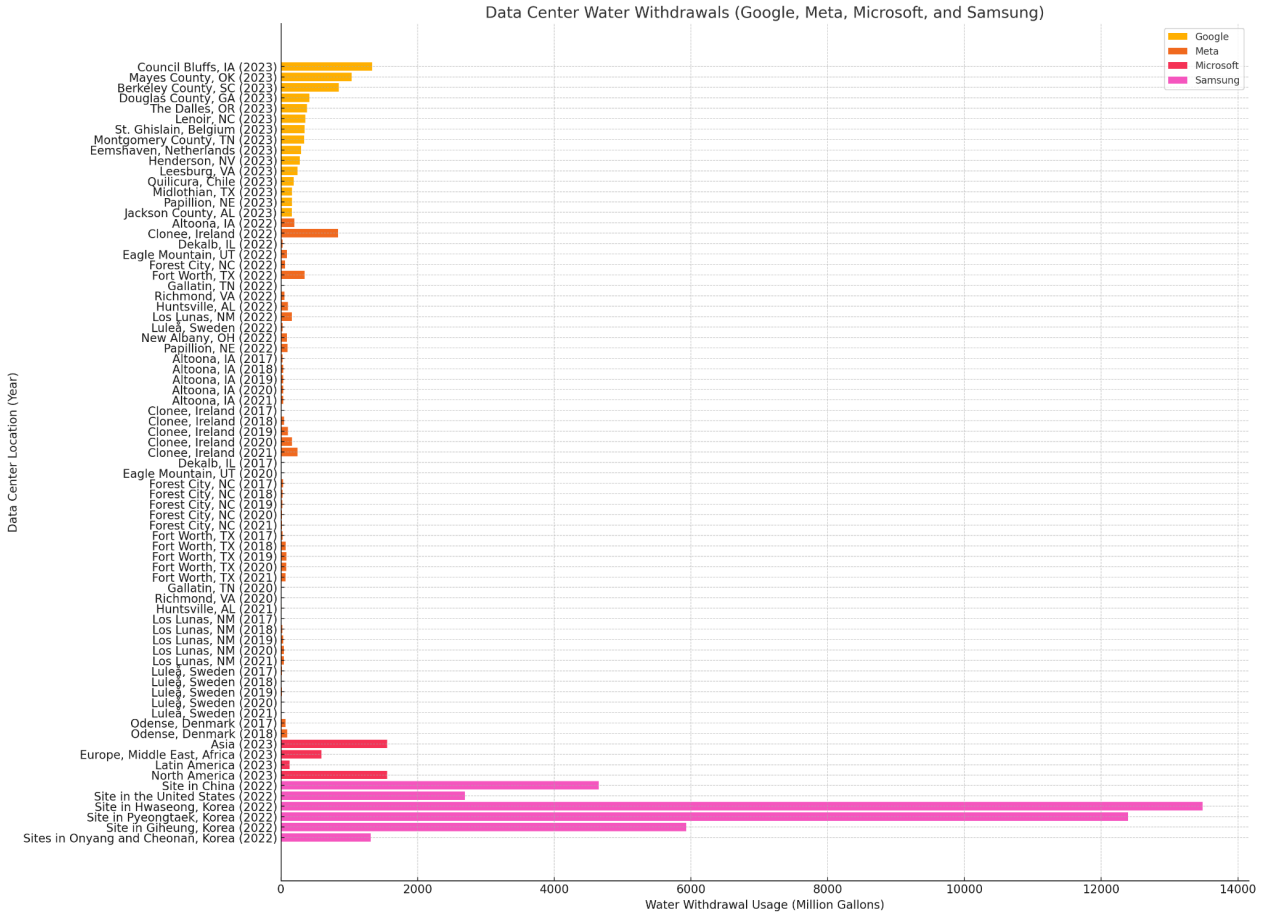
Google
https://www.statista.com/statistics/1498226/google-water-withdrawals-worldwide-by-data-center

Meta
https://sustainability.atmeta.com/wp-content/uploads/2023/07/Meta-2023-Environmental-Data-Index.pdf

Microsoft
https://cdn-dynmedia-1.microsoft.com/is/content/microsoftcorp/microsoft/msc/documents/presentations/CSR/2024-Environmental-Sustainability-Report-Data-Fact.pdf

Samsung
https://download.semiconductor.samsung.com/resources/others/Samsung_Semiconductors_Water_Stewardship_ENG.pdf

Note: Samsung water withdrawal's usage includes data center's and other.



Create a bar chart displaying the water withdrawal usage of major companies' data centers. Include the following details: 1) **Company Name** (e.g., Google, Meta, Microsoft, Samsung,); 2) **Data Center Location** (specific locations if available); 3) **Water Withdrawal Usage** in million gallons per year; and 4) **Year** (reporting year for the data). Use accurate figures where possible, and for missing data, provide estimates or aggregates with clear labels. Cite all data sources and assumptions used for the chart.

Used to create bar graph:

OpenAI. (2025). Data center water withdrawal usage of Google, Meta, and Microsoft [Bar graph]. Sources: Statista, Meta 2023 Environmental Data Index, Microsoft 2024 Environmental Sustainability Report Data Fact Sheet. from https://chat.openai.com.