

# GLOBAL BITCOIN MINING DATA REVIEW

## Q4 2021

DECEMBER 2021

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









© 2022 BITCOIN MINING COUNCIL




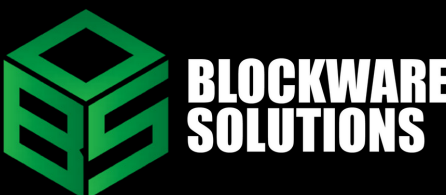



Bitcoin  
Mining  
Council
















# BITCOIN MINING COUNCIL








36 MINING COMPANIES REPRESENTING 46% OF THE NETWORK

# EXECUTIVE SUMMARY

Bitcoin mining:

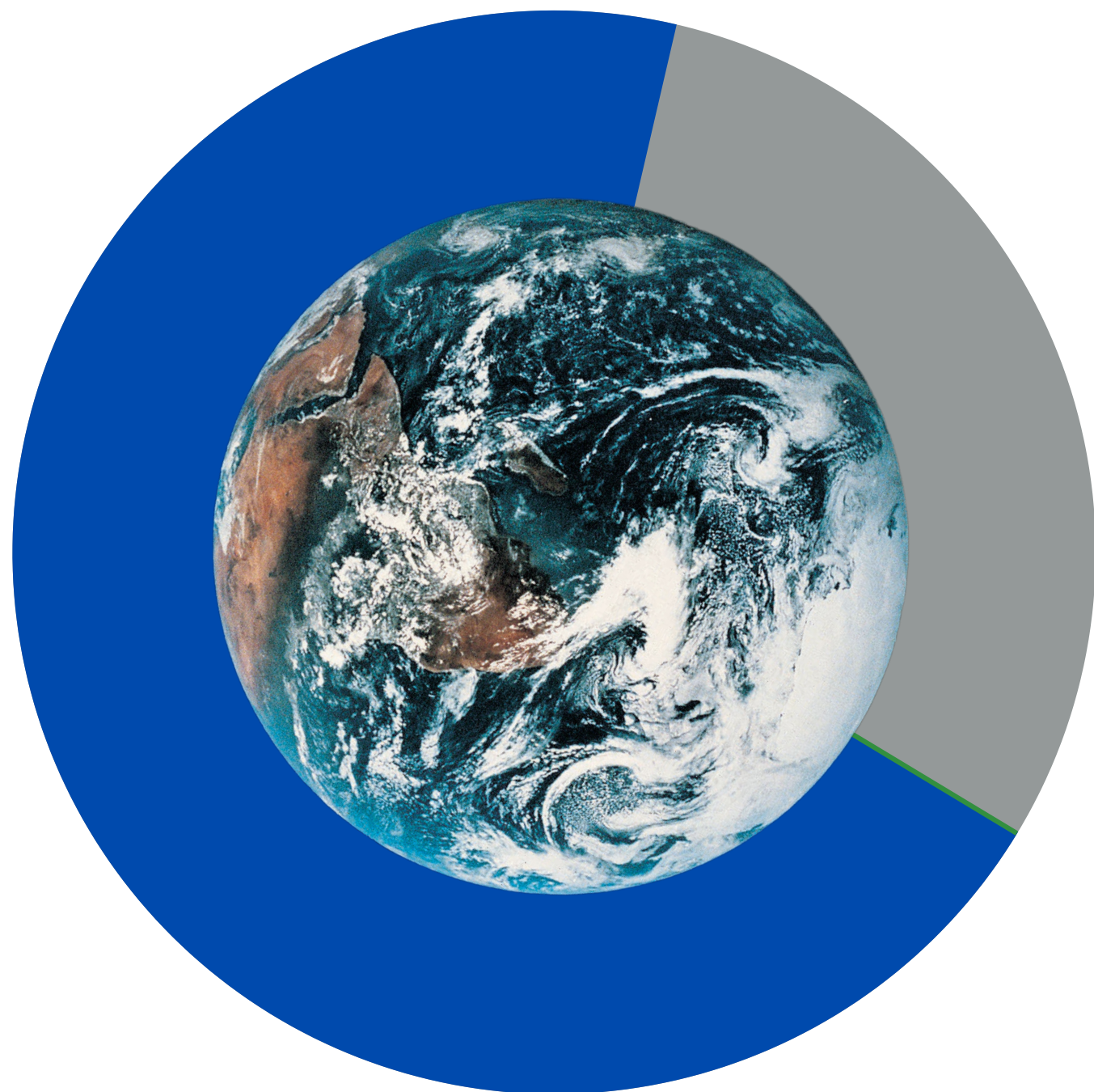
- 1** Uses an inconsequential amount of energy.
- 2** Is rapidly becoming more efficient.
- 3** Is powered by a higher mix of sustainable energy than any major country or industry.

# PRESENTATION OVERVIEW

- 1 BITCOIN MINING ENERGY USE VS GLOBAL ENERGY USE
- 2 BITCOIN MINING ENERGY USE VS UNITED STATES ENERGY USE
- 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 USE



**154,750 TWh<sup>i</sup>**  
**TOTAL ENERGY GENERATED WORLDWIDE**

**50,000 TWh<sup>ii</sup>**  
**ENERGY LOST DUE TO INEFFICIENCIES**

**220 TWh<sup>iii</sup>**  
**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 US ELECTRICITY GENERATION USE



**10,463 TWh**<sup>i</sup>

TOTAL ENERGY USED TO GENERATE &  
DISTRIBUTE ELECTRICITY IN THE US

**6,800 TWh**<sup>i</sup>

ELECTRICAL SYSTEM ENERGY WASTED  
OR LOST IN THE US

**220 TWh**<sup>ii</sup>

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

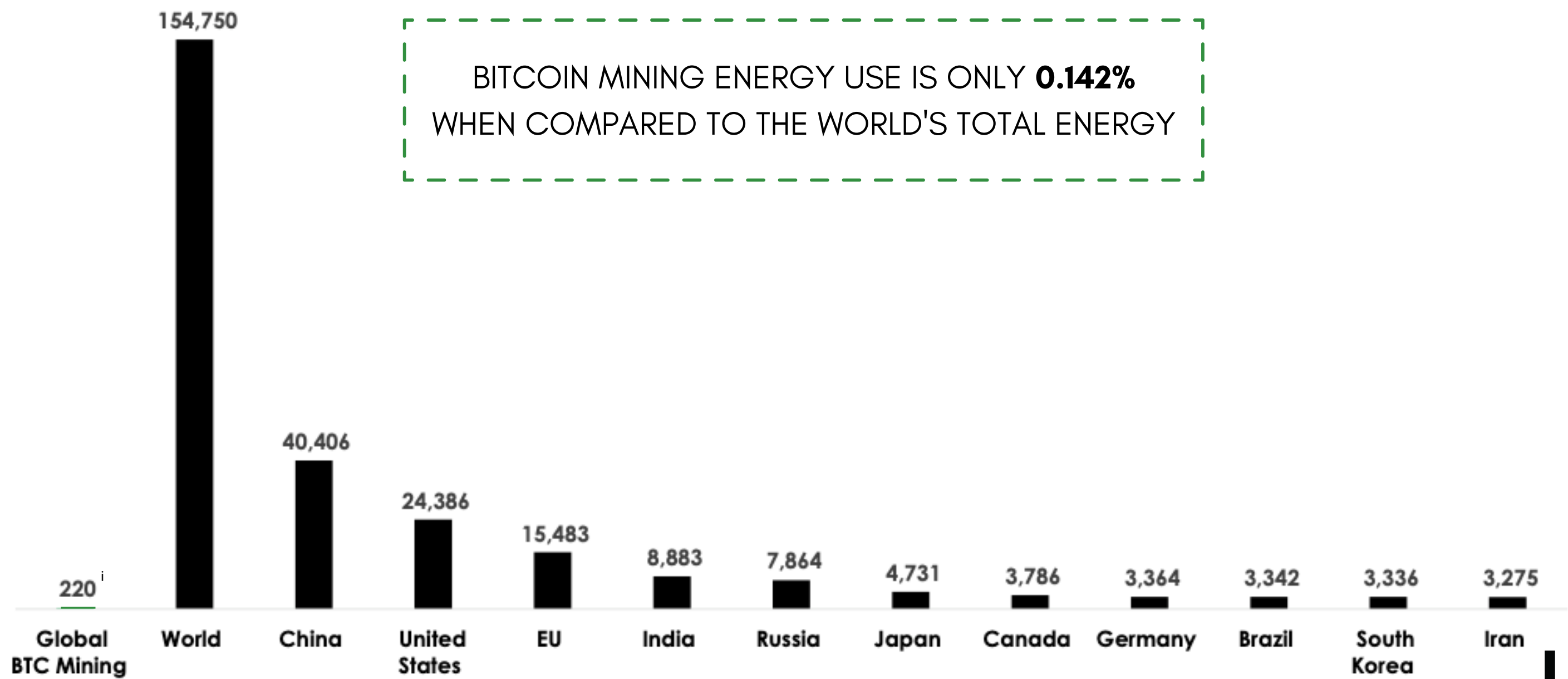
**65% OF ALL ENERGY**  
USED TO GENERATE & DISTRIBUTE  
ELECTRICITY IN THE US  
IS LOST OR WASTED

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

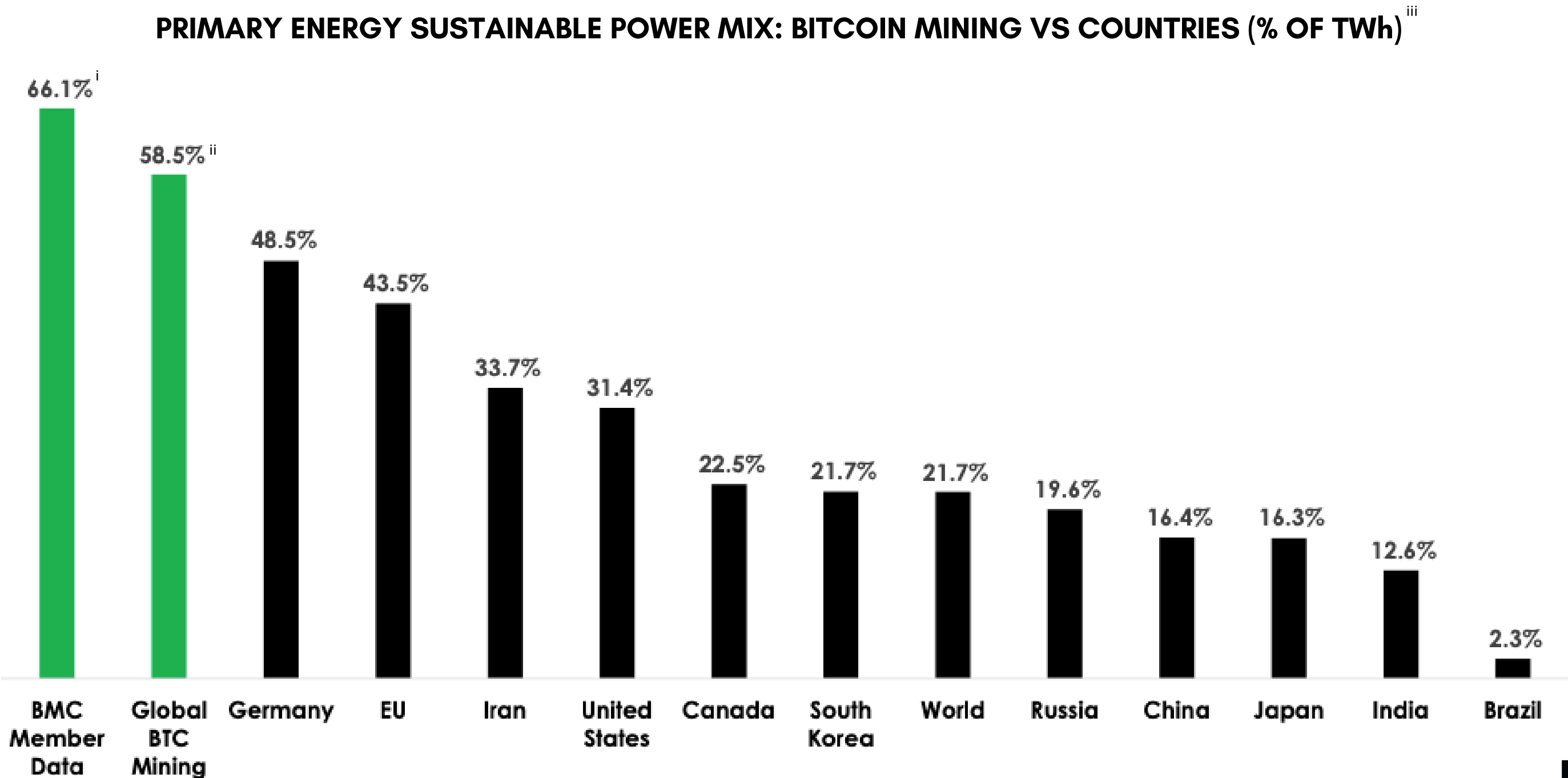


# GLOBAL BITCOIN MINING ENERGY USE IS NEGLIGIBLE

PRIMARY ENERGY CONSUMPTION: BITCOIN MINING VS COUNTRIES (TWh)<sup>ii</sup>

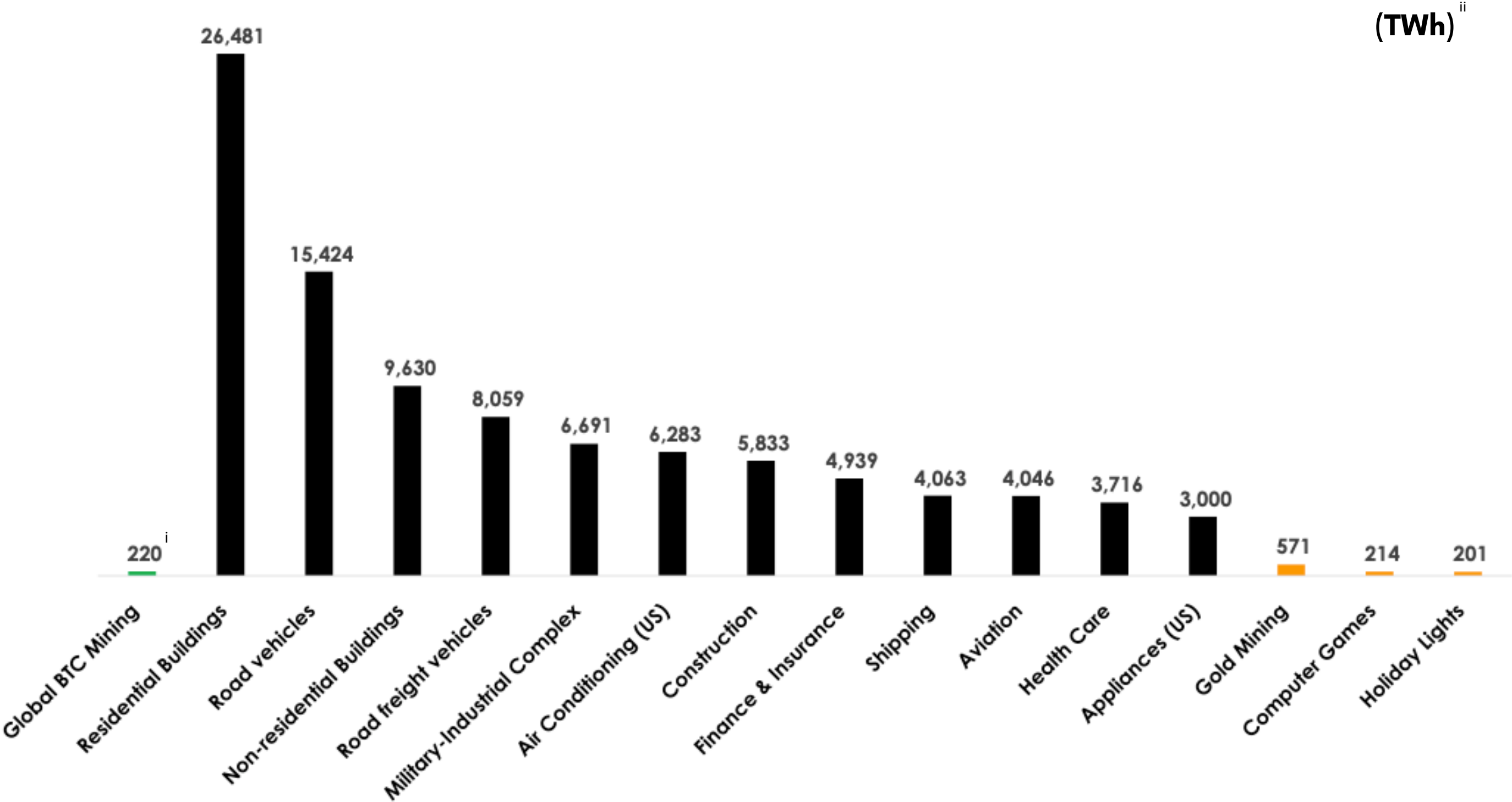


# GLOBAL BITCOIN MINING HAS THE HIGHEST SUSTAINABLE ENERGY MIX



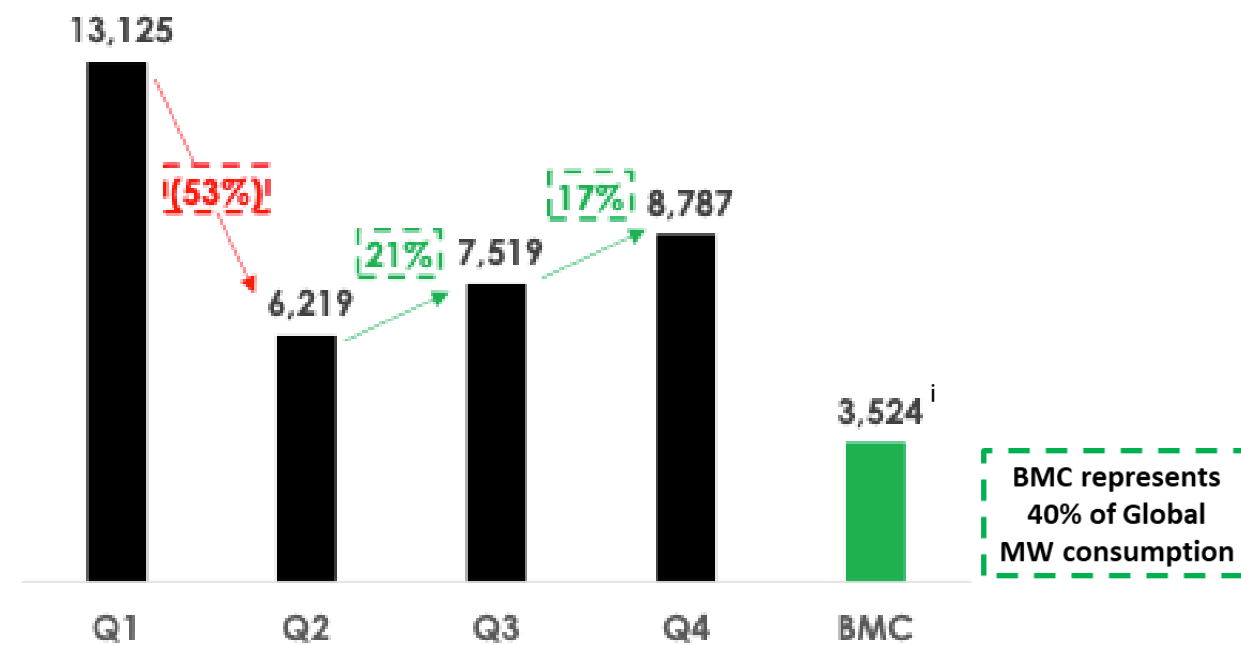


# GLOBAL BITCOIN MINING VS OTHER INDUSTRIES

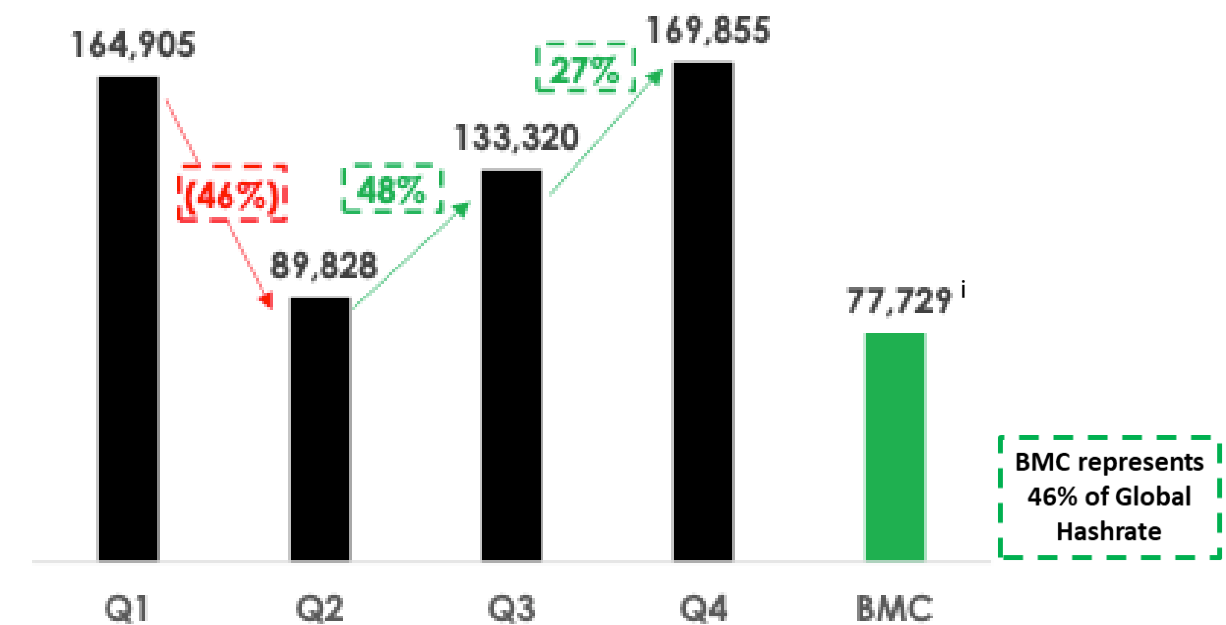


# IN Q4, MINING EFFICIENCY INCREASED 9% AND SUSTAINABLE ELECTRICITY MIX INCREASED 1%

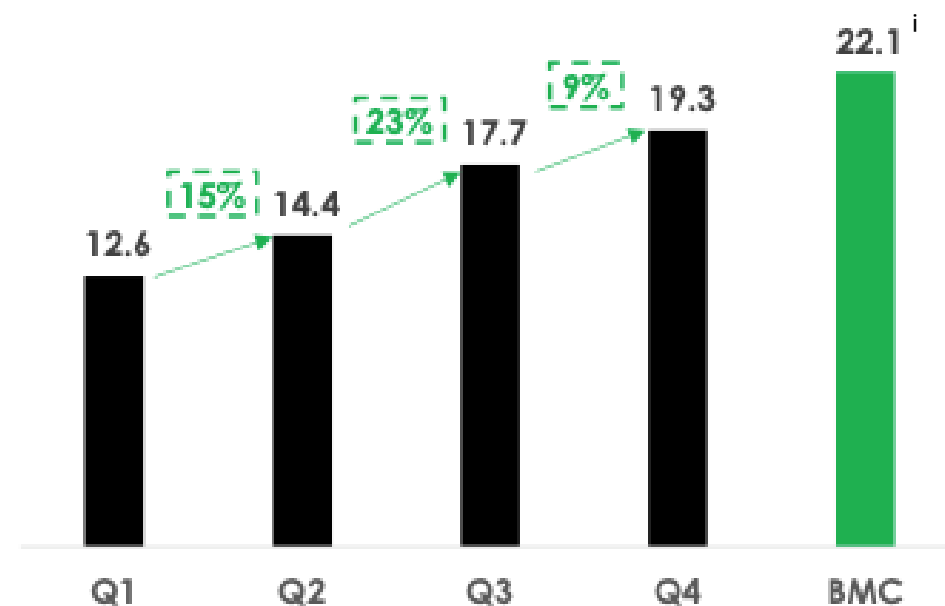
FLEET ELECTRICITY CONSUMPTION (MW)<sup>ii</sup>



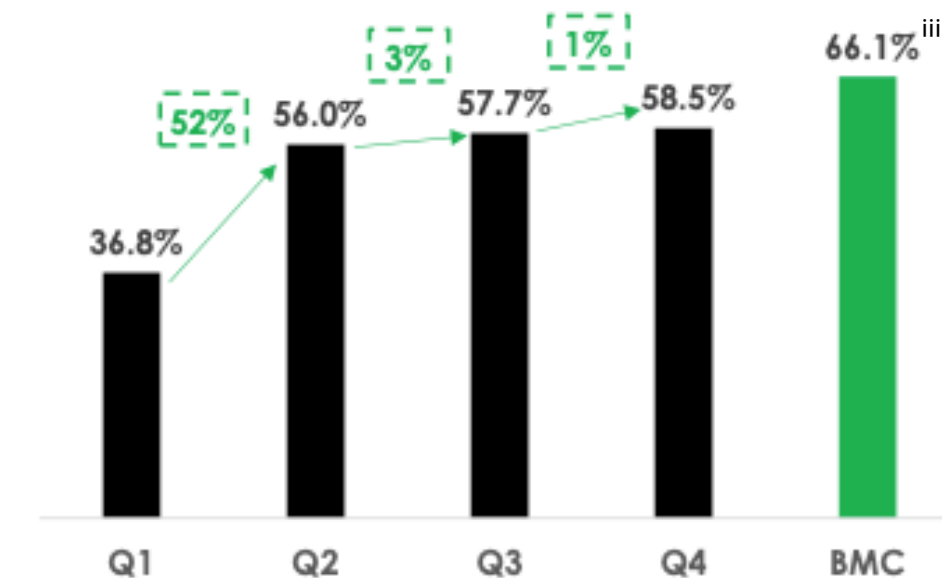
HASHRATE (PH)<sup>ii</sup>



MINING EFFICIENCY (PH/MW)<sup>ii</sup>



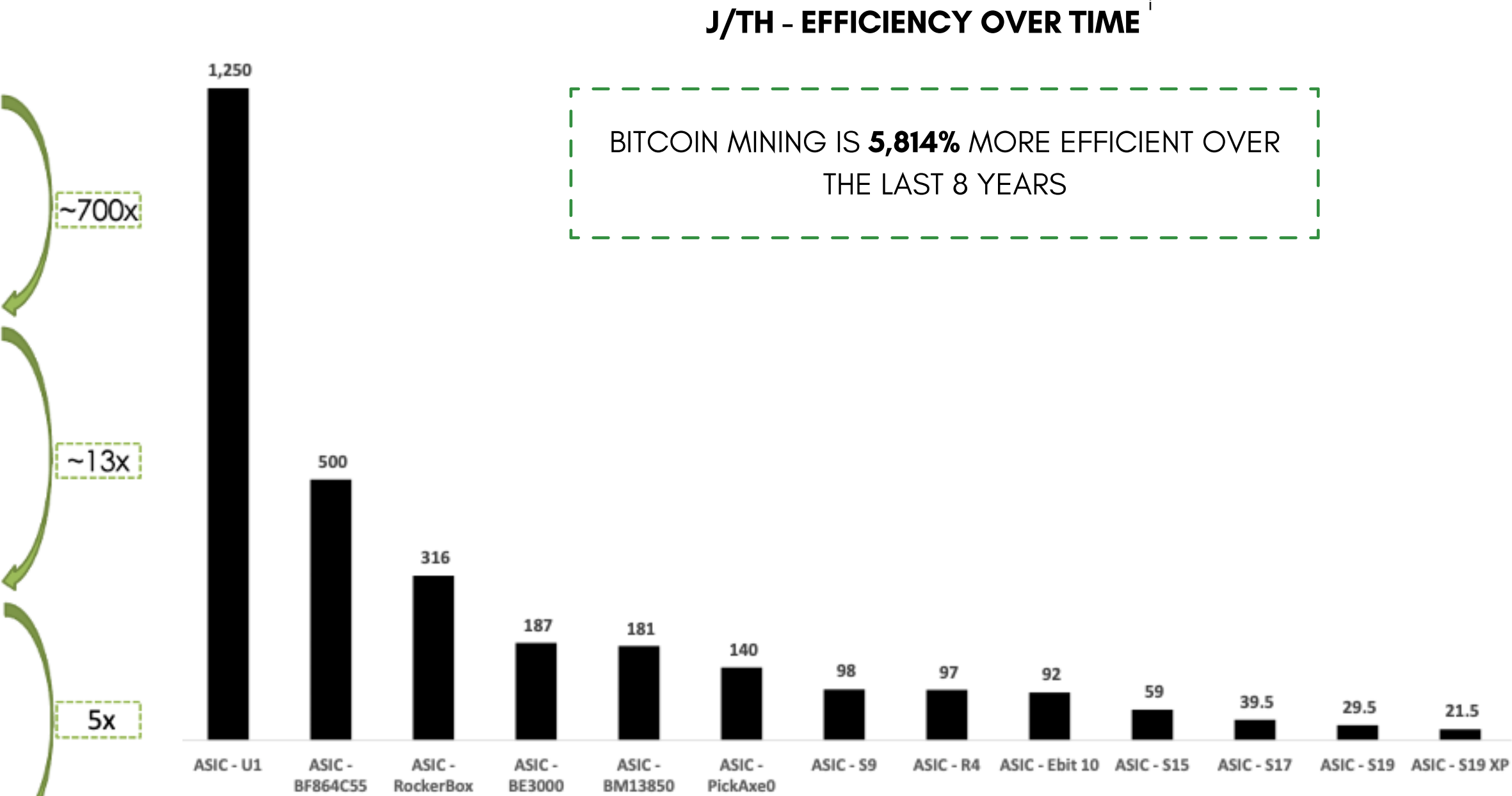
SUSTAINABLE ELECTRICITY (%)<sup>ii</sup>





# 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



# 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/PRIMARY-ENERGY](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/primary-energy). 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/PRIMARY-ENERGY](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/primary-energy).
- 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/PRIMARY-ENERGY](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/primary-energy). 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).
- 4** [HTTPS://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY/PRIMARY-ENERGY](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/primary-energy).
- 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://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY/PRIMARY-ENERGY](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/primary-energy).
- 6** BMC ADVISORY COUNCIL MEMBERSHIP DATA, ANALYSIS AND EXTRAPOLATION. AS SUBMITTED AS AT SEPTEMBER 30, 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