GLOBAL BITCOIN MINING DATA REVIEW
Q3 2022

51 MINING COMPANIES REPRESENTING 45.4% OF THE GLOBAL NETWORK

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AGENDA

1 Introduction: Michael Saylor
2 Full BMC Q3 2022 Update: Ben Gagnon
3 Impact of Ethereum Merge: Will Foxley
4 Grid Stabilization Initiatives: Romain Nouzareth
5 Q & A
BITCOIN MINING COUNCIL

51 MINING COMPANIES FROM 5 CONTINENTS REPRESENTING 45.4% OF THE GLOBAL NETWORK
Bitcoin mining, in Q3 2022:

1. Uses an inconsequential amount of global energy (16bps) and generates negligible carbon emissions (10bps).

2. Bitcoin mining hashrate is up 73% YoY while energy usage is up 41% YoY, due to an increase in efficiency of 23%.

3. Bitcoin is the industry leader in sustainability with a 59.4% sustainable energy mix.

4. Bitcoin is the most secure crypto network, 100x more powerful than all competing networks combined.
1. Bitcoin Mining Energy Use Vs Global Energy Use
2. Bitcoin Mining Carbon Generation Vs Global Carbon Generation
3. Global Bitcoin Mining Energy Use Is Negligible
4. Global Bitcoin Mining Has The Highest Sustainable Energy Mix
5. Global Bitcoin Mining Vs Other Industries
6. Q3-22, Mining Efficiency Increased 3% & Sustainable Electricity Remained Equal
7. YoY, Mining Efficiency Increased 23% and Sustainable Electricity Mix Increased 3%
8. Bitcoin Mining Is Technology Intensive, 58x+ In Efficiency In 8 Years
9. Conclusion: Bitcoin Mining Energy Efficiency Is Improving, Rapidly
10. Sources And Methodology
BITCOIN MINING ENERGY USE VS TOTAL GLOBAL ENERGY USE

165,317 TWh
TOTAL ENERGY UTILIZED WORLDWIDE

266 TWh
ENERGY CONSUMED BY BITCOIN MINING ON THE WORLD’S ELECTRIC GRID

GLOBAL BITCOIN MINING CONSUMES 0.16% OF THE WORLD’S ENERGY PRODUCTION

SOURCES:
2. BMC ESTIMATED BITCOIN MINING ENERGY USE (September 30, 2022).
BITCOIN MINING CARBON EMISSIONS VS TOTAL GLOBAL CARBON EMISSIONS

34.8 BMt
TOTAL ESTIMATED CO₂ GENERATED GLOBALLY

0.04 BMt
ESTIMATED CO₂ GENERATED BY BITCOIN MINING ON THE WORLD’S ELECTRIC GRID

GLOBAL BITCOIN MINING IS 0.10% OF THE WORLD’S CO₂ PRODUCTION

SOURCES: ¹ CO₂ EMISIONS ARE ESTIMATED BY EXTRAPOLATING U.S. CARBON EMISSIONS GENERATED BY ELECTRICAL GENERATION. HTTPS://WWW.EIA.GOV/TOOLS/FAQS/FAQ.PHP?id=74&t=11
² BITCOIN MINING ESTIMATE IS DERIVED FROM THE Q3 2022 BMC ESTIMATED TWH ELECTRICITY CONSUMED GLOBALLY.
GLOBAL BITCOIN MINING ENERGY USE IS NEGLIGIBLE

BITCOIN MINING VS COUNTRIES (TWh)^{ii}

BITCOIN MINING ENERGY USE IS ONLY 0.16% WHEN COMPARED TO THE WORLD'S TOTAL ENERGY

SOURCES: ^1 BMC ESTIMATED BITCOIN MINING ENERGY USE (September 30, 2022); ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY & ELECTRICITY USE.
^2 BP'S STATISTICAL REVIEW OF WORLD ENERGY (2021); HTTPS://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY/PRIMARY-ENERGY.
GLOBAL BITCOIN MINING HAS THE HIGHEST SUSTAINABLE ENERGY MIX

SUSTAINABLE POWER MIX: BITCOIN MINING VS COUNTRIES (% OF TWh)

<table>
<thead>
<tr>
<th>Country</th>
<th>BMC Member Data</th>
<th>Global BTC Mining</th>
<th>Germany</th>
<th>EU</th>
<th>South Korea</th>
<th>United States</th>
<th>Canada</th>
<th>Brazil</th>
<th>World</th>
<th>Russia</th>
<th>China</th>
<th>Japan</th>
<th>Poland</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>67.8%</td>
<td>59.4%</td>
<td>48.5%</td>
<td>43.5%</td>
<td>33.7%</td>
<td>31.4%</td>
<td>22.5%</td>
<td>21.7%</td>
<td>21.7%</td>
<td>19.6%</td>
<td>16.4%</td>
<td>16.3%</td>
<td>15.6%</td>
<td>12.6%</td>
</tr>
</tbody>
</table>

**SOURCES:**

*i* VALUE REPRESENTS DATA COMPILLED FROM BMC ADVISORY COUNCIL MINERS. ANNUALIZED PRIMARY ENERGY USE.

*i* *ii* ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON BMC ANALYSIS, ASSUMPTIONS AND EXTRAPOLATION. (September 30, 2022)

GLOBAL BITCOIN MINING VS OTHER INDUSTRIES


© 2022 BITCOIN MINING COUNCIL
DURING Q3-22, MINING EFFICIENCY INCREASED 3% AND NETWORK SECURITY INCREASED 8%
YoY, MINING EFFICIENCY INCREASED 23% AND SECURITY INCREASED 73%

FLEET ELECTRICITY CONSUMPTION (GW)

<table>
<thead>
<tr>
<th></th>
<th>Q3-21</th>
<th>Q3-22</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMC</td>
<td>7.5</td>
<td>4.2</td>
</tr>
<tr>
<td>BMC</td>
<td>10.6</td>
<td></td>
</tr>
</tbody>
</table>

MINING EFFICIENCY (EH/GW)

<table>
<thead>
<tr>
<th></th>
<th>Q3-21</th>
<th>Q3-22</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMC</td>
<td>17.7</td>
<td>24.9</td>
</tr>
<tr>
<td>BMC</td>
<td>21.7</td>
<td></td>
</tr>
</tbody>
</table>

HASRATE (EH)

<table>
<thead>
<tr>
<th></th>
<th>Q3-21</th>
<th>Q3-22</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMC</td>
<td>133.3</td>
<td>105.0</td>
</tr>
<tr>
<td>BMC</td>
<td>231.1</td>
<td></td>
</tr>
</tbody>
</table>

SUSTAINABLE ELECTRICITY (%)

<table>
<thead>
<tr>
<th></th>
<th>Q3-21</th>
<th>Q3-22</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMC</td>
<td>57.7%</td>
<td>67.8%</td>
</tr>
<tr>
<td>BMC</td>
<td>59.4%</td>
<td></td>
</tr>
</tbody>
</table>

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BITCOIN MINING IS TECHNOLOGY INTENSIVE, INCREASING 58X IN EFFICIENCY OVER 8 YEARS

<table>
<thead>
<tr>
<th>Combined</th>
<th>Hardware name</th>
<th>Date</th>
<th>J/Th</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>ARM Cortex A9</td>
<td>3-Jan-09</td>
<td>877,193</td>
</tr>
<tr>
<td>GPU</td>
<td>ATI 5870M</td>
<td>23-Sep-09</td>
<td>264,550</td>
</tr>
<tr>
<td>FPGA</td>
<td>X6500 FPGA Miner</td>
<td>29-Aug-11</td>
<td>43,000</td>
</tr>
<tr>
<td>ASIC - Avalon B1</td>
<td>Canaan AvalonMiner Batch 1</td>
<td>1-Jan-13</td>
<td>9,351</td>
</tr>
<tr>
<td>ASIC - Jupiter</td>
<td>KnCMiner Jupiter</td>
<td>5-Oct-13</td>
<td>1,484</td>
</tr>
<tr>
<td>ASIC - U1</td>
<td>Antminer U1</td>
<td>1-Dec-13</td>
<td>1,250</td>
</tr>
<tr>
<td>ASIC - BF864C55</td>
<td>Bitfury BF864C55</td>
<td>3-Mar-14</td>
<td>500</td>
</tr>
<tr>
<td>ASIC - RockerBox</td>
<td>RockerBox</td>
<td>22-Jul-14</td>
<td>316</td>
</tr>
<tr>
<td>ASIC - BE3000</td>
<td>ASICMiner BE300</td>
<td>16-Sep-14</td>
<td>187</td>
</tr>
<tr>
<td>ASIC - BM13850</td>
<td>BM1385</td>
<td>19-Aug-15</td>
<td>181</td>
</tr>
<tr>
<td>ASIC - PickAxe0</td>
<td>PickAxe</td>
<td>23-Sep-15</td>
<td>140</td>
</tr>
<tr>
<td>ASIC - S9</td>
<td>Antminer S9 - 11.5TH</td>
<td>1-Jun-16</td>
<td>98</td>
</tr>
<tr>
<td>ASIC - R4</td>
<td>Antminer R4</td>
<td>1-Feb-17</td>
<td>97</td>
</tr>
<tr>
<td>ASIC - Ebit 10</td>
<td>Ebang Ebit 10</td>
<td>15-Feb-18</td>
<td>92</td>
</tr>
<tr>
<td>ASIC - S15</td>
<td>Antminer S15</td>
<td>9-Apr-18</td>
<td>59</td>
</tr>
<tr>
<td>ASIC - S17</td>
<td>Antminer S17</td>
<td>9-Apr-19</td>
<td>39.5</td>
</tr>
<tr>
<td>ASIC - S19</td>
<td>Antminer S19 Pro</td>
<td>23-Mar-20</td>
<td>29.5</td>
</tr>
<tr>
<td>ASIC - S19 XP</td>
<td>Antminer S19 Pro</td>
<td>12-Nov-21</td>
<td>21.5</td>
</tr>
</tbody>
</table>

J/TH - EFFICIENCY OVER TIME

BITCOIN MINING IS 5,814% MORE EFFICIENT OVER THE LAST 8 YEARS. IT'S ESTIMATED THAT THE GLOBAL J/TH EFFICIENCY IS 46.0.

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CONCLUSION: BITCOIN MINING ENERGY EFFICIENCY IS IMPROVING, RAPIDLY

The Bitcoin Mining Council is estimating a 3x and 2x improvement in mining efficiency over the next four and following four years, respectively.

Satoshi’s protocol reduces energy consumption incentives by 2x every 4 years, for the foreseeable future.

6x + 4x = Bitcoin mining is guaranteed to be dramatically more energy efficient in the next eight years.
BITCOIN IS 99% OF ALL CRYPTO POWER, 100 TIMES THE SECURITY OF ALL THE OTHER NETWORKS COMBINED.

<table>
<thead>
<tr>
<th>Crypto</th>
<th>Hashrate (TH/s)</th>
<th>Relative to Bitcoin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethereum Classic</td>
<td>141</td>
<td>A grain of sand</td>
</tr>
<tr>
<td>Dogecoin</td>
<td>410</td>
<td>A house fly</td>
</tr>
<tr>
<td>Litecoin</td>
<td>467</td>
<td>A grain of rice</td>
</tr>
<tr>
<td>Bitcoin</td>
<td>267,390,203</td>
<td>Mt. Fuji</td>
</tr>
</tbody>
</table>

SOURCES: NETWORK HASHRATE AND POWER EFFICIENCY DATA COMPILED FROM WHATOMINE.COM ON OCTOBER 14, 2022
The combined power of AWS, Azure and Google Cloud would be less than 1% of Bitcoin.

It would take approximately 66 TW to attack the Bitcoin network using standard cloud computing hardware. The equivalent of 3.5x what the entire Earth is currently producing. Bitcoin is currently using 0.16%, making Bitcoin 2,187.5x more efficient.

Sources:
1. Network hashrate and power efficiency data compiled from whattomine.com on October 14, 2022.
2. Cloud computer hashrate and power efficiency data pulled for Tesla P100 PCIe 12 GB from AskGeek.io.
SOURCES & METHODOLOGY

BMC SURVEY METHODOLOGY:

THE BMC SURVEYED BITCOIN MINERS AROUND THE WORLD ASKING THREE QUESTIONS;
1.) HOW MUCH ELECTRICITY DOES YOUR TOTAL FLEET CONSUME TODAY?;
2.) WHAT IS THE TOTAL % OF SUSTAINABLE ELECTRICITY* WITHIN YOUR FLEET’S POWER GENERATION MIX TODAY?;
3.) WHAT IS THE TOTAL AGGREGATE HASHRATE OF YOUR FLEET TODAY?

*THE ANNOTATED TERM “SUSTAINABLE ELECTRICITY” WAS DEFINED AS ELECTRICITY GENERATED BY: HYDRO, WIND, SOLAR, NUCLEAR, GEOTHERMAL.

THE Q3 2022 BMC SUSTAINABILITY ELECTRICITY VALUE NO LONGER TAKES INTO ACCOUNT RENEWABLE ENERGY CREDITS (REC).

SOURCES:

2. CO2 EMISSIONS ARE ESTIMATED BY EXTRAPOLATING U.S. CARBON EMISSIONS GENERATED BY ELECTRICAL GENERATION. HTTPS://WWW.EIA.GOV/TOOLS/FAQS/FAQ.PHP?ID=74&T=11. BITCOIN MINING ESTIMATE IS DERIVED FROM THE Q3 2022 BMC ESTIMATED TWH ELECTRICITY CONSUMED GLOBALLY.
6. DATA COMPILED FROM BMC ADVISORY COUNCIL MEMBERS. ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY AND ELECTRICITY USE. ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON BMC ANALYSIS, ASSUMPTIONS AND EXTRAPOLATION. As of Q4-21, BMC SUSTAINABILITY ELECTRICITY VALUE NO LONGER TAKES INTO ACCOUNT RENEWABLE ENERGY CREDITS (REC).
8. NETWORK HASHRATE SNAPSHOT ON OCTOBER 14, 2022 COMPILED FROM HTTPS://WHATCOMINE.COM/.
9. CLOUD COMPUTE HASHRATE PERFORMANCE DATA ARE FROM HTTPS://ASKGEEK.IO/EN/GPUS/VS/AMD_RADEON-PRO-V520-VS-NVIDIA_TESLA-P100-Pcie-12-GB.

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5 Q & A
"The Merge"
The How and When

- Occurred at Total Terminal Difficulty (TTD), not block height.
- Reduce chance of miners interfering with change.
What’s Happened Since?

1. Smooth operation for the Proof-of-Stake network
2. Dubious energy claims
3. Unemployed Ethereum miners
4. Censorship concerns mounting
Proof-of-Stake operations

Ethereum’s Hash Rate (TH/s, 7DMA)
Proof-of-Stake operations

Ethereum 2.0 Beacon Chain Chart

Validators
History of daily active validators.

From Nov 30, 2020 To Oct 13, 2022
Performance Since The Merge

Ethereum Block Validator Revenue (Monthly)

- Miner Subsidy
- Transaction Fees
- Miner Uncle Reward
- Staker Revenue

SOURCES: COIN METRICS, BEACONSCAN
UPDATED: OCT 14, 2022
More energy efficient?
The Merge – Implications on the Electricity Consumption and Carbon Footprint of the Ethereum Network

(Crypto Carbon Ratings Institute; commissioned by ConsenSys)

<table>
<thead>
<tr>
<th></th>
<th>Ethereum PoW</th>
<th>Ethereum PoS</th>
<th>Reduction factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity consumption [MWh/year]</td>
<td>22,900,320</td>
<td>2,600.86</td>
<td>0.99988</td>
</tr>
<tr>
<td>CO₂e emissions [t/year]</td>
<td>11,016,000</td>
<td>869.78</td>
<td>0.99992</td>
</tr>
</tbody>
</table>

Figure 1: Estimates of power usage of the Ethereum network by Gallersdörfer et al, Kyle McDonald and Nilsenrot. Data from Nilsenrot is transformed to GW to align.
Unemployed Ethereum Miners

Seeking future revenue streams:

- Artificial intelligence
- Graphics rendering
- Altcoins
- Zero Knowledge Proofs
**Down Only for GPU Mining Alternatives**

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Price</th>
<th>Last 30 Days</th>
<th>30d %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Ethereum ETH</td>
<td>$1,295.11</td>
<td></td>
<td>-21.12%</td>
</tr>
<tr>
<td>23</td>
<td>Ethereum Classic ETC</td>
<td>$22.98</td>
<td></td>
<td>-40.74%</td>
</tr>
<tr>
<td>211</td>
<td>EthereumPoW ETHW</td>
<td>$7.13</td>
<td></td>
<td>-79.64%</td>
</tr>
<tr>
<td>235</td>
<td>Ergo ERG</td>
<td>$2.21</td>
<td></td>
<td>-56.28%</td>
</tr>
<tr>
<td>460</td>
<td>Kaspa KAS</td>
<td>$0.002286</td>
<td></td>
<td>-42.92%</td>
</tr>
<tr>
<td></td>
<td>Raven RAVEN</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Biggest risk? Censorship
“Show me the incentives, I’ll show you the outcome…”
Flashbots MEV-Boost: >51% blocks created by OFAC compliant validators. Why? Profit.
Almost all blocks since The Merge (~210,000)

red = censoring block

(left to right = time)
Wrap

- Flashbots is working on a new decentralized marketplace for relays announced last week at Devcon called “Suave.”
- Ethereum miners are likely to trash hardware on secondary markets.
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Bitcoin Mining - CURTAILMENT - Benefits

The only tech solution that can:

- Stop on Demand
- Grid balancing with excess energy
- Good locally and globally

INTERMITTENT RENEWABLE PRICES

BALANCED GRID

PROOF OF WORK MINING PROFITABILITY
THANK YOU