Introductory

This is more or less the document in which I just keep information on AI, in the possible case that I forget something.
So it won’t be structured all too well, but it reads clearly. For me, at least.

How AI Trains & Generates

How AI is Trained

A big database is collected. Tons and tons and tons of publicly available content, and the database stable diffusion is trained off of contains 2.9 exabytes of just stuff (an exabyte is 1000 petabytes, a petabyte is 1000 terabytes, a terabyte is 1,000 gigabytes). Other databases like LAION contain ~7 exabytes.
Then, the AI analyzes patterns in the images and learns to associate visual elements with textual descriptions. Human annotators sometimes help refine the training process, though most of the learning happens automatically as the model processes vast amounts of data.
By the time the training is completed for the specific model (it never really ends), it doesn't need the images it trained off of anymore. It has learned all the statistical patterns that it needs at the time (as AI works with math).
Anyhow, when the model is released, it doesn't have access to its database. As said before, doesn't need the images anymore, and the model also has to be small enough to download- most locally hosted models tend to be 3 to 4 GB in size (weights; they're essentially parameters learned during the training process of a neural network. They represent the importance of each input feature or connection between neurons).

How AI Generates

Stable diffusion works by giving the "educated" AI model a wall of random pixels, referred to as "noise". The AI then goes through a process known as "denoising", in which it will apply its learned patterns to make a coherent image. This usually takes ~50 “denoising” phases, and the process is only about 30 seconds to 2 minutes, in my experience. The more denoising phases, the clearer or better the result.

AI Energy and Water

Energy Use

AI training doesn't use up a lot of energy. Stanford University data shows most models trained in 2024 used under 400 MWh, with GPT-3 having been an outlier at over 1,200 MWh in 2021.
The energy used to generate something- inference* energy- is significantly less. A single image generation on a model like Stable Diffusion uses about 1.35 watt-hours (Wh), roughly equivalent to charging a smartphone to 5%. For context, if 10,000 users on r/comics each generated one AI comic panel, that's 13.5 kWh-about what a single U.S. household uses in a day.
The International Energy Agency (IEA) estimated that data centers (including AI, cloud computing, and crypto) used 460 terawatt-hours (TWh) globally in 2022, or 2% of the world's electricity. AI specifically accounted for 4.5 gigawatts (GW) in 2023, about 8% of total data center consumption (Schneider Electric, 2023). The IEA projects data center energy use could double to 1,000 TWh by 2026, roughly matching Japan's annual consumption (125 million people).
While 1,000 TWh sounds huge, it's still only 4% of global electricity use (projected at 25,000 TWh by 2026). For comparison, the aviation sector used 2% of global energy-related CO_2 emissions in 2022, and the steel industry used 7-9%. AI's energy footprint is growing but not uniquely disastrous.
AI chips are getting more efficient- Nvidia's 2024 "superchip" uses 25 times less energy for the same generative AI tasks compared to 2019 models. Data centers are also improving: the IEA notes that chip efficiency for AI has doubled every 2.5-3 years since 2008.

*"Inference" is the term used to describe the process where a trained AI model uses its learned knowledge to make predictions or draw conclusions from new, unseen data- which is usually called "noise".

Water Use

Generating an AI image uses about 12 milliliters of water for cooling, based on estimates for typical data center setups (posts on X). For comparison, 5-50 ChatGPT prompts uses about 500 milliliters; 40 times more than an image.
Google's U.S. data centers used 12.7 billion liters of fresh water in 2021 (Planet Detroit, 2024). Google's global water use in 2023 was 5.56 billion gallons (22 billion liters), up 17% from 2022 (Washington Post, 2024). Microsoft's water use jumped 34% from 2021 to 2022, reaching 1.7 billion gallons (6.4 billion liters).
AI's global water consumption could hit 4.2-6.6 billion cubic meters by 2027, equivalent to 4-6 times Denmark's annual water use (Forbes, 2024). That's significant, but context matters: the U.S. alone uses 322 billion gallons of water per day (1.2 trillion liters), so AI's projected use is about 0.5% of that.
Companies are acting- Google aims to replenish 120% of its water use by 2030 (currently at 18%), and Veolia's water recycling tech saved a data center in Illinois 12 million gallons annually (Veolia WTS, 2024).

Additional water information:
In data centers, many closed-loop cooling systems transfer the captured heat to the building, and in some cases, even provide heating for an entire town. So the heat removed by the water in the closed loop isn't waste; it helps reduce the need for fossil fuels in those areas.