

GLOBAL BITCOIN MINING DATA REVIEW

Q4 2021

DECEMBER 2021

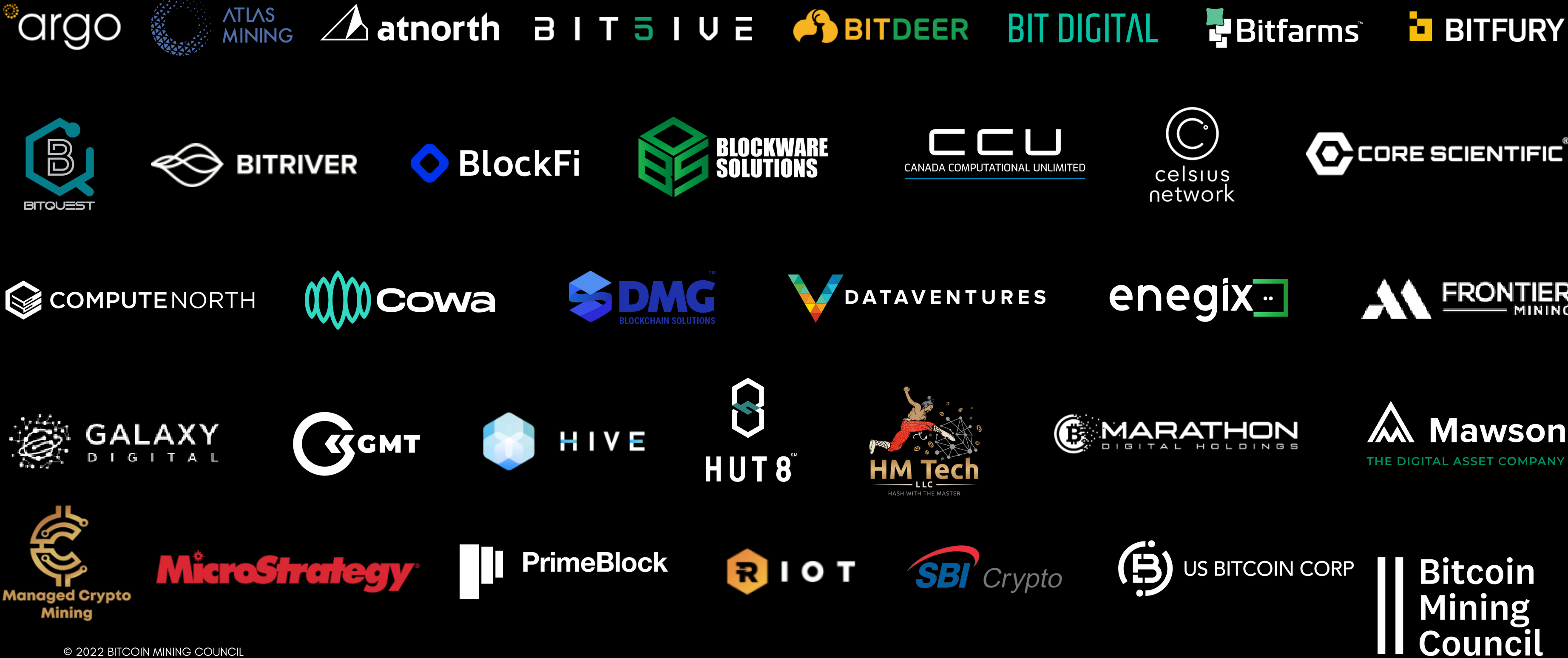
36 MINING COMPANIES REPRESENTING **46%** OF THE NETWORK

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36 MINING COMPANIES REPRESENTING 46% OF THE NETWORK



EXECUTIVE SUMMARY

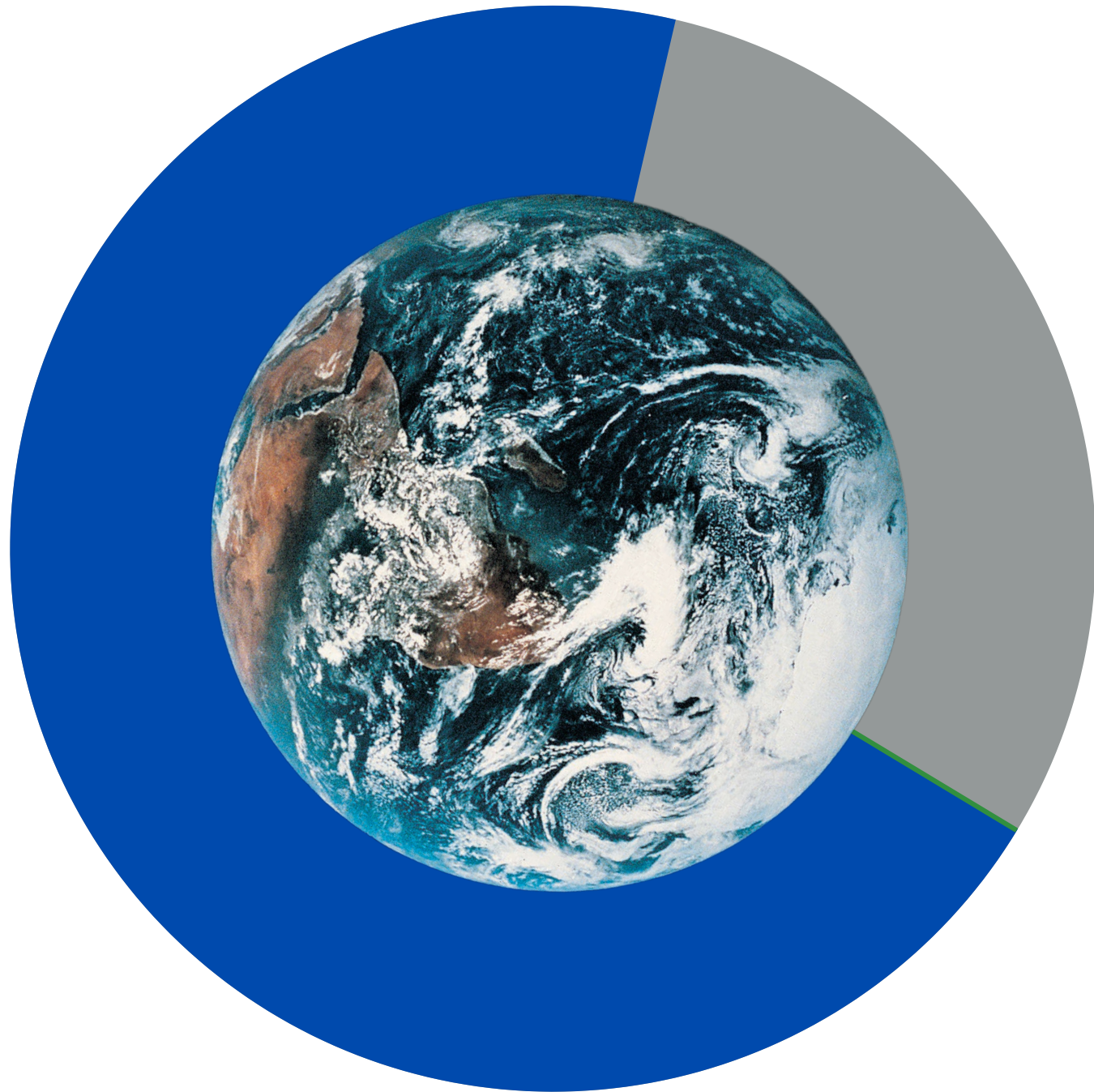
Bitcoin mining:

- 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.

PRESENTATION OVERVIEW

- 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
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BITCOIN MINING ENERGY USE VS TOTAL GLOBAL ENERGY GENERATION



154,750 TWhⁱ
TOTAL ENERGY GENERATED WORLDWIDE

50,000 TWhⁱⁱ
ENERGY LOST DUE TO INEFFICIENCIES

220 TWhⁱⁱⁱ
**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

BITCOIN MINING ENERGY USE VS U.S. ELECTRICITY GENERATION



10,463 TWhⁱ

TOTAL ENERGY USED TO GENERATE & DISTRIBUTE ELECTRICITY IN THE US

6,800 TWhⁱ

ELECTRICAL SYSTEM ENERGY WASTED OR LOST IN THE US

220 TWhⁱⁱ

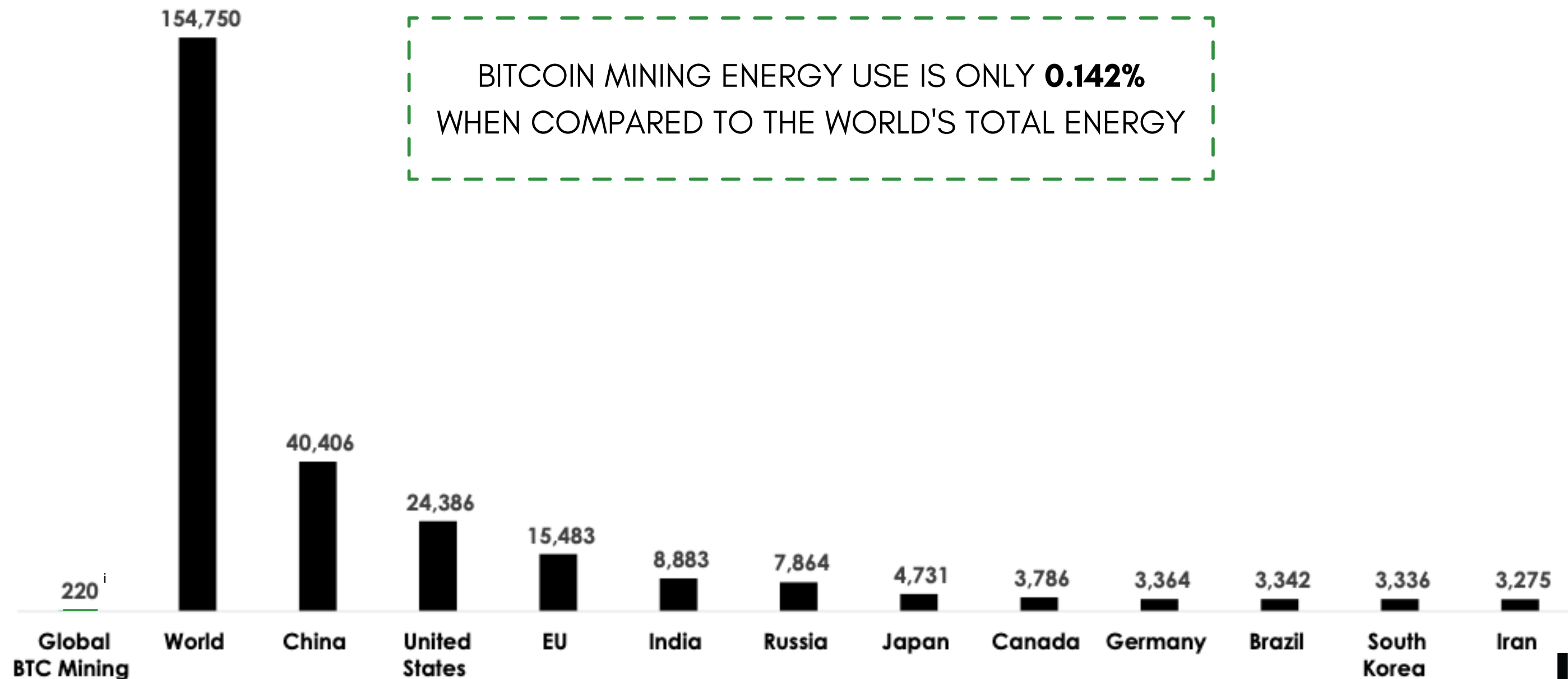
ENERGY CONSUMED BY BITCOIN MINING ON THE WORLD'S ELECTRIC GRID

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

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

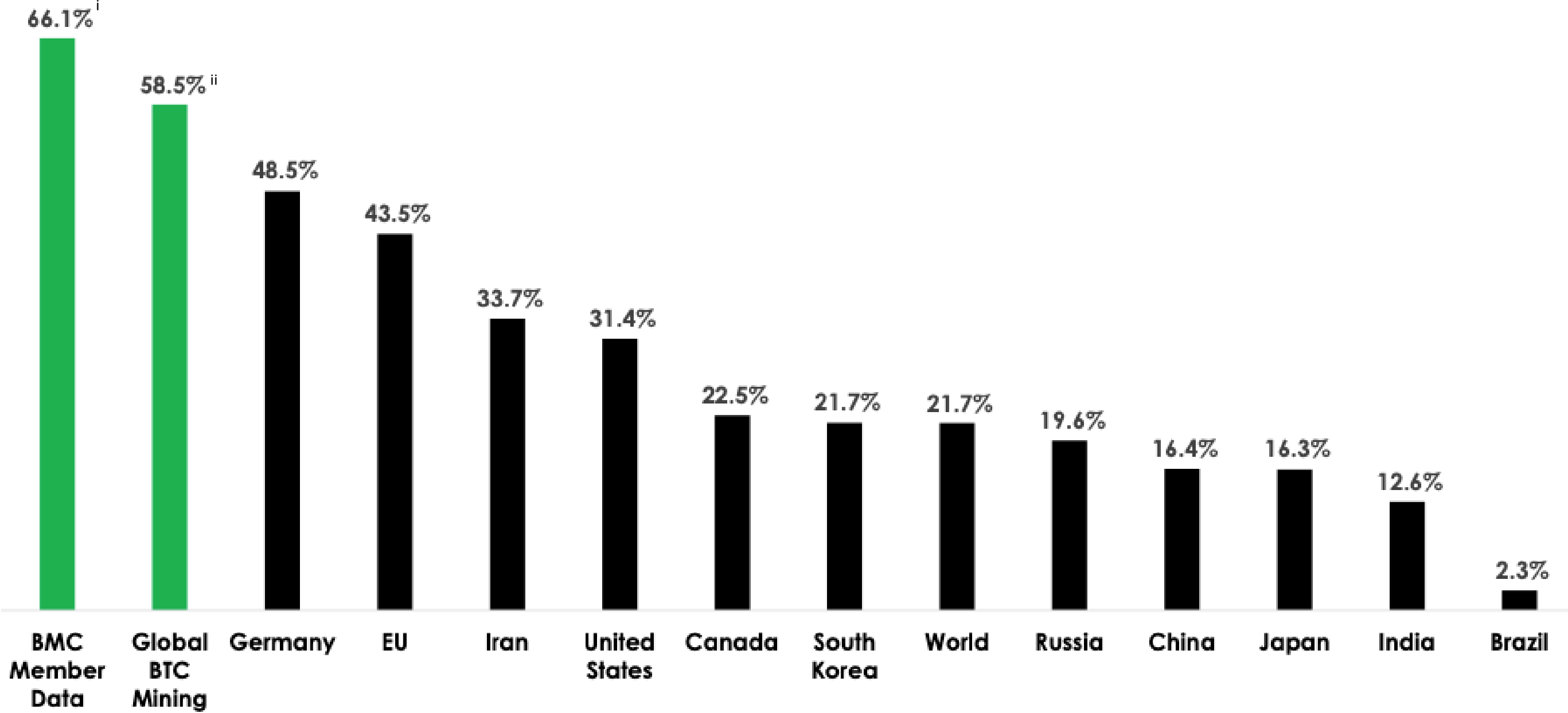
GLOBAL BITCOIN MINING ENERGY USE IS NEGLIGIBLE

PRIMARY ENERGY CONSUMPTION: BITCOIN MINING VS COUNTRIES (TWh)ⁱⁱ



GLOBAL BITCOIN MINING HAS THE HIGHEST SUSTAINABLE ENERGY MIX

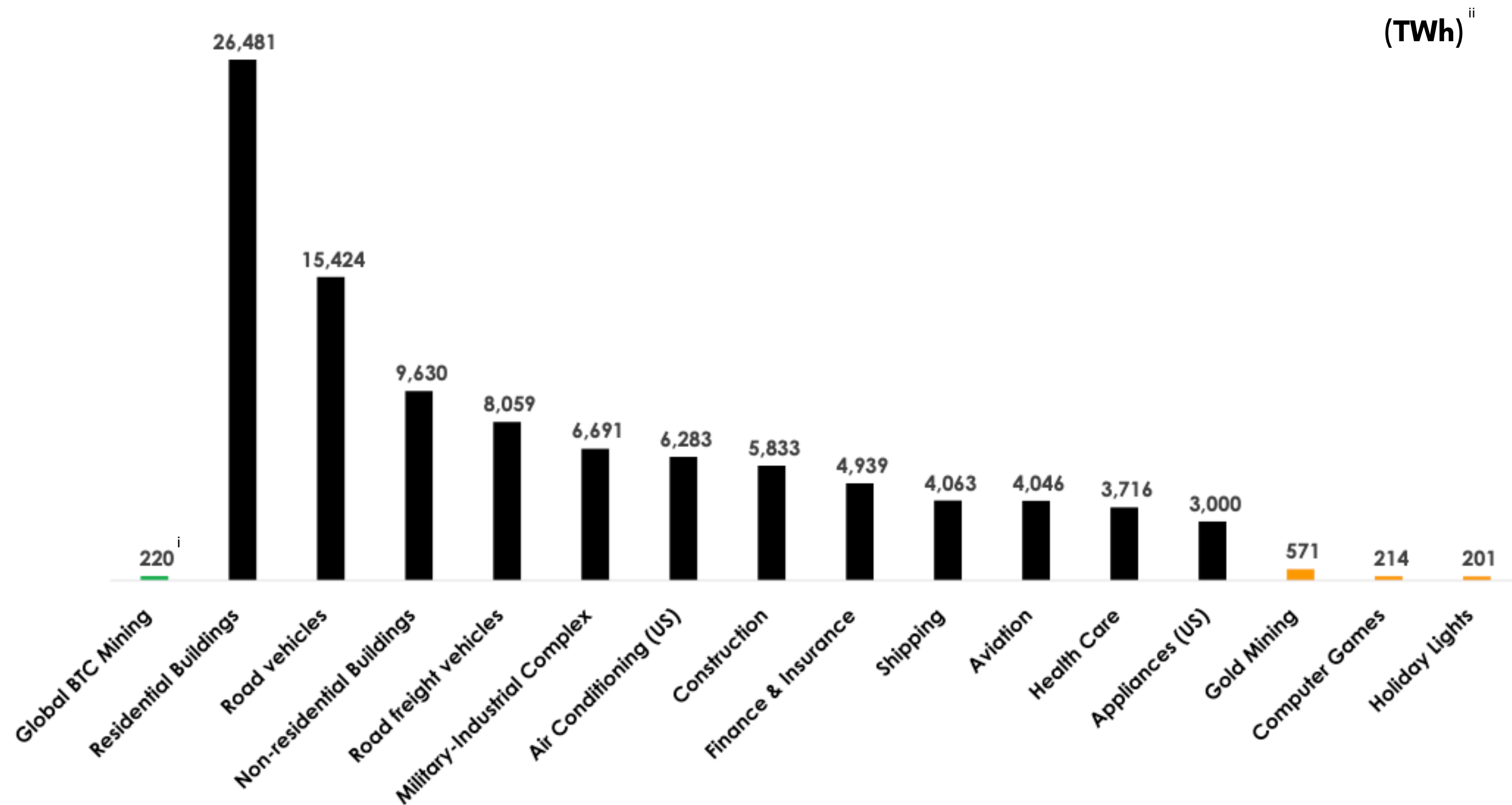
PRIMARY ENERGY SUSTAINABLE POWER MIX: BITCOIN MINING VS COUNTRIES (% OF TWh)ⁱⁱⁱ



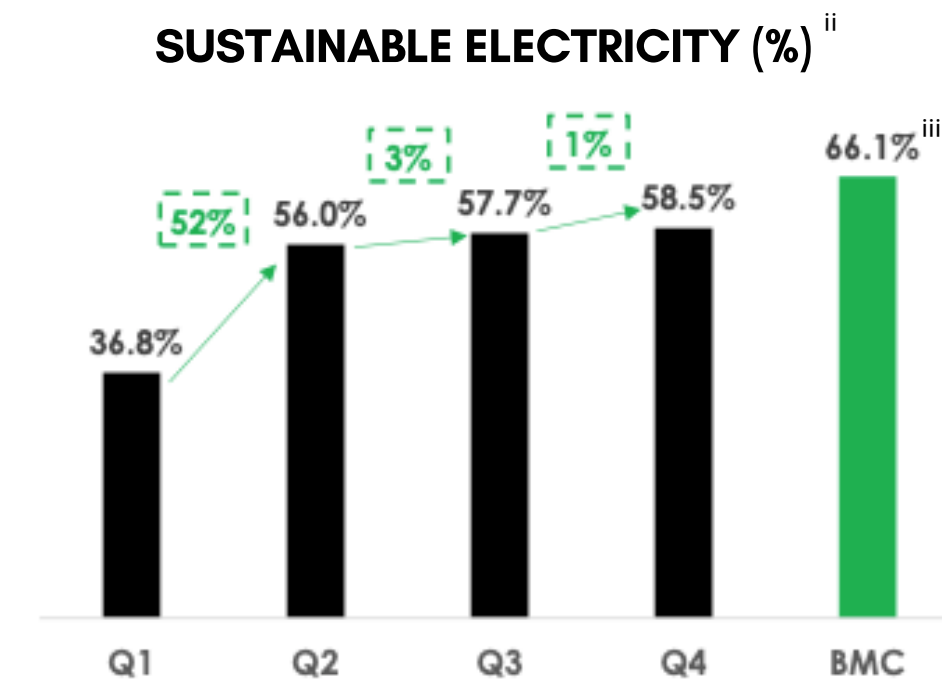
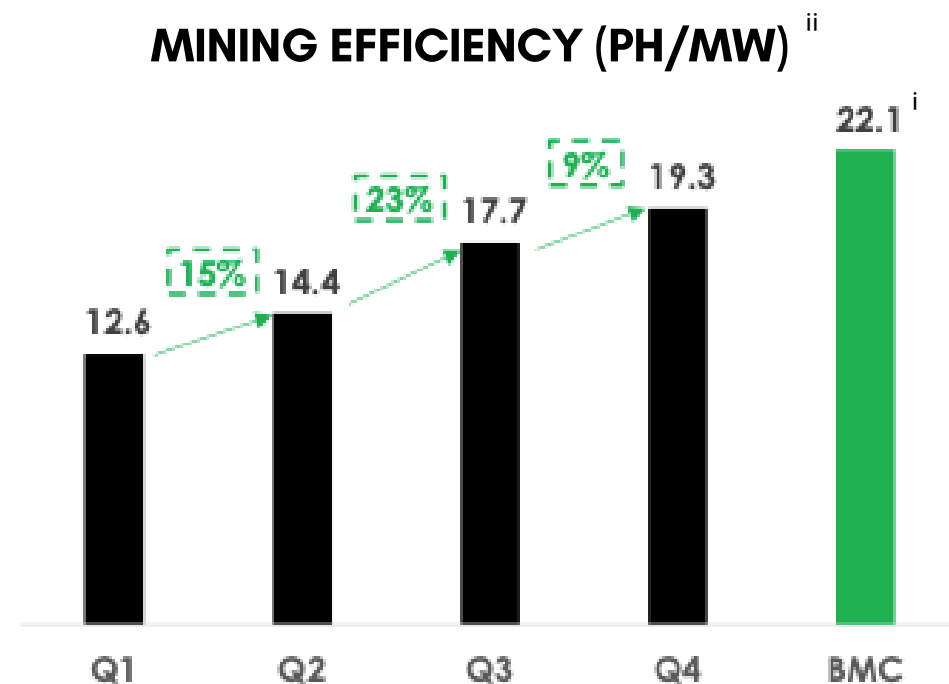
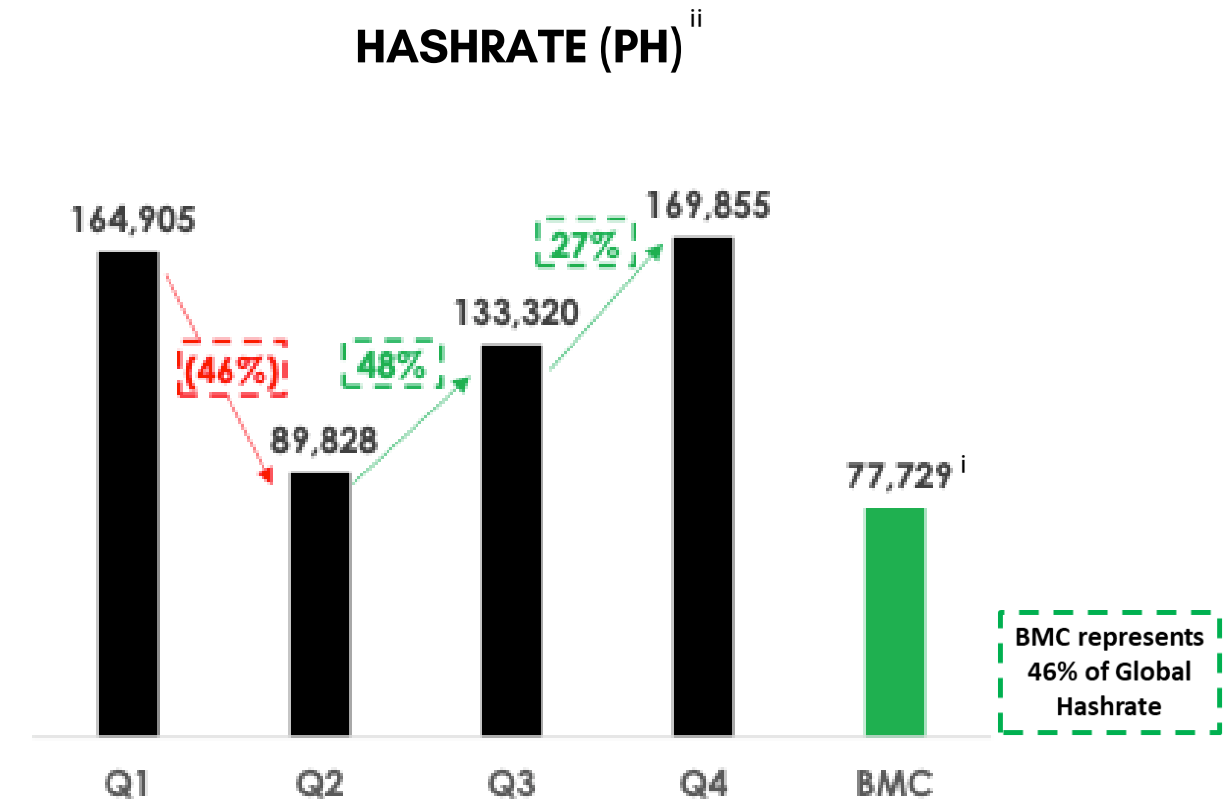
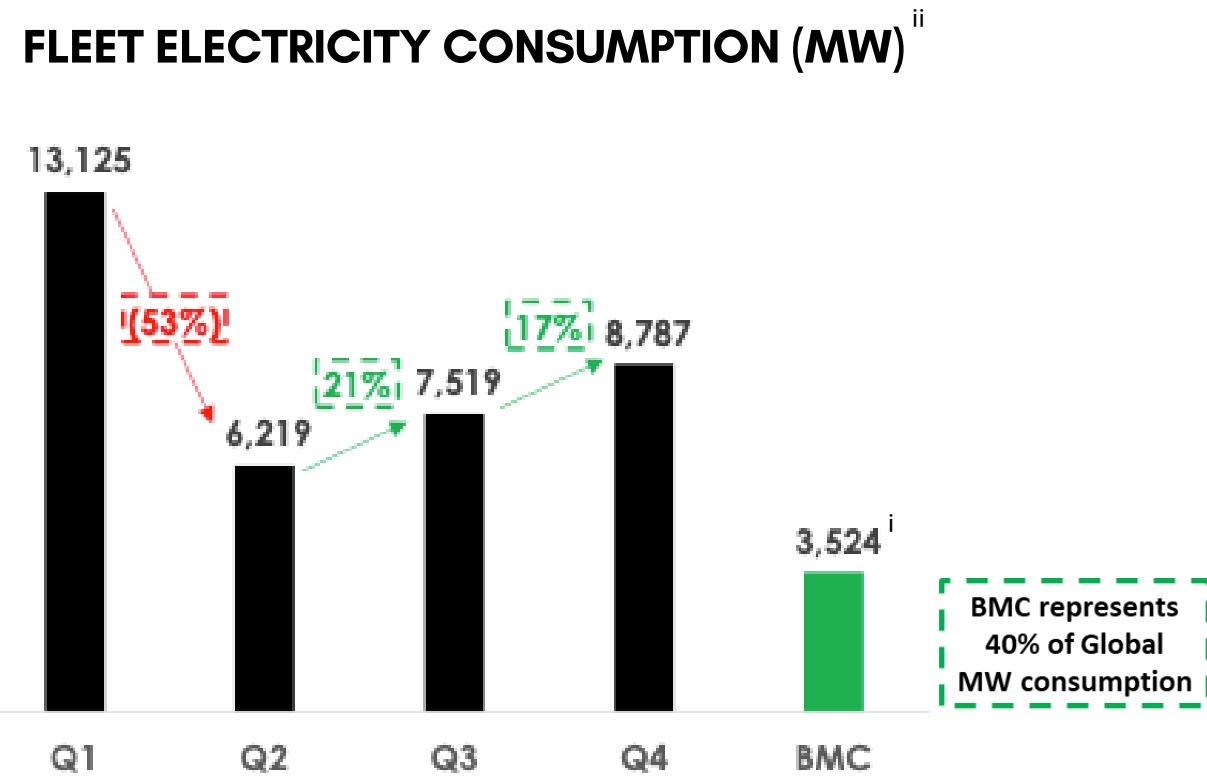
SOURCES 4: ⁱ VALUE REPRESENTS DATA COMPILED FROM BMC ADVISORY COUNCIL MINERS. ANNUALIZED PRIMARY ENERGY USE.
ⁱⁱ ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON BMC ANALYSIS, ASSUMPTIONS AND EXTRAPOLATION. (DEC 31, 2021)
ⁱⁱⁱ COUNTRY DATA COMPILED FROM BP'S STATISTICAL REVIEW OF WORLD ENERGY (2021). [HTTPS://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY.HTML](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html)



GLOBAL BITCOIN MINING VS OTHER INDUSTRIES



IN Q4, MINING EFFICIENCY INCREASED 9% AND SUSTAINABLE ELECTRICITY MIX INCREASED 1%



BITCOIN MINING IS TECHNOLOGY INTENSIVE, IT HAS HAS INCREASED 58X IN EFFICIENCY OVER 8 YEARS

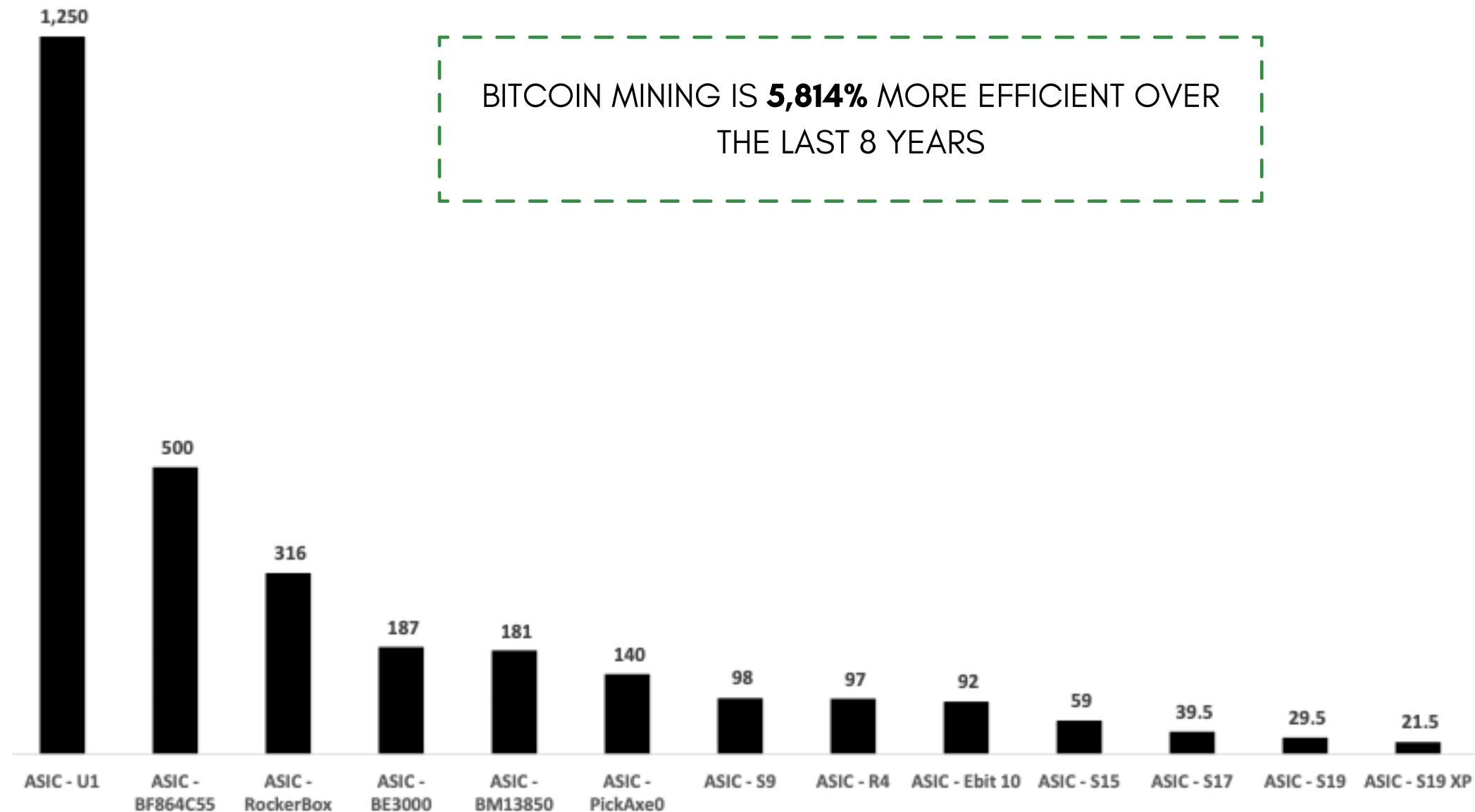
Combined	Hardware name	Date	J/Th
CPU	ARM Cortex A9	3-Jan-09	877,193
GPU	ATI 5870M	23-Sep-09	264,550
FPGA	X6500 FPGA Miner	29-Aug-11	43,000
ASIC - Avalon B1	Canaan AvalonMiner Batch 1	1-Jan-13	9,351
ASIC - Jupiter	KnCMiner Jupiter	5-Oct-13	1,484
ASIC - U1	Antminer U1	1-Dec-13	1,250
ASIC - BF864C55	Bitfury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

~700x

~13x

5x

J/TH - EFFICIENCY OVER TIME¹



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

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

6x



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

4x



Bitcoin mining is guaranteed to be **dramatically more energy efficient** in the next 8 years.

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:

- 1 BP STATISTICAL REVIEW OF WORLD ENERGY (2021), [HTTPS://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY.HTML](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html) . INTERNATIONAL ENERGY AGENCY, [HTTPS://WWW.IEA.ORG/DATA-AND-STATISTICS/DATA-PRODUCT/WORLD-ENERGY-STATISTICS-AND-BALANCES/](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 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](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 ENERGY (2021). [HTTPS://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY.HTML](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html) . VALUE REPRESENTS DATA COMPILED FROM BMC ADVISORY COUNCIL MINERS. ANNUALIZED PRIMARY ENERGY USE. ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON
- 4 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](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html) .
- 5 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://www.eia.gov/outlooks/ieo/pdf/transportation.pdf) / [HTTPS://ACADEMIC.OUP.COM/EURPUB/ARTICLE-ABSTRACT/30/SUPPLEMENT_5/CKAA165.843/5914601](https://academic.oup.com/eurpub/article-abstract/30/supplement_5/CKAA165.843/5914601) / [HTTPS://HASSMCCOOK.MEDIUM.COM/COMPARING-BITCOINS-ENVIRONMENTAL-IMPACT-F56B18014F64](https://hassmccook.medium.com/comparing-bitcoins-environmental-impact-f56b18014f64) / [HTTPS://BITCOINMAGAZINE.COM/BUSINESS/INTRODUCING-CBEI-A-NEW-WAY-TO-MEASURE-BITCOIN-NETWORK-ELECTRICAL-CONSUMPTION](https://bitcoinmagazine.com/business/introducing-cbei-a-new-way-to-measure-bitcoin-network-electrical-consumption) .
- 6 BMC ADVISORY COUNCIL MEMBERSHIP DATA, ANALYSIS AND EXTRAPOLATION. AS SUBMITTED AS AT DECEMBER 31, 2021.
- 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](https://arxiv.org/pdf/2004.04605.pdf) .



THANK YOU