Largest Bitcoin Mining Farms in the World

If all Bitcoin mining operations were a country, they would rank 61st in terms of energy consumption. This is because Bitcoin networks are estimated to contain the computing power equivalent to over 3.7 million supercomputers.

Fundamentally, Bitcoin mining operations and traditional data centers are similar in basic design and operational principles. Power must be brought into the building and distributed to the equipment, air distribution systems cool the equipment, and the building provides protection from outdoor conditions and security threats.

For many Bitcoin mining operations, the owners, exact locations, and details are not made entirely public. However, some of the largest Bitcoin mining farms in the world include:

Dalian, China

Hashrate:
360,000 TH

Monthly energy cost:
$1,170,000

Mines 750 Bitcoin every month

Mines 3% of all Bitcoins

Genesis Mining Farm, Reykjavik, Iceland

Hashrate:
1,000 GH

Strategically placed in a cold climate

Largest cloud mining company in the world

Estimated to consume the most electricity of any company in Iceland

Moscow, Russia

Hashrate:
38 PH

Monthly energy cost:
$120,000

Mines 600 BTC every month

GigaWatt, Washington, USA

Hashrate:
1.3 PH

Located in Washington state due to it having some of the cheapest power in the US at $0.0842 per kWh

Started in the owner's basement

Linthal, Switzerland

Located in a factory building in a small village with attractive energy costs

Cool climate helps the mining process and prevents further overheating of equipment

Bitfury, Amsterdam, Netherlands

One of the oldest mining farms in the world

Since 2011, has deployed more than 500 megawatts of computing power and mined more than 600,000 Bitcoin

Uses a two-phase immersion cooling system that delivers energy savings as high as 95%

Key Differences Between Bitcoin Mining Farms and Traditional Data Centers

While Bitcoin mining farms and traditional data centers share some similarities, several key differences distinguish the two:

Server design. Whereas enterprise servers must be able to handle a multitude of applications, mining servers are designed to accomplish only one task. Mining servers can operate in temperatures as high as 90˚F and 10% to 80% relative humidity. A powerful mining server might have an electrical demand of 1.4 kW or more and dissipates high amounts of heat. As such, some manufacturers include a controller that varies the server's fan speed, voltage, and clock speed based on its temperature. Mining servers also have larger cross-sectional areas to allow for better airflow across their specialized chips to enable better heat dissipation.

Building structure. Mining farms are often found in storage facilities or warehouses. They have low levels of reliability and are not entirely protected from extreme weather events. Operational errors and spontaneous failures of site infrastructure are not uncommon, and there is often little to no redundancy in cooling systems. With less cooling infrastructure, the mechanical rooms are smaller, which creates more space for mining servers but increases the required power capacity.

Air distribution. In a traditional data center, servers are mounted in racks that secure them in place, allow for cable management, and enable proper airflow. In a mining farm, servers are often mounted on industrial shelving units, allowing for quick replacement in the event of a device failure. This shelving is cost-effective to purchase and install. The openness of this configuration allows air to flow above, below, and on both sides of the equipment. Since there is no formal airflow management like hot/cold aisle containment, the air temperature at the inlet of the servers varies greatly.

Cooling. By reducing or eliminating cooling system components like chillers, cooling towers, pumps, piping, and ductwork, mining farms can significantly reduce energy costs. Plus, with servers that can operate in high temperatures, outdoor air can often be used for cooling with no mechanical cooling required. Therefore, the geographic location of a mining farm is highly important. Cooler locations with servers that can operate in the hottest temperatures result in the highest energy efficiency. Some data centers that accommodate cryptocurrency mining are leveraging liquid immersion cooling in which liquid surrounds the servers, absorbs the heat, and converts to gas to dissipate the heat.

Energy consumption and efficiency. Energy costs are the primary concern for mining farms. Unlike enterprise servers where it is difficult to draw a one-to-one correlation between a server's energy consumption and its return-on-investment, this metric is easily obtainable for mining servers since they only perform one task. Understanding the influencing parameters on energy consumption and financial return is important to maximizing profit.

Reliability. Reliability is not a not key concern for mining farms, unlike their enterprise counterparts. This is because if a server fails, it is simply quickly replaced. Money is lost, but it is not on the same level as an enterprise data center experiencing downtime and impacting hundreds or thousands of customers.

Maximum capacity. Mining farms are densely packed with power-hungry equipment that runs at maximum capacity 24x7x365 compared to traditional data centers whose workloads fluctuate with demand. Mining data centers have reached hundreds of kilowatts per rack, orders of magnitude higher than racks in traditional data centers.

Sustainability concerns. The industrial scale and massive power consumption inherent to cryptocurrency mining operations have led to negative attention from governments, media, and consumers. Countries like China, Russia, Vietnam, Bolivia, Columbia, and Ecuador have already banned Bitcoin from being used as payment for goods and services.

Can Data Centers Pave the Way to a Greener Bitcoin?

0.55% of global energy consumption

Bitcoin mining currently consumes around 110 terawatt-hours per year. This is 0.55% of global energy consumption and is roughly equivalent to the annual energy demand of Malaysia or Sweden.

1 million transatlantic flights

The current carbon emissions caused by Bitcoin mining is equivalent to 1 million transatlantic flights, or the energy output of the Republic of Ireland, New Zealand, Hungary, or Peru.

65% of the current hashrate is based in China

The majority of Bitcoin mining is done where energy is abundant and cheap. For example, 65% of the current hashrate is based in China where coal power is cheap, hydro and wind power are plentiful, and locally manufactured mining hardware is cost-effective and convenient to deliver.

39% to 73% renewable energy range

Estimates for what percentage of Bitcoin mining uses renewable energy range from 39% to 73%. Also, Bitcoin mining rigs' short shelf-life is expected to result in a substantial amount of electronic waste.

500 megawatts of Bitcoin capacity by 2025

Bitcoin mining is continuing to grow as an industry. Beowulf Mining expects to deploy 500 megawatts of Bitcoin capacity by 2025.

257 megawatts by the end of 2022

Riot Blockchain projects that its energy consumption will grow from 51 megawatts to 257 megawatts by the end of 2022. BitFarms says it may add as much as 210 megawatts of capacity at an operation in Argentina.

185 terawatt-hours each year

In the future, the entire Bitcoin network is estimated to consume up to 185 terawatt-hours each year, almost as much as all global data centers consume annually.

90.2 million metric tons of CO2 emissions

This consumed energy would result in 90.2 million metric tons of CO2 emissions, comparable to the carbon footprint of metropolitan London and more than annual emissions related to global gold mining. As such, there are growing sustainability concerns about Bitcoin mining.

Energy consumption by global data centers grew by just 6% from 2010-2018

A decade ago, the data center industry faced similar concerns and was able to dramatically increase efficiency and use of renewables to the point where many organizations are now targeting zero carbon emissions. Energy consumption by global data centers grew by just 6% from 2010-2018 while the number of physical servers grew 30% and virtual machines increased by 550%. This was an impressive reversal from the 90% growth in data center energy consumption from 2000-2005.

Bitcoin miners may need to learn from their traditional counterparts to avoid regulators' enforcing higher electricity rates, equipment confiscation, additional taxes, or restrictions on cryptocurrencies.

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