

GLOBAL BITCOIN MINING DATA REVIEW

Q4 2022

January 2023

53 MINING COMPANIES REPRESENTING 48.4% OF THE GLOBAL NETWORK

AGENDA

- 1** Introduction: Michael Saylor
- 2** Full BMC Q4 2022 Update: Ben Gagnon
- 3** Q & A

BITCOIN MINING COUNCIL

53 MINING COMPANIES FROM 6 CONTINENTS REPRESENTING 48.4% OF THE GLOBAL NETWORK



EXECUTIVE SUMMARY

Bitcoin mining, in Q4 2022:

1. Uses an inconsequential amount of global energy (17bps) and generates negligible carbon emissions (11bps)
2. Bitcoin mining hashrate is up 45% YoY while energy usage is up 25% YoY, due to an increase in efficiency of 16%
3. Bitcoin is the industry leader in sustainability with a 58.9% sustainable energy mix

PRESENTATION OVERVIEW

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. Q4-22, Mining Efficiency Increased 3% & Sustainable Electricity Remains Stable
7. YoY, Mining Efficiency Increased 16% and Network Security Increased 45%
8. Bitcoin Mining Is Technology Intensive, 58x+ In Efficiency In 8 Years
9. Curtailment: Bitcoin Mining Is A Meaningful Amount Of Demand Response
10. Sources And Methodology

BITCOIN MINING ENERGY USE VS TOTAL GLOBAL ENERGY USE



165,317 TWhⁱ
TOTAL ENERGY UTILIZED WORLDWIDE

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

**GLOBAL BITCOIN
MINING CONSUMES
0.17%**
OF THE WORLD'S ENERGY PRODUCTION

SOURCES: ⁱ BP STATISTICAL REVIEW OF WORLD ENERGY (2021), [HTTPS://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY/PRIMARY-ENERGY.HTML](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/primary-energy.html).
ⁱⁱ BMC ESTIMATED BITCOIN MINING ENERGY USE (DECEMBER 31, 2022).

BITCOIN MINING CARBON EMISSIONS VS TOTAL GLOBAL CARBON EMISSIONS



34.8 BMtⁱ

TOTAL ESTIMATED CO² GENERATED GLOBALLY

0.04 BMtⁱⁱ

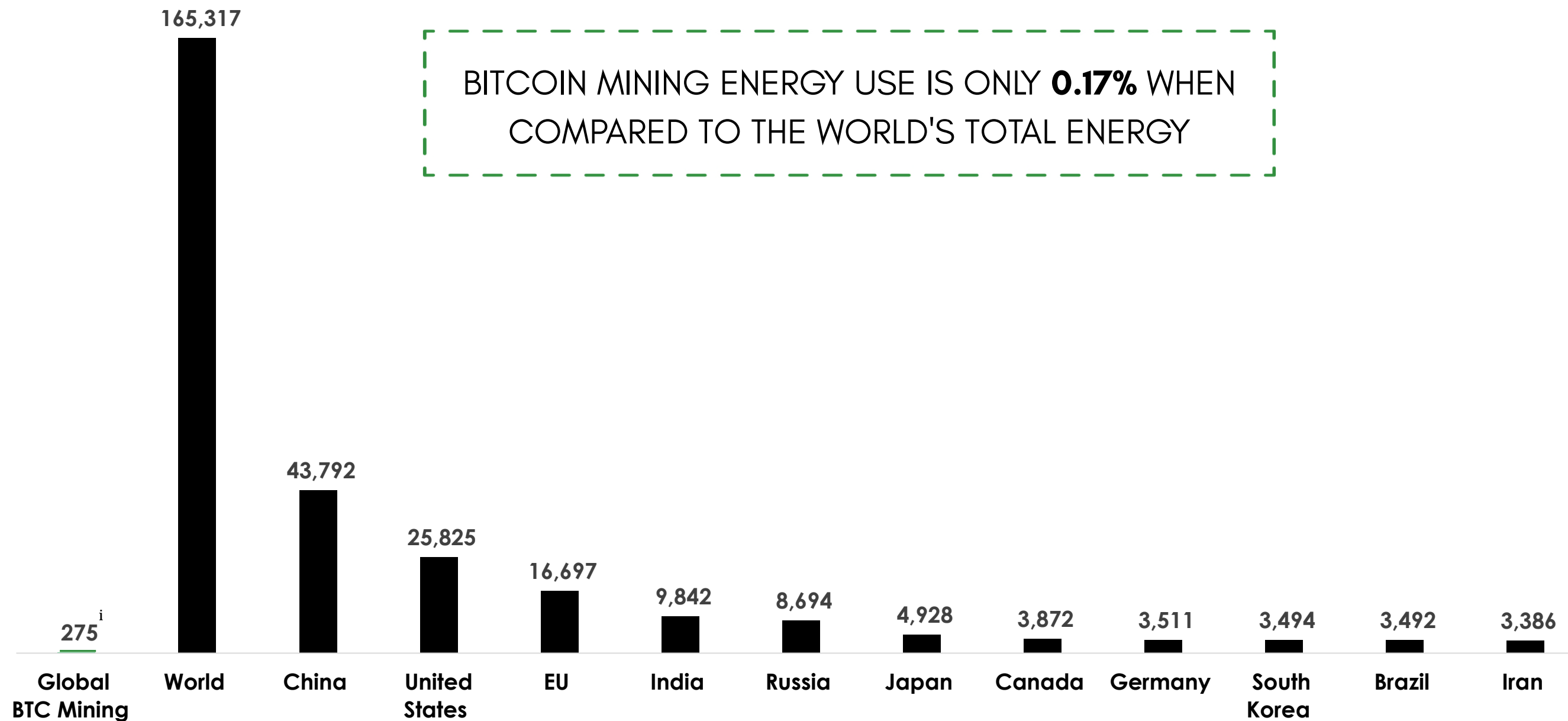
**ESTIMATED CO² GENERATED BY BITCOIN
MINING ON THE WORLD'S ELECTRIC GRID**

**GLOBAL BITCOIN
MINING IS
0.107%
OF THE WORLD'S CO² PRODUCTION**

SOURCES: ⁱ 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](https://www.eia.gov/tools/faqs/faq.php?id=74&t=11)
ⁱⁱ BITCOIN MINING ESTIMATE IS DERIVED FROM THE Q4 2022 BMC ESTIMATED TWH ELECTRICITY CONSUMED GLOBALLY.

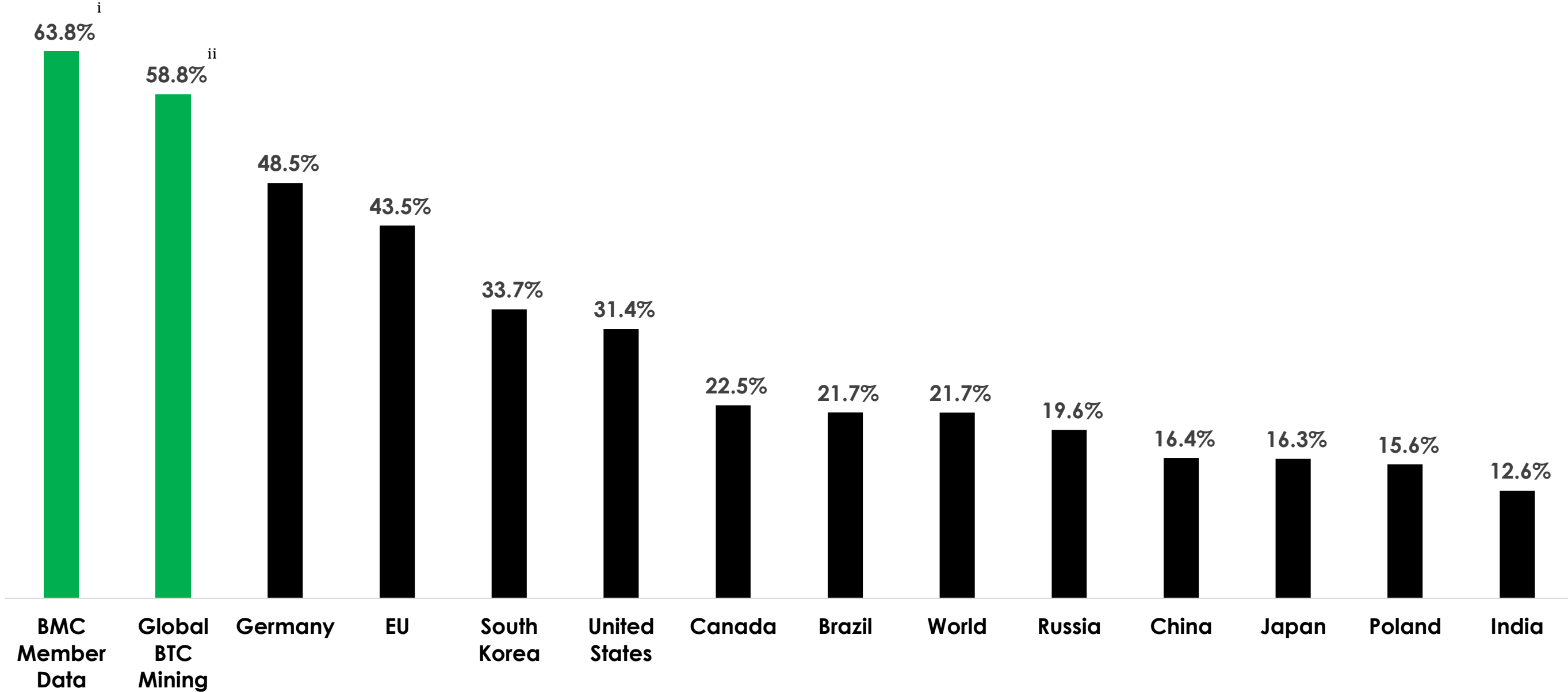
GLOBAL BITCOIN MINING ENERGY USE IS NEGLIGIBLE

BITCOIN MINING VS COUNTRIES (TWh)ⁱⁱ



GLOBAL BITCOIN MINING HAS THE HIGHEST SUSTAINABLE ENERGY MIX

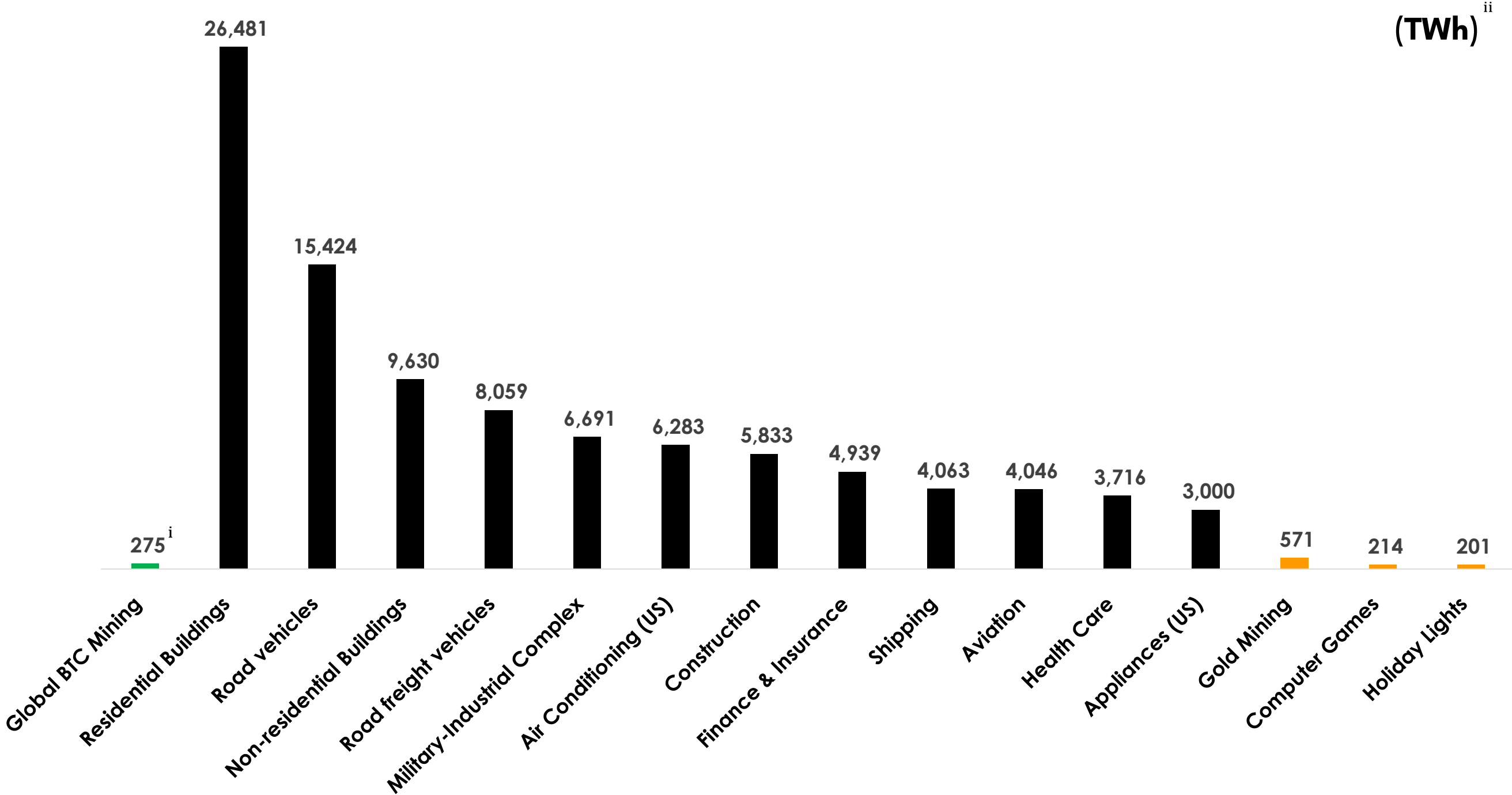
SUSTAINABLE POWER MIX: BITCOIN MINING VS COUNTRIES (% OF TWh)ⁱⁱⁱ



SOURCES: 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. (December 31, 2022)
ⁱⁱⁱ COUNTRY DATA COMPILED FROM BP'S STATISTICAL REVIEW OF WORLD ENERGY (2022). [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).



GLOBAL BITCOIN MINING VS OTHER INDUSTRIES



SOURCES: ⁱ BMC ESTIMATED BITCOIN MINING ENERGY USE (December 31, 2022). ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY & ELECTRICITY USE.

ⁱⁱ ESTIMATED INDUSTRY ENERGY USE BASED ON SEVERAL SOURCES:

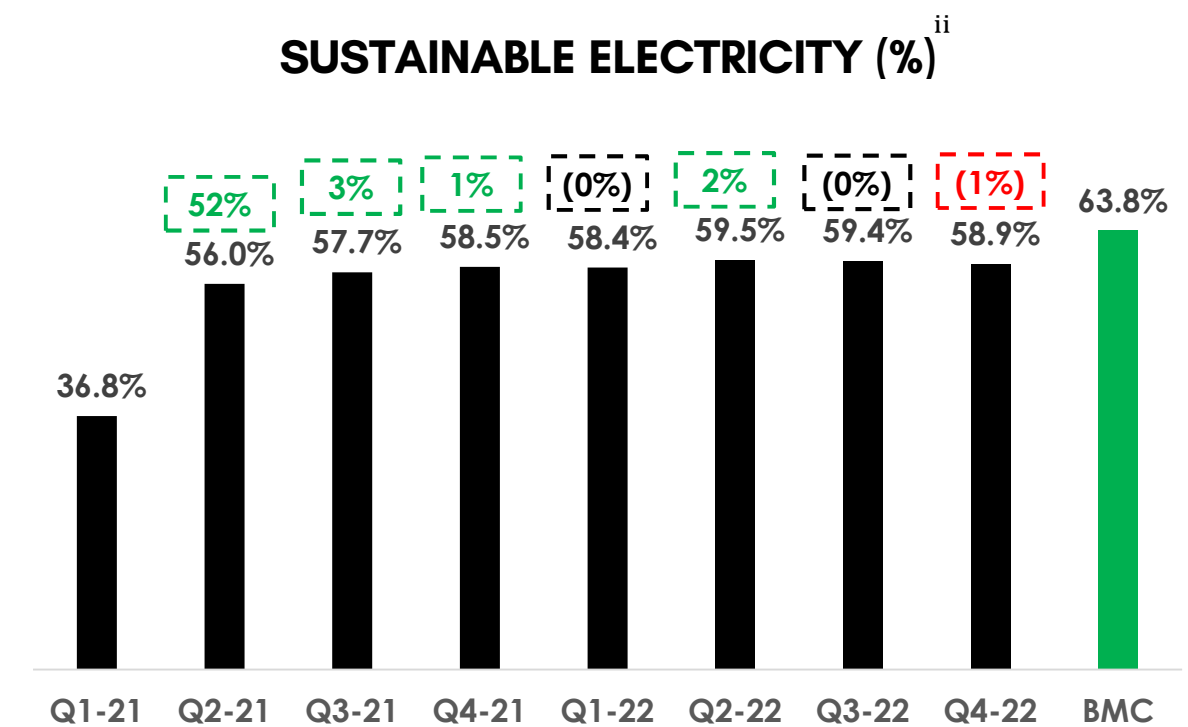
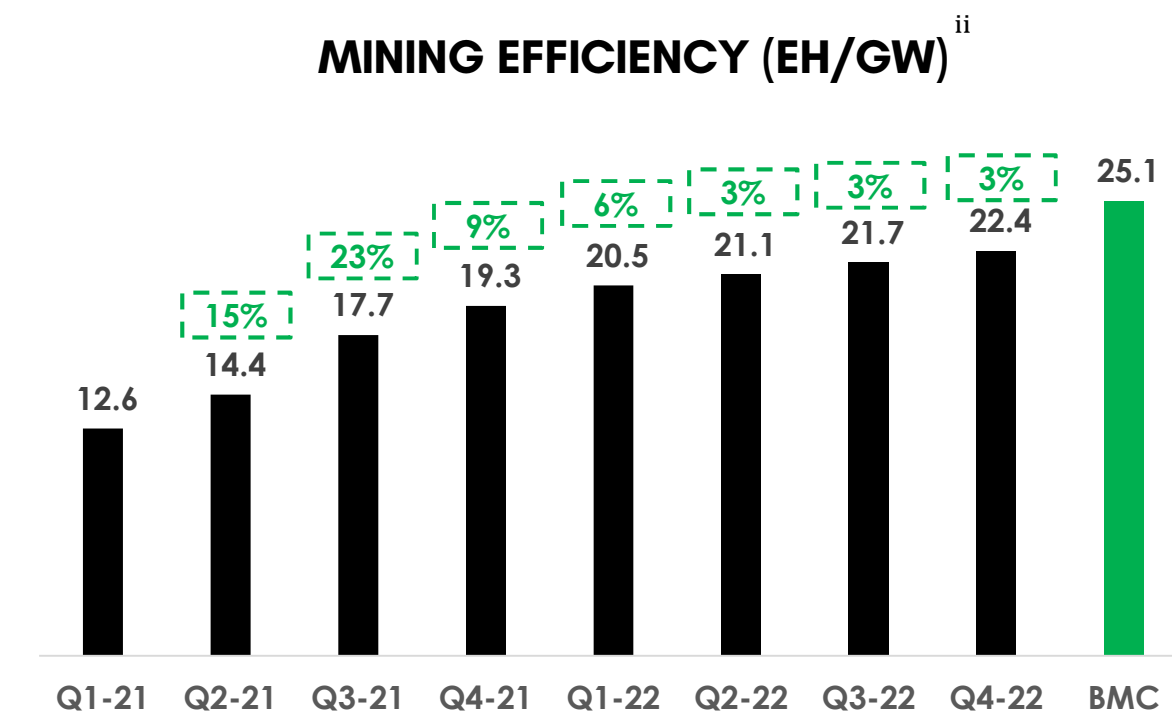
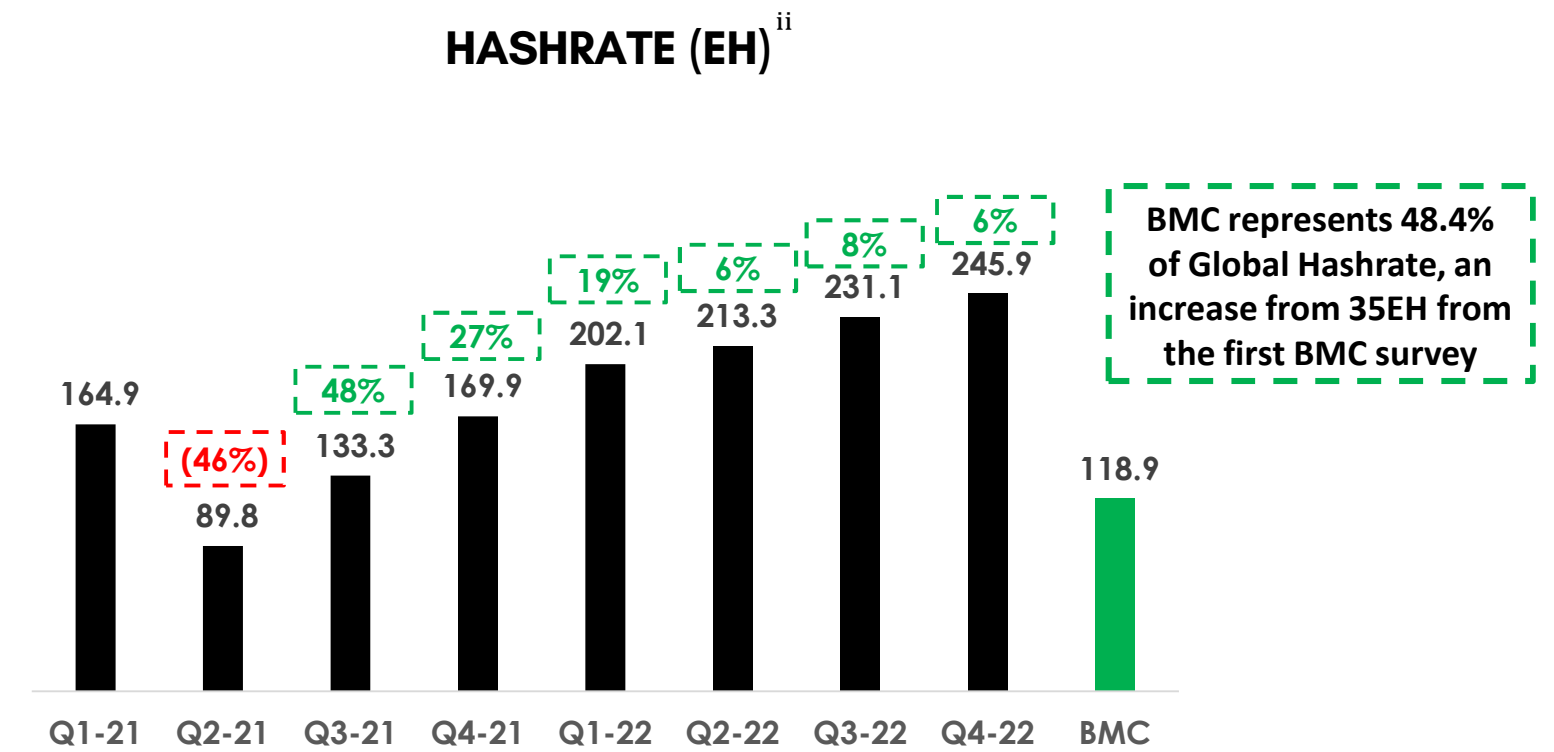
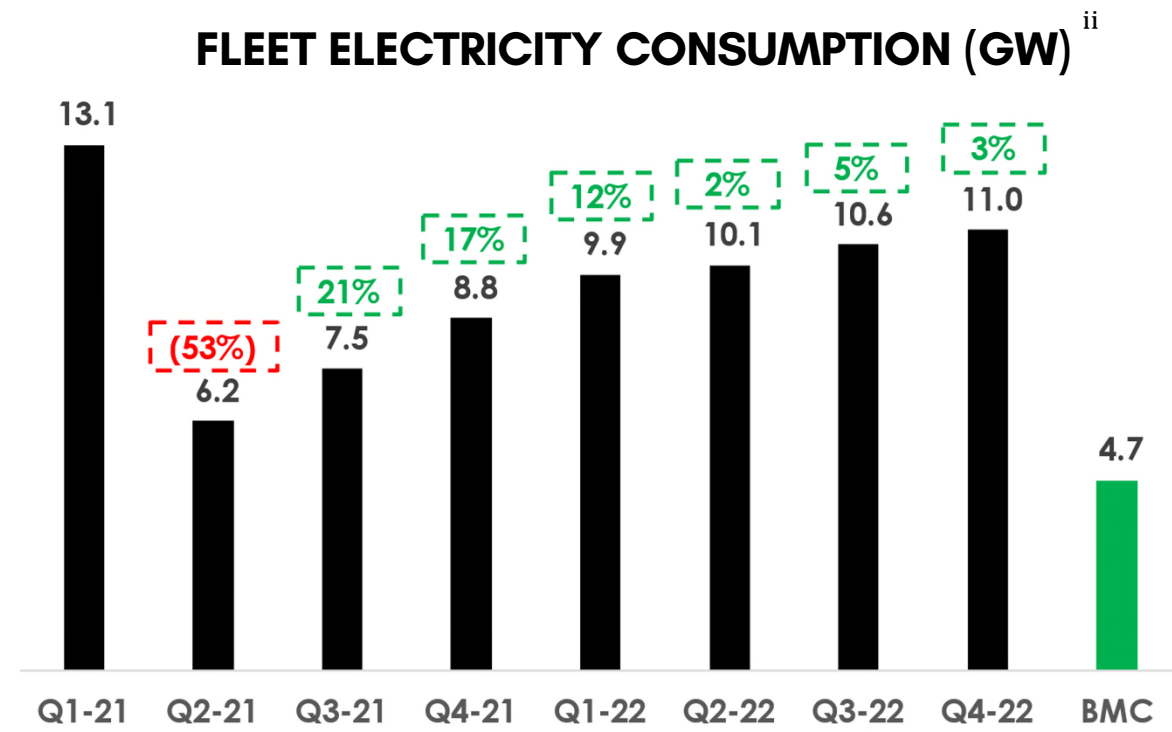
[HTTPS://WWW.EIA.GOV/OUTLOOKS/IEO/PDF/TRANSPORTATION.PDF](https://www.eia.gov/outlooks/ieo/pdf/transportation.pdf)

[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://SMCCOOK.MEDIUM.COM/COMPARING-BITCOINS-ENVIRONMENTAL-IMPACT-F56B18014F64](https://smccook.medium.com/comparing-bitcoins-environmental-impact-f56b18014f64)

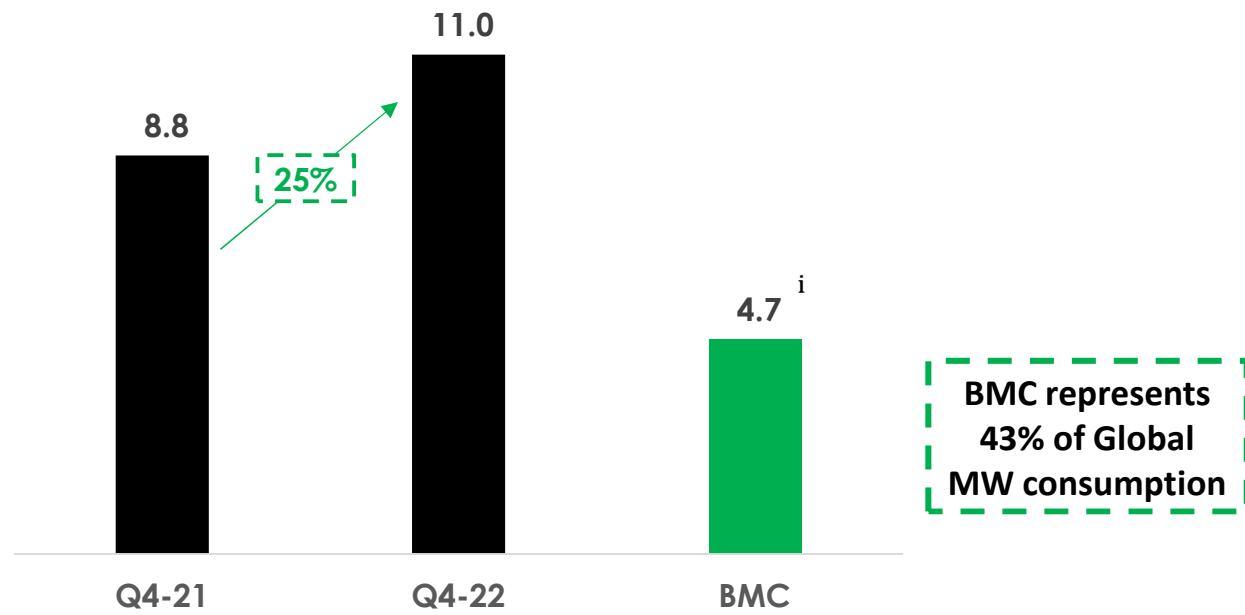
[HTTPS://BITCOINMAGAZINE.COM/BUSINESS/INTRODUCING-CBEI-A-NEW-WAY-TO-MEASURE-BITCOIN-NETWORK-ELECTRICAL-CONSUMPTION.](https://bitcoinmagazine.com/business/introducing-cbei-a-new-way-to-measure-bitcoin-network-electrical-consumption)

Q4-22, MINING EFFICIENCY INCREASED 3% AND THE SUSTAINABLE ELECTRICITY HAS REMAINED STABLE

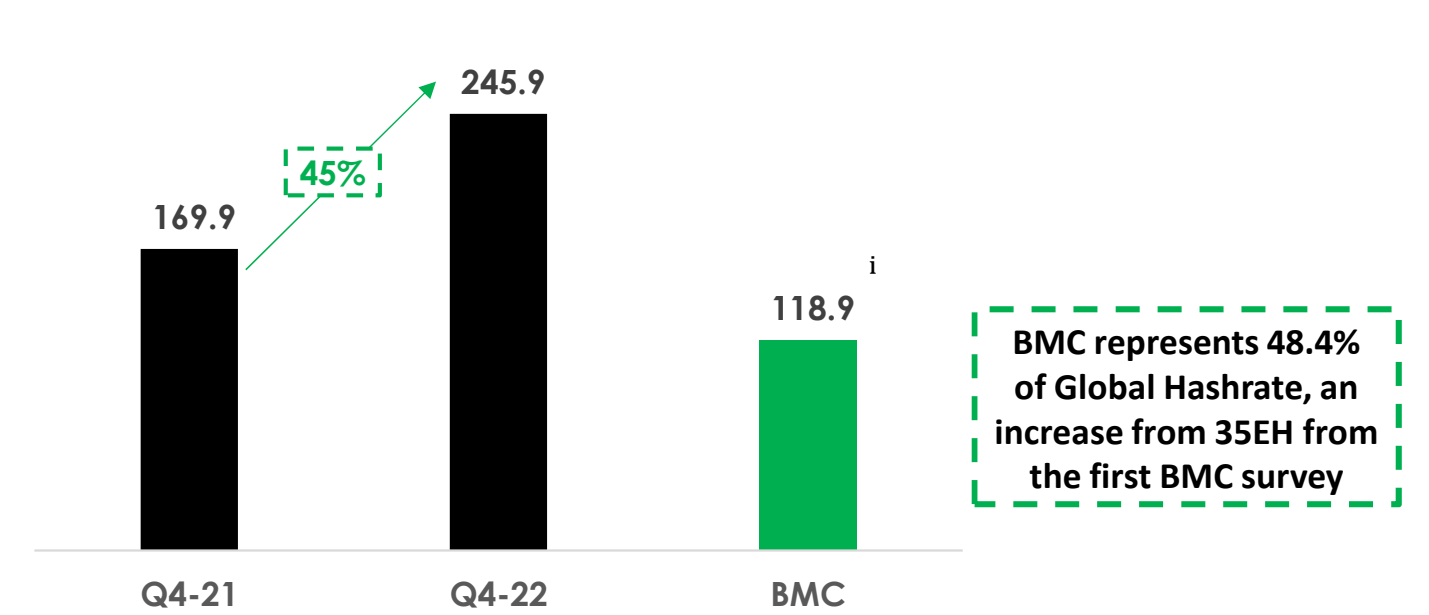


YOY, MINING EFFICIENCY INCREASED 16% AND SECURITY INCREASED 45%

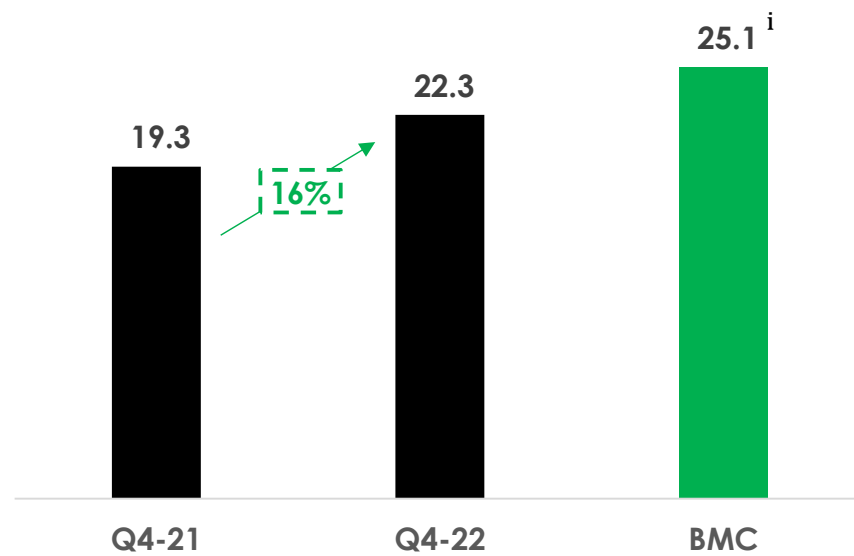
FLEET ELECTRICITY CONSUMPTION (GW)ⁱⁱ



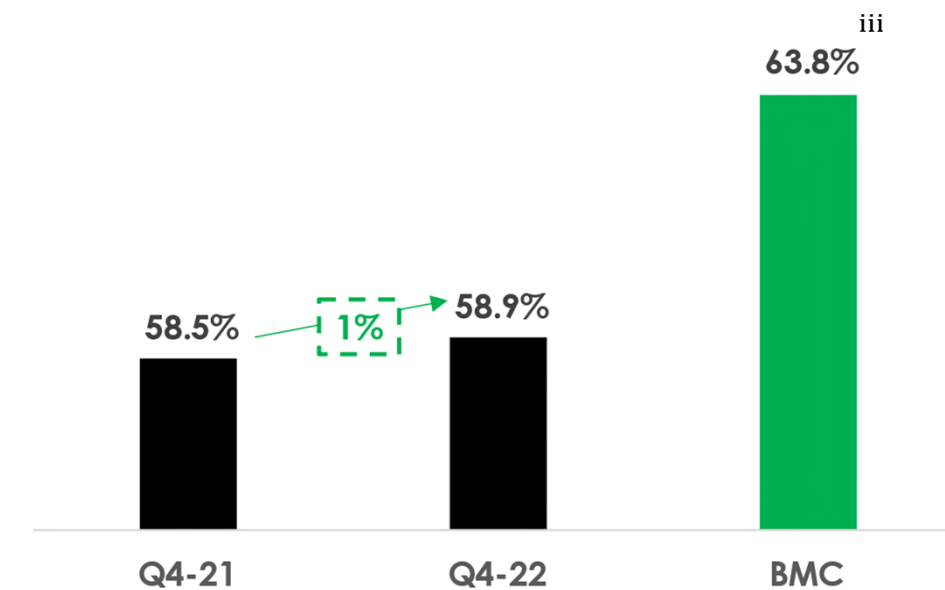
HASHRATE (EH)ⁱⁱ



MINING EFFICIENCY (EH/GW)ⁱⁱ



SUSTAINABLE ELECTRICITY (%)ⁱⁱ

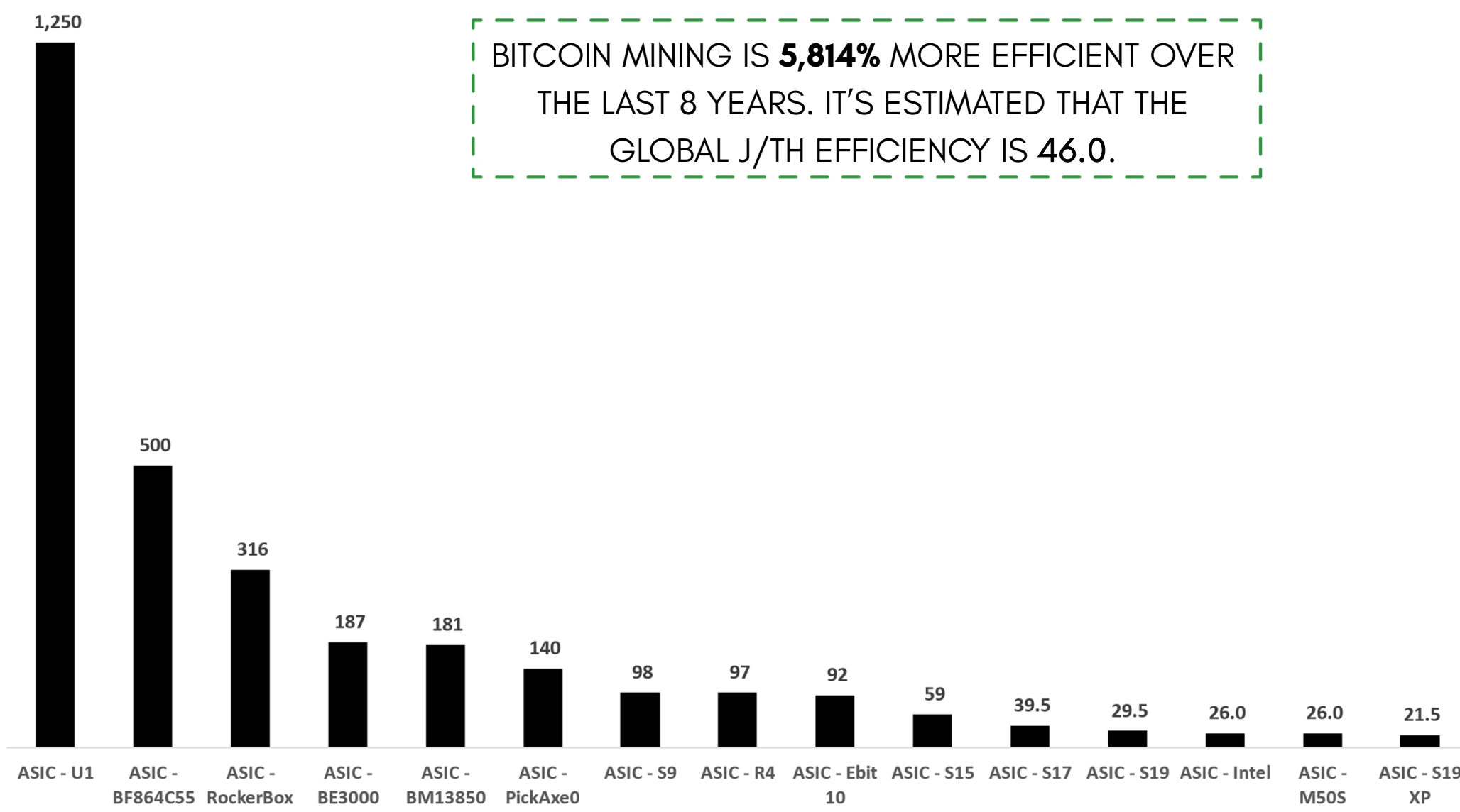


BITCOIN MINING IS TECHNOLOGY INTENSIVE, INCREASING 58X IN EFFICIENCY OVER 8 YEARS

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 BE3000	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 - Intel	Intel Bonanza	13-Jan-23	26.0
ASIC - M50S	MicroBT M50S	15-Jul-22	26.0
ASIC - S19 XP	Antminer S19 XP	12-Nov-21	21.5



J/TH - EFFICIENCY OVER TIMEⁱ



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 eight years.

CURTAILMENT STATISTICS



14

BMC Members Reported

1,280

GWh Curtailed

2.5

**GW In Curtail Programs
(Global)**

2.1

**GW In Curtailment Programs
(USA/CA)**

8.3

**Utility Battery Storage
(USA/CA)**

+25%

**Effective Utility Battery Storage
(NA/CA)**

SOURCES & METHODOLOGY

BMC SURVEY METHODOLOGY:

THE BMC SURVEYED BITCOIN MINERS AROUND THE WORLD ASKING FOUR 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?
- 4.) DO YOU CURTAIL? IF SO, WHAT IS THE TOTAL AMOUNT OF HOURS AND MWH THAT YOU CURTAILED IN THE QUARTER?

*THE ANNOTATED TERM "SUSTAINABLE ELECTRICITY" WAS DEFINED AS ELECTRICITY GENERATED BY: HYDRO, WIND, SOLAR, NUCLEAR, GEOTHERMAL.
THE Q4 2022 BMC SUSTAINABILITY ELECTRICITY VALUE NO LONGER TAKES INTO ACCOUNT RENEWABLE ENERGY CREDITS (REC).

SOURCES:

- ⁱ 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).ⁱⁱ BMC ESTIMATED BITCOIN MINING ENERGY USE (DECEMBER 30, 2022).
- ⁱ 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](https://www.eia.gov/tools/faqs/faq.php?id=74&t=11) ⁱⁱ BITCOIN MINING ESTIMATE IS DERIVED FROM THE Q4 2022 BMC ESTIMATED TWH ELECTRICITY CONSUMED GLOBALLY.
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- ⁱ DATA COMPILED FROM BMC ADVISORY COUNCIL MEMBERS. ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY AND ELECTRICITY USE.ⁱⁱ ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON BMC ANALYSIS, ASSUMPTIONS AND EXTRAPOLATION.ⁱⁱⁱ As of Q4-21, BMC SUSTAINABILITY ELECTRICITY VALUE NO LONGER TAKES INTO ACCOUNT RENEWABLE ENERGY CREDITS (REC).
- ⁱ UTILITY STORAGE DATA FOR UNITED STATES AND CANADA COMPILED FROM: [HTTPS://WWW.EIA.GOV/TODAYINENERGY/DETAIL.PHP?ID=54939](https://www.eia.gov/todayinenergy/detail.php?id=54939) & [HTTPS://GATEWAY.EME.NRC.CA/EN/ES/DEMO_PROJECTS](https://gateway.eme.nrc.ca/en/es/demo_projects)

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THANK YOU