GLOBAL BITCOIN MINING DATA REVIEW
Q4 2021

DECEMBER 2021

36 MINING COMPANIES REPRESENTING 46% OF THE NETWORK
BITCOIN MINING COUNCIL
36 MINING COMPANIES REPRESENTING 46% OF THE NETWORK

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EXECUTIVE SUMMARY

Bitcoin mining:

1. Uses an inconsequential amount of energy.
2. Is rapidly becoming more efficient.
3. Is powered by a higher mix of sustainable energy than any major country or industry.
1. BITCOIN MINING ENERGY USE VS GLOBAL ENERGY GENERATION
2. BITCOIN MINING ENERGY USE VS UNITED STATES ENERGY 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. IN Q4, MINING EFFICIENCY & SUSTAINABLE ELECTRICITY MIX INCREASED 9% & 1%
7. BITCOIN MINING IS TECHNOLOGY INTENSIVE, 58X+ IN EFFICIENCY IN 8 YEARS
8. CONCLUSION: BITCOIN MINING ENERGY EFFICIENCY IS IMPROVING, RAPIDLY
9. SOURCES AND METHODOLOGY
BITCOIN MINING ENERGY USE VS TOTAL GLOBAL ENERGY GENERATION

154,750 TWh
TOTAL ENERGY GENERATED WORLDWIDE

50,000 TWh
ENERGY LOST DUE TO INEFFICIENCIES

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

GLOBAL BITCOIN MINING CONSUMES
0.14%
OF THE WORLD’S ENERGY PRODUCTION

GLOBAL BITCOIN MINING CONSUMES
0.44%
OF THE WORLD’S ENERGY WASTED

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SOURCES:
2. INTERNATIONAL ENERGY AGENCY, HTTPS://WWW.IEA.ORG/DATA-AND-STATISTICS/DATA-PRODUCT/WORLD-ENERGY-STATISTICS-AND-BALANCES
ENERGY CONSUMED BY BITCOIN MINING ON THE WORLD'S ELECTRIC GRID

BITCOIN MINING ENERGY USE VS U.S. ELECTRICITY GENERATION

10,463 TWh
TOTAL ENERGY USED TO GENERATE & DISTRIBUTE ELECTRICITY IN THE US

6,800 TWh
ELECTRICAL SYSTEM ENERGY WASTED OR LOST IN THE US

220 TWh
ENERGY CONSUMED BY BITCOIN MINING ON THE WORLD'S ELECTRIC GRID

GLOBAL BITCOIN MINING CONSUMES 3.2% OF THE ELECTRICAL SYSTEM ENERGY WASTED OR LOST IN THE US

65% OF ALL ENERGY USED TO GENERATE & DISTRIBUTE ELECTRICITY IN THE US IS LOST OR WASTED

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SOURCES:
1. HTTPS://WWW.EIA.GOV/TOTALENERGY/DATA/MONTHLY/PDF/FLOW/TOTAL_ENERGY_2020.PDF
2. BMC ESTIMATED BITCOIN MINING ENERGY USE (DEC 31, 2021)
GLOBAL BITCOIN MINING ENERGY USE IS NEGLIGIBLE

Primary Energy Consumption: Bitcoin Mining vs Countries (TWh)

- Bitcoin Mining Energy Use is only 0.142% when compared to the world’s total energy.

Sources:
1. BMC Estimated Bitcoin Mining Energy Use (Dec 31, 2021). Annualized values are used for Bitcoin mining energy & electricity use.
GLOBAL BITCOIN MINING HAS THE HIGHEST SUSTAINABLE ENERGY MIX

**Primary Energy Sustainable Power Mix: Bitcoin Mining vs Countries (% of TWh)**

66.1% ^\textsuperscript{i}

58.8% ^\textsuperscript{ii}

48.5%

43.5%

33.7%

31.4%

22.5%

21.7%

21.7%

19.6%

16.4%

16.3%

12.6%

2.3%

- **Sources:**
  - Value represents data compiled from BMC Advisory Council miners, annualized primary energy use.
  - Estimated global Bitcoin network annualized power based on BMC analysis, assumptions, and extrapolation (Dec 31, 2021).

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GLOBAL BITCOIN MINING VS OTHER INDUSTRIES

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SOURCES: \(^i\) BMC ESTIMATED BITCOIN MINING ENERGY USE (DEC 31, 2021). ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY & ELECTRICITY USE.


GLOBAL BITCOIN MINING VS OTHER INDUSTRIES (TWh)

- Global BTC Mining: 26,481
- Residential Buildings: 15,424
- Pollution: 8,059
- Road freight vehicles: 9,630
- Air Conditioning (US): 6,691
- Construction: 5,833
- Shipping: 4,939
- Aviation: 4,063
- Appliances (US): 4,046
- Gold Mining: 3,716
- Computer Games: 3,000
- Holiday Lights: 571
- 214
IN Q4, MINING EFFICIENCY INCREASED 9% AND SUSTAINABLE ELECTRICITY MIX INCREASED 1%
BITCOIN MINING IS TECHNOLOGY INTENSIVE, IT HAS INCREASED 58X IN EFFICIENCY OVER 8 YEARS

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<th>Combined</th>
<th>Hardware name</th>
<th>Date</th>
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<tr>
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<td>ARM Cortex A9</td>
<td>3-Jan-09</td>
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<td>ATI 5870M</td>
<td>23-Sep-09</td>
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<td>FPGA</td>
<td>X6500 FPGA Miner</td>
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<td>KnCMiner Jupiter</td>
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<td>Antminer U1</td>
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<td>ASIC - S9</td>
<td>Antminer S9 - 11.5TH</td>
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<td>Ebang Ebit 10</td>
<td>15-Feb-18</td>
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<td>Antminer S19 Pro</td>
<td>12-Nov-21</td>
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</tr>
</tbody>
</table>

BITCOIN MINING IS 5,814% MORE EFFICIENT OVER THE LAST 8 YEARS

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SOURCES 7: HARDWARE DATA COMPILED FROM RESPECTIVE HARDWARE MANUFACTURER WEBSITES. OLDER GENERATION MODEL EFFICIENCY DATA FROM "THE COST OF BITCOIN MINING HAS NEVER REALLY INCREASED" (2020) HTTPS://ARXIV.ORG/PDF/2004.04605.PDF
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 8 years.

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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 Q4 2021 BMC SUSTAINABILITY ELECTRICITY VALUE NO LONGER TAKES INTO ACCOUNT RENEWABLE ENERGY CREDITS (REC).

**SOURCES:**

   INTERNATIONAL ENERGY AGENCY, HTTPS://WWW.IEA.ORG/DATA-AND-STATISTICS/DATA-PRODUCT/WORLD-ENERGY-STATISTICS-AND-BALANCES/
   BMc ESTIMATED BITCOIN MINING ENERGY USE.

2. VALUE REPRESENTS DATA COMPILED FROM BMC ADVISORY COUNCIL MINERS. ANNUALIZED PRIMARY ENERGY USE. ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON
   HTTPS://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY.HTML

3. BMc ESTIMATED BITCOIN MINING ENERGY USE (DEC 31, 2021). ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY & ELECTRICITY USE. BP'S STATISTICAL REVIEW OF WORLD
   VALUE REPRESENTS DATA COMPILED FROM BMC ADVISORY COUNCIL MINERS. ANNUALIZED PRIMARY ENERGY USE. ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON
   BMc ANALYSIS, ASSUMPTIONS AND EXTRAPOLATION. COUNTRY DATA COMPILED FROM BP'S STATISTICAL REVIEW OF WORLD ENERGY (2021).
   HTTPS://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY.HTML

4. VALUE REPRESENTS DATA COMPILED FROM BMC ADVISORY COUNCIL MINERS. ESTIMATED INDUSTRY ENERGY USE BASED ON SEVERAL SOURCES:
   HTTPS://WWW.EIA.GOV/OUTLOOKS/IEO/PDF/TRANSPORTATION.PDF / HTTPS://ACADEMIC.OUP.COM/EURPUB/ARTICLE-ABSTRACT/30/SUPPLEMENT_5/CKAA165.843.5914601 /
   HTTPS://HASSMCCOOK.MEDIUM.COM/COMPARING-BITCOINS-ENVIRONMENTAL-IMPACT-F568B8014F64
   HTTPS://BITCOINMAGAZINE.COM/BUSINESS/INTRODUCING-CBEI-A-NEW-WAY-TO-MEASURE-BITCOIN-NETWORK-ELECTRICAL-CONSUMPTION

5. HARDWARE DATA COMPILED FROM RESPECTIVE HARDWARE MANUFACTURER WEBSITES. OLDER GENERATION MODEL EFFICIENCY DATA FROM “THE COST OF BITCOIN MINING HAS NEVER REALLY INCREASED” (2020) HTTPS://ARXIV.ORG/PDF/2004.04605.PDF
THANK YOU