

# GLOBAL BITCOIN MINING DATA REVIEW

## H1 2023

August 2023

57 MINING COMPANIES REPRESENTING 43.4% OF THE GLOBAL NETWORK





# AGENDA


- 1** Introduction: Ben Gagnon
- 2** Full BMC H1 2023 Update: Ben Gagnon
- 3** Q & A


# BITCOIN MINING COUNCIL


57 MINING COMPANIES FROM 6 CONTINENTS REPRESENTING 43.4% OF THE GLOBAL NETWORK


ASICXchange


ALPHA MINER  
THE POWER BEHIND


ARKON  
ENERGY


argo


ATLAS  
MINING


atnorth


BITFURY


BITDEER


BIT DIGITAL


Bitfarms


BITFURY


BITRIVER


BLOCKFUSION


BLOCKWARE  
MINING


BLOCKWARE  
SOLUTIONS


BTCM


CHOLLA  
ENERGY


CleanSpark


celsius  
network


CORE SCIENTIFIC


COMPASS  
MINING


COMPUTENORTH


COWA


cormint


CONSENSUS  
MINING


DELTA  
MINING


DMG  
BLOCKCHAIN SOLUTIONS


enegix

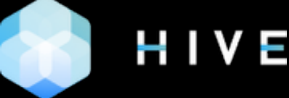
FRONTIER  
MINING


galaxy


GEM  
MINING


GMR


GMT


HIVE


HORIZON KINETICS


HUT 8


HM Tech  
LLC  
HASH WITH THE MASTER


Iris Energy


JKL MINING


MARATHON  
DIGITAL HOLDINGS


Mawson  
Infrastructure  
Group Inc.


MEROX


MicroStrategy


MINEDMAP


MININGSTORE


NFN8 GROUP  
INC.  
Leveraging the Evolution of Money


Poolin


PrimeBlock


RIOT


SATO


SBI Crypto


STRONGHOLD  
DIGITAL MINING


SOLUNA


SUMMIT  
MINING

SunnySide  
DIGITAL

TERAWOLF

TRUE NORTH  
DATA SOLUTIONS LTD.

US BITCOIN CORP

Bitcoin  
Mining  
Council

# EXECUTIVE SUMMARY

Bitcoin mining, in H1 2023:

1. Uses an inconsequential amount of global energy (17bps) and generates negligible carbon emissions (11bps)
2. Bitcoin mining hashrate is up 70% YoY while energy usage is up 38% YoY, due to an increase in efficiency of 24%
3. Bitcoin is the industry leader in sustainability with a 59.9% 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. H1-23, Mining Efficiency Increased 6% & Sustainable Electricity Remains Stable
7. YoY, Mining Efficiency Increased 24% and Network Security Increased 70%
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



**167,788 TWh<sup>i</sup>**  
**TOTAL ENERGY UTILIZED WORLDWIDE**

**348 TWh<sup>ii</sup>**  
**ENERGY CONSUMED BY BITCOIN MINING  
ON THE WORLD'S ELECTRIC GRID**

**GLOBAL BITCOIN  
MINING CONSUMES  
0.21%  
OF THE WORLD'S ENERGY PRODUCTION**

SOURCES: <sup>i</sup> BP STATISTICAL REVIEW OF WORLD ENERGY (2022), [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).  
<sup>ii</sup> BMC ESTIMATED BITCOIN MINING ENERGY USE (JUNE 30, 2023).



# BITCOIN MINING CARBON EMISSIONS VS TOTAL GLOBAL CARBON EMISSIONS



**34.8 BMt<sup>i</sup>**

TOTAL ESTIMATED CO<sup>2</sup> GENERATED GLOBALLY

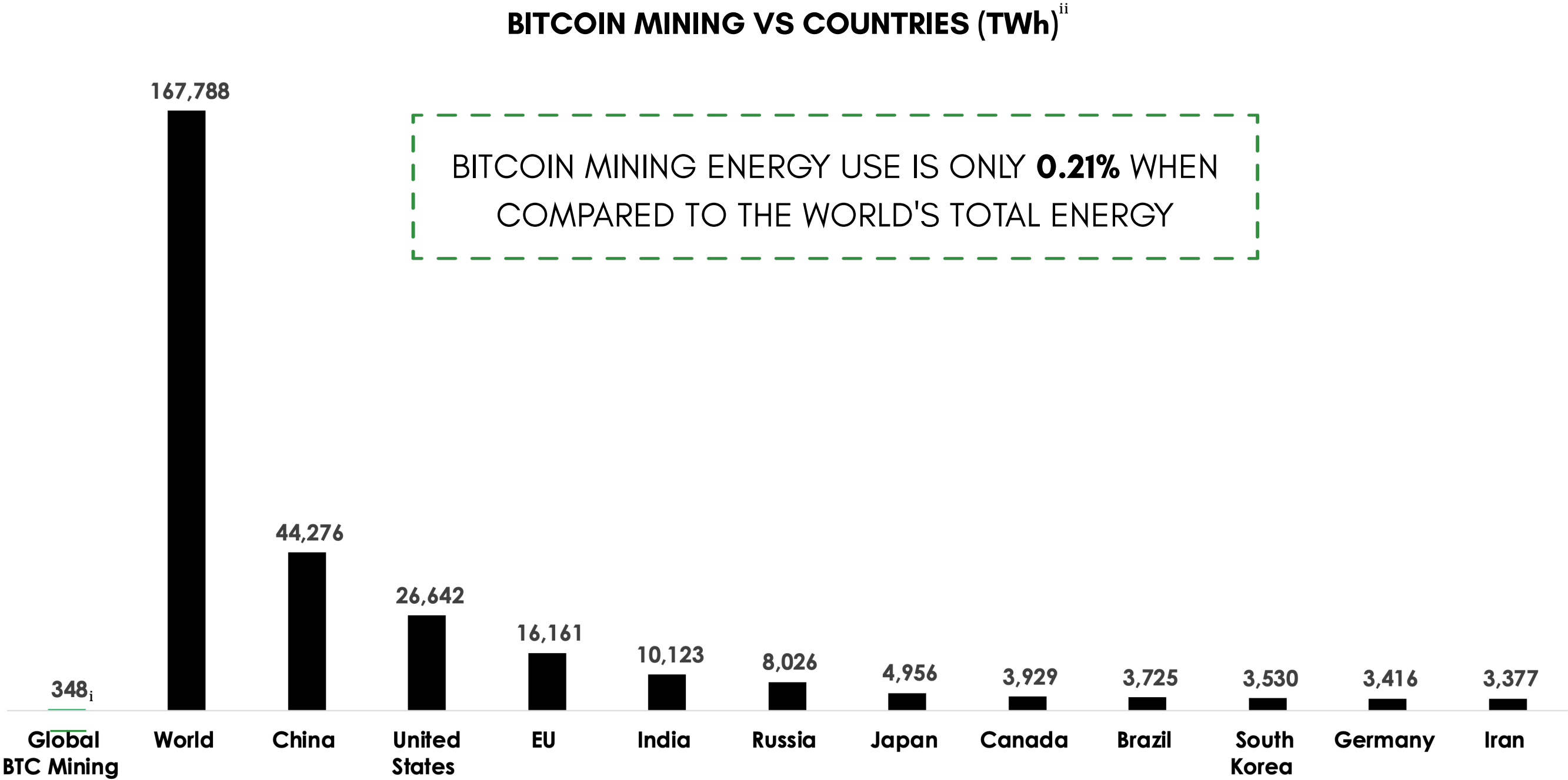
**0.05 BMt<sup>ii</sup>**

ESTIMATED CO<sup>2</sup> GENERATED BY BITCOIN  
MINING ON THE WORLD'S ELECTRIC GRID

**GLOBAL BITCOIN  
MINING IS  
0.135%  
OF THE WORLD'S CO<sup>2</sup> PRODUCTION**

SOURCES: <sup>i</sup> CO<sup>2</sup> 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)  
<sup>ii</sup> BITCOIN MINING ESTIMATE IS DERIVED FROM THE H1 2023 BMC ESTIMATED TWH ELECTRICITY CONSUMED GLOBALLY.

# GLOBAL BITCOIN MINING ENERGY USE IS NEGLIGIBLE

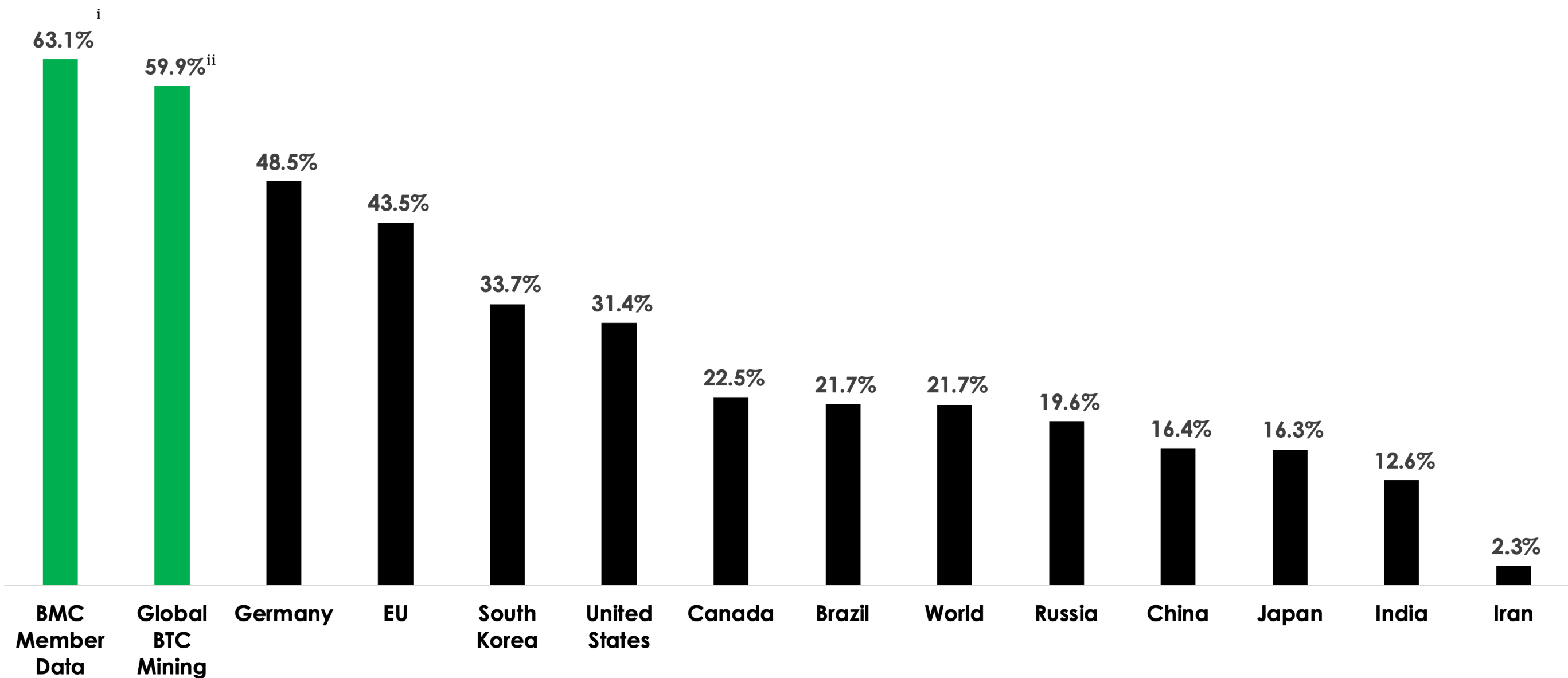


SOURCES: <sup>i</sup> BMC ESTIMATED BITCOIN MINING ENERGY USE (JUNE 30, 2023). ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY & ELECTRICITY USE.  
<sup>ii</sup> BP'S STATISTICAL REVIEW OF WORLD ENERGY (2022). [HTTPS://WWW.BP.COM/EN/GLOBAL/CORPORATE/ENERGY-ECONOMICS/STATISTICAL-REVIEW-OF-WORLD-ENERGY/PRIMARY-ENERGY](https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/primary-energy).



# GLOBAL BITCOIN MINING HAS THE HIGHEST SUSTAINABLE ENERGY MIX

SUSTAINABLE POWER MIX: BITCOIN MINING VS COUNTRIES (% OF TWh)<sup>iii</sup>

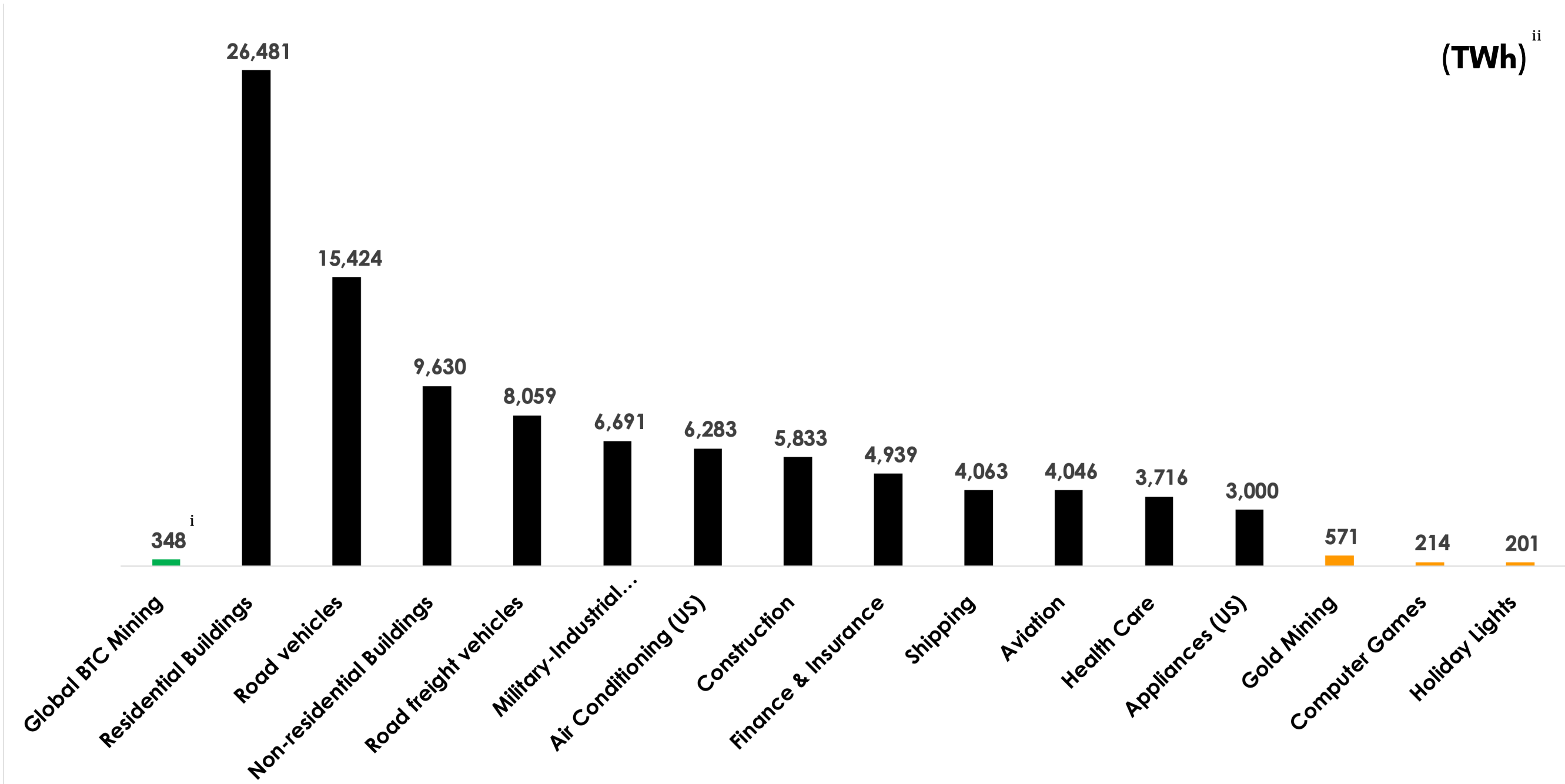


SOURCES: <sup>i</sup> VALUE REPRESENTS DATA COMPILED FROM BMC ADVISORY COUNCIL MINERS. ANNUALIZED PRIMARY ENERGY USE.

<sup>ii</sup> ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON BMC ANALYSIS, ASSUMPTIONS AND EXTRAPOLATION. (JUNE 30, 2023)

<sup>iii</sup> 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: <sup>i</sup> BMC ESTIMATED BITCOIN MINING ENERGY USE (JUNE 30, 2023). ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY & ELECTRICITY USE.

<sup>ii</sup> 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/eu/pub/article-abstract/30/supplement_5/ckaa165.843/5914601)

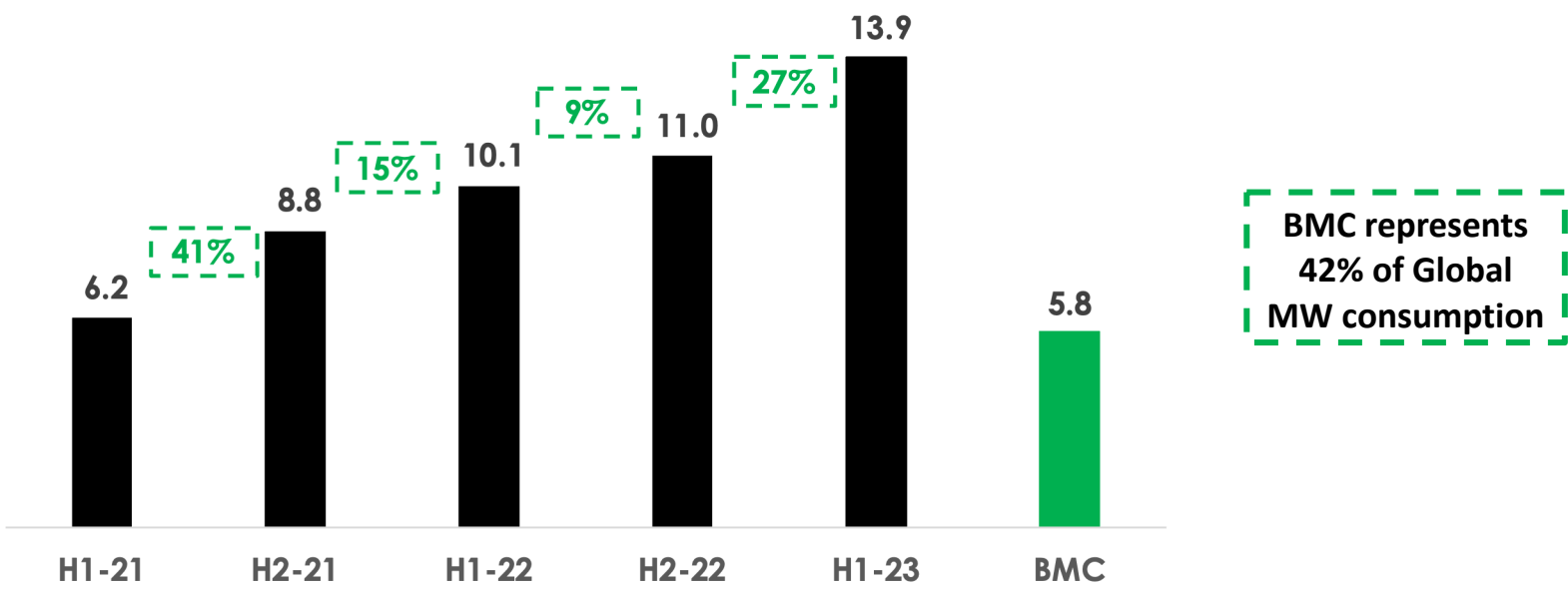
[HTTPS://SMCCOOK.MEDIUM.COM/COMPARING-BITCOINS-ENVIRONMENTAL-IMPACT-F56B18014F64](https://smccook.medium.com/comparing-bitcoins-environmental-impact-f56b18014f64)

[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)

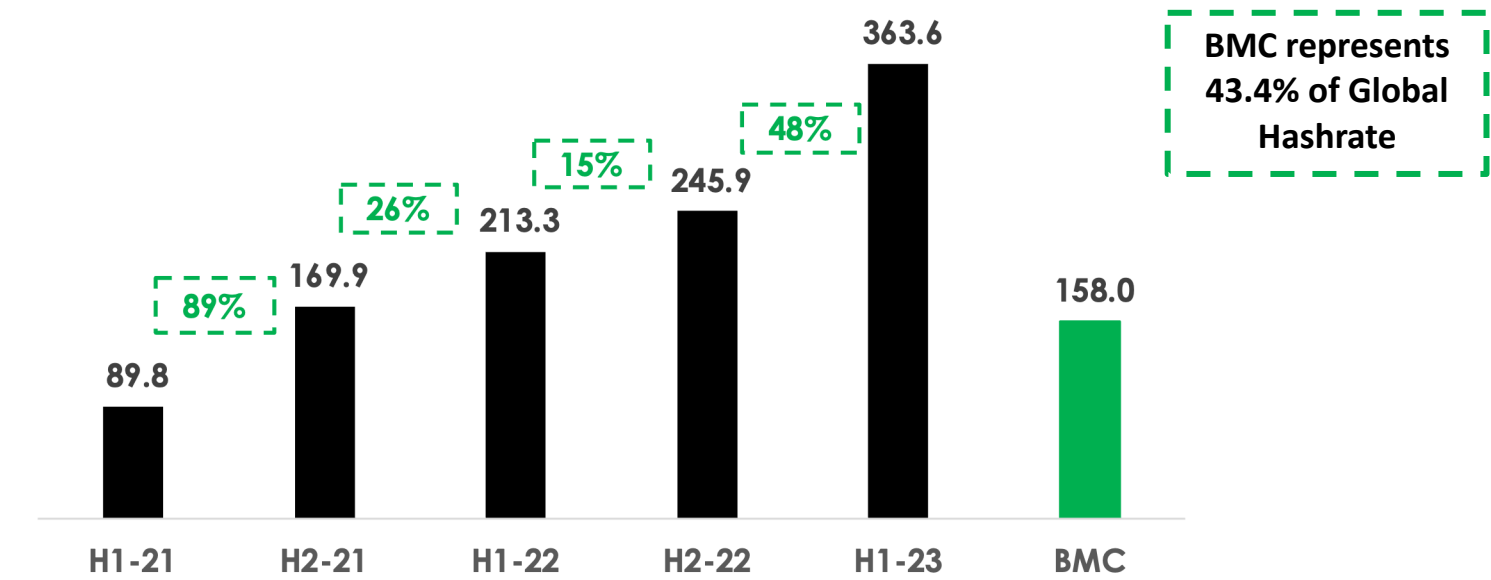


# H1-23, MINING EFFICIENCY INCREASED 6% AND THE SUSTAINABLE ELECTRICITY HAS REMAINED STABLE

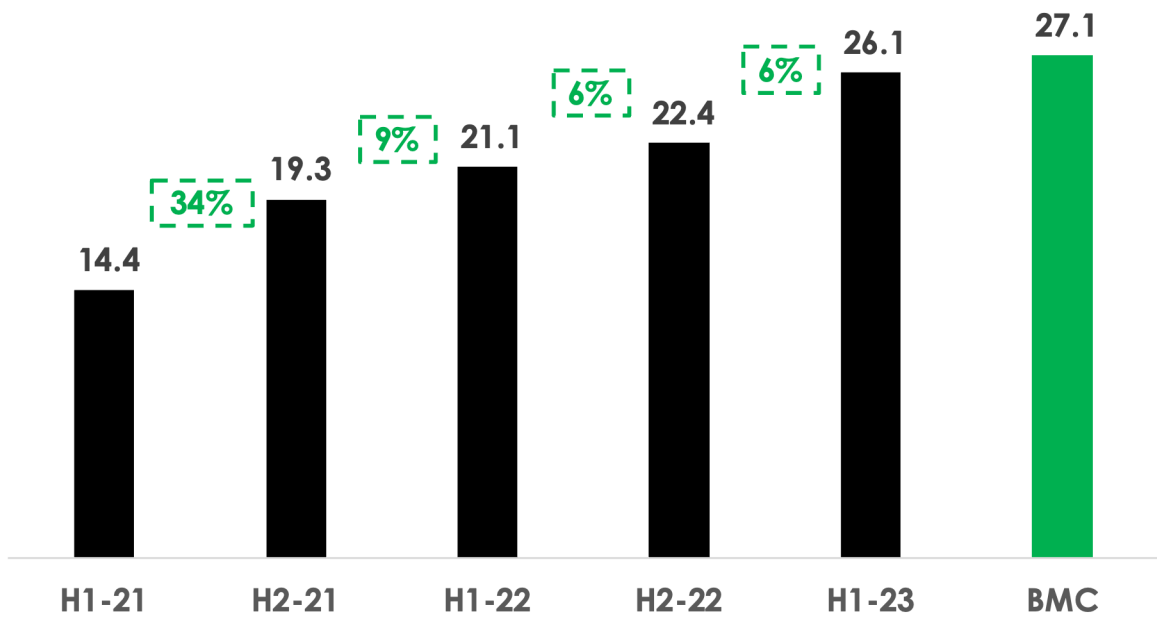
FLEET ELECTRICITY CONSUMPTION (GW)<sup>ii</sup>



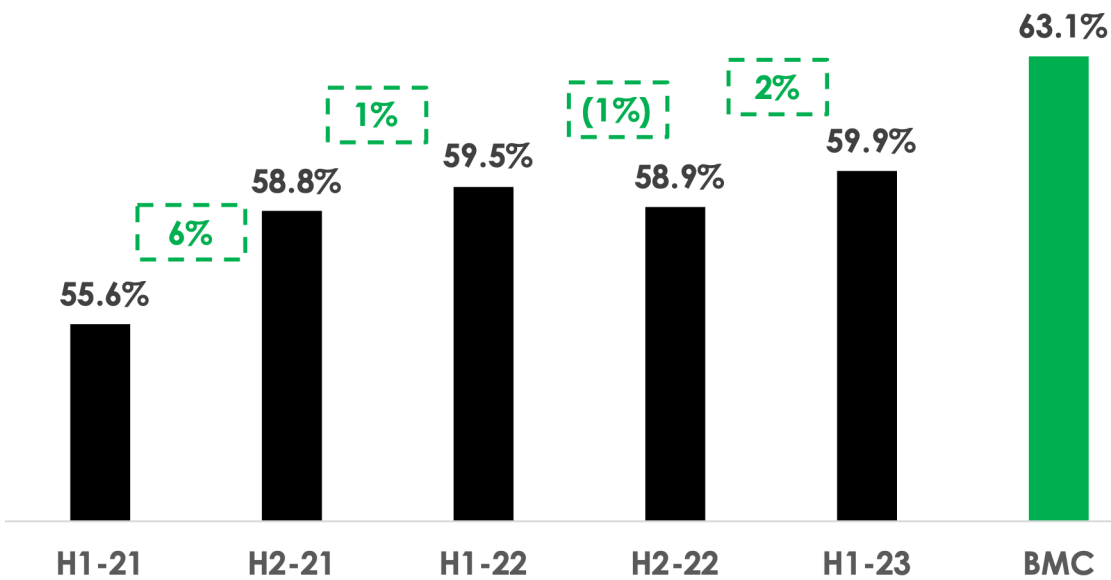
HASHRATE (EH)<sup>ii</sup>



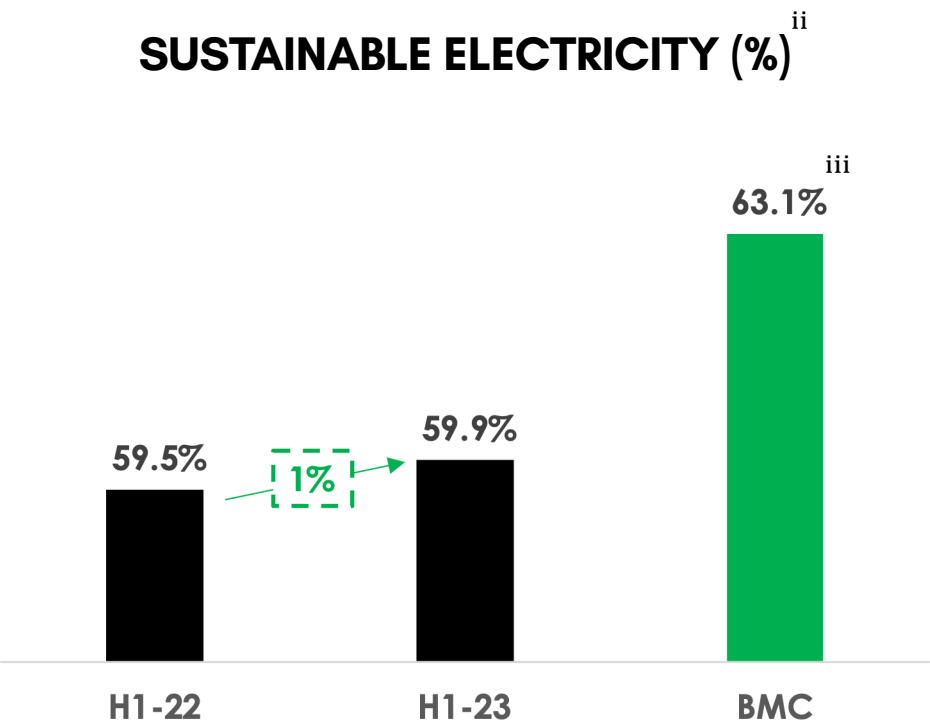
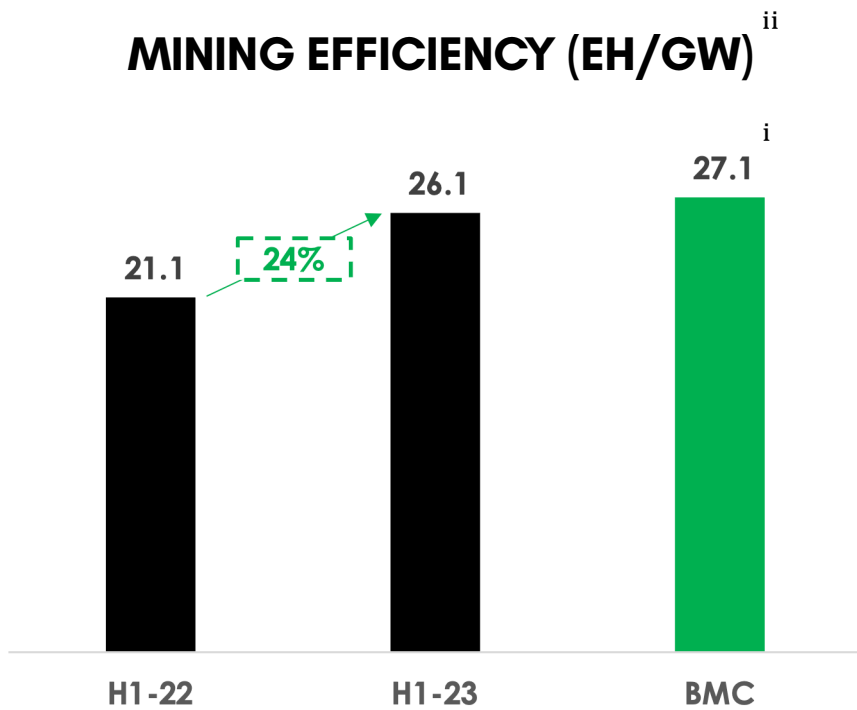
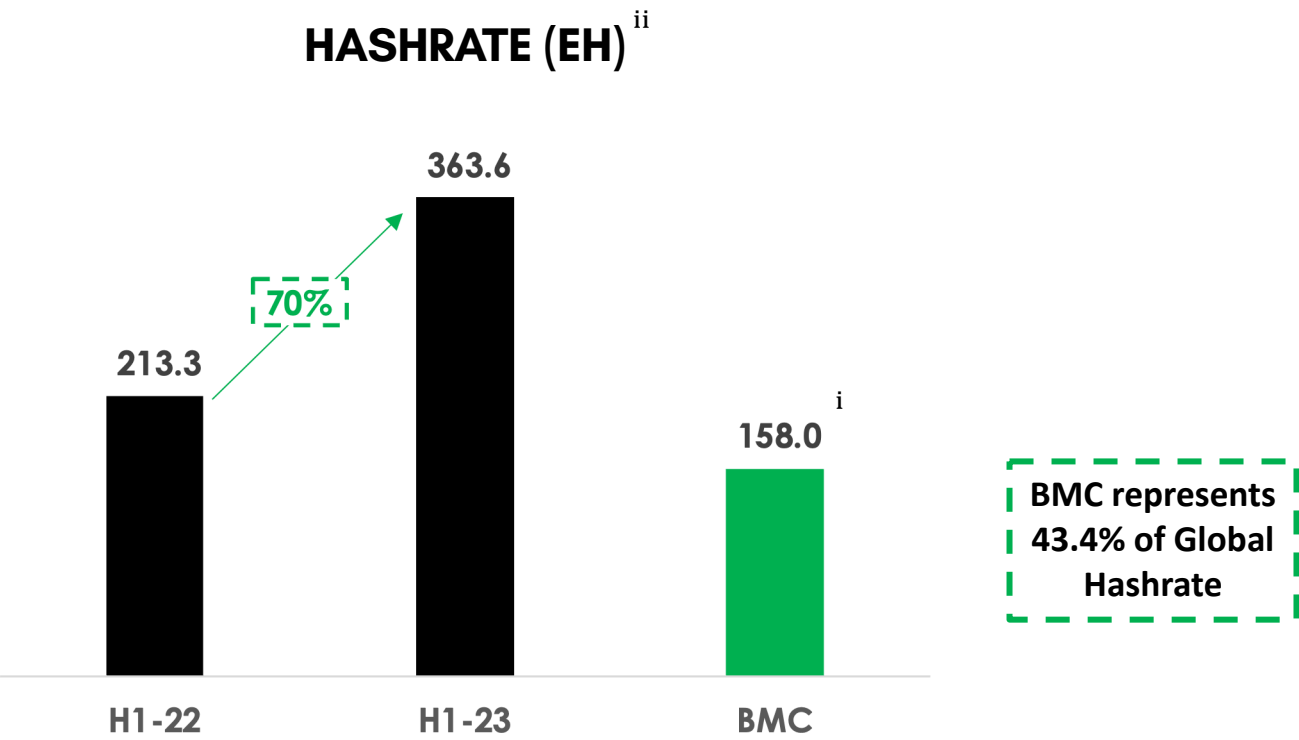
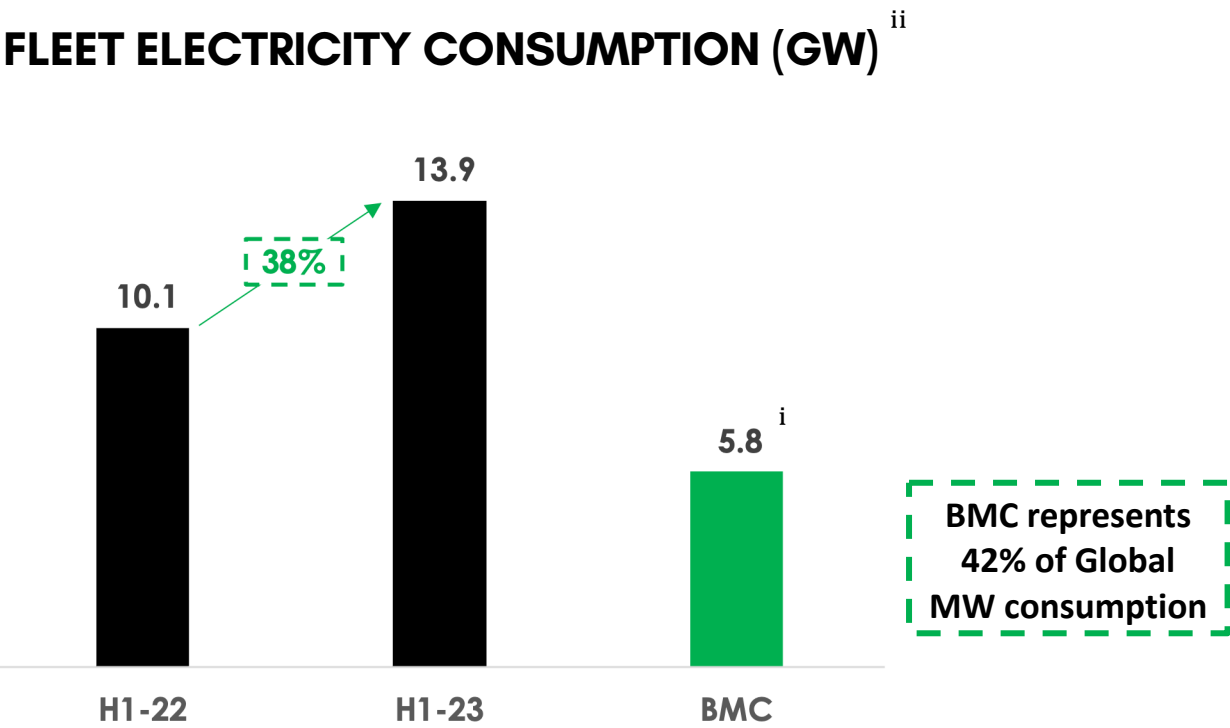
MINING EFFICIENCY (EH/GW)<sup>ii</sup>



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



# YoY, MINING EFFICIENCY INCREASED 16% AND SECURITY INCREASED 45%



SOURCES: <sup>i</sup> DATA COMPILED FROM BMC ADVISORY COUNCIL MEMBERS. ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY AND ELECTRICITY USE.  
<sup>ii</sup> ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON BMC ANALYSIS, ASSUMPTIONS AND EXTRAPOLATION.  
<sup>iii</sup> BMC SUSTAINABILITY ELECTRICITY VALUE NO LONGER TAKES INTO ACCOUNT RENEWABLE ENERGY CREDITS (REC).



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

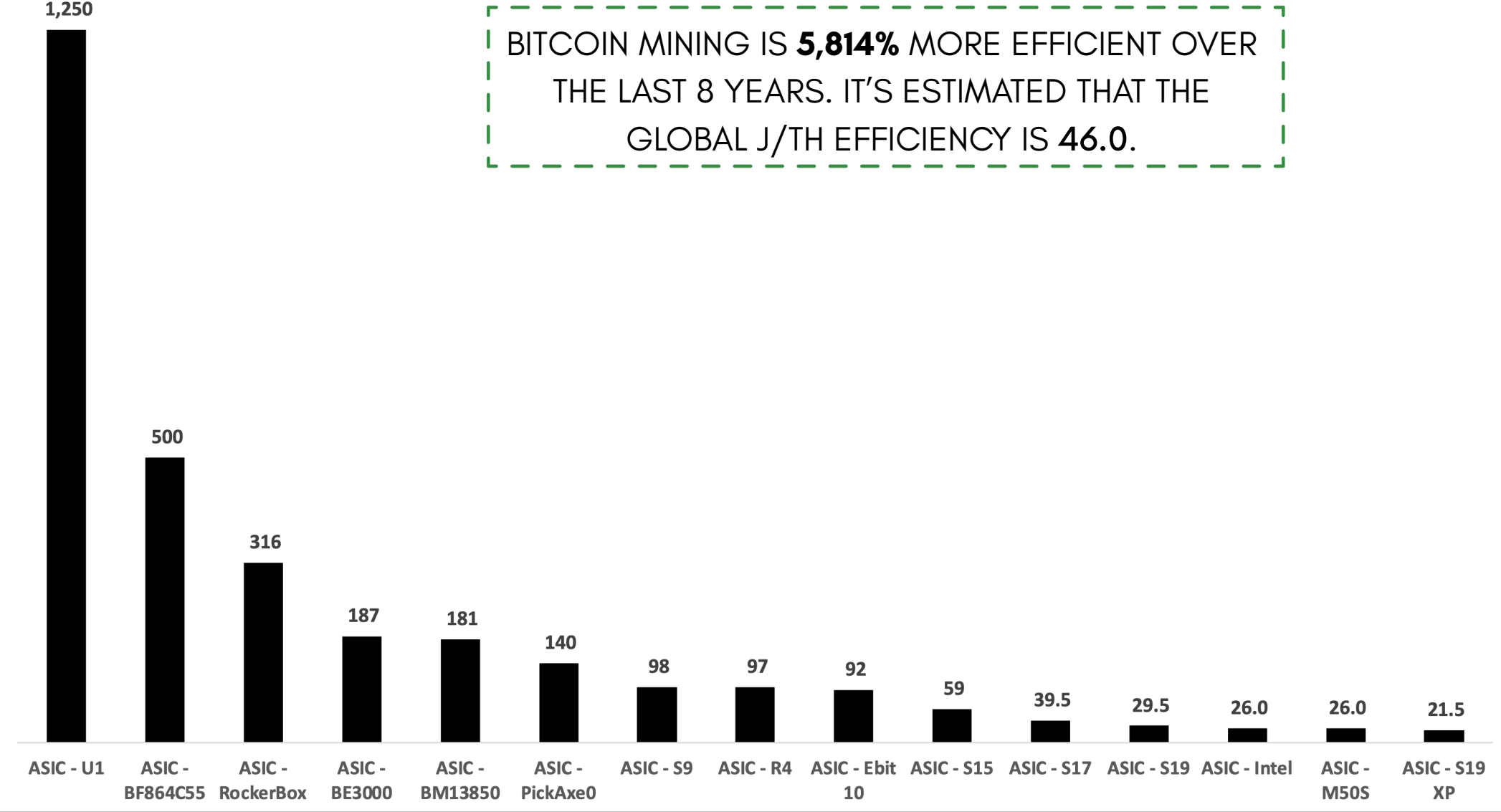
Combined	Hardware name	Date	J/Th
CPU	ARM Cortex A9	3-Jan-09	877,193
GPU	ATI 5870M	23-Sep-09	264,550
FPGA	X6500 FPGA Miner	29-Aug-11	43,000
ASIC - Avalon B1	Canaan AvalonMiner Batch 1	1-Jan-13	9,351
ASIC - Jupiter	KnCMiner Jupiter	5-Oct-13	1,484
ASIC - U1	Antminer U1	1-Dec-13	1,250
ASIC - BF864C55	Bitfury BF864C55	3-Mar-14	500
ASIC - RockerBox	RockerBox	22-Jul-14	316
ASIC - BE3000	ASICMiner 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 - 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

~700x

~13x

~5x

J/TH - EFFICIENCY OVER TIME<sup>i</sup>



# 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



**17**

BMC Members Reported

**815**

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)

# H1-23 STATISTICS



**43%**

Network Growth

**84%**

Bitcoin Price

**33%**

Hash price (USD/TH)

**4.5 B**

Mining Revenue

**185%**

Public Miners Stock Price

**168k**

Bitcoins Mined



# 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 H1 2023 BMC SUSTAINABILITY ELECTRICITY VALUE NO LONGER TAKES INTO ACCOUNT RENEWABLE ENERGY CREDITS (REC).*

## SOURCES:

- 1** <sup>i</sup> BP 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).<sup>ii</sup> BMC ESTIMATED BITCOIN MINING ENERGY USE (June 30, 2023).
- 2** <sup>i</sup> 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) <sup>ii</sup> BITCOIN MINING ESTIMATE IS DERIVED FROM THE H1 2023 BMC ESTIMATED TWH ELECTRICITY CONSUMED GLOBALLY.
- 3** <sup>i</sup> BMC ESTIMATED BITCOIN MINING ENERGY USE (DECEMBER 30, 2022). ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY & ELECTRICITY USE.<sup>ii</sup> 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).
- 4** <sup>i</sup> VALUE REPRESENTS DATA COMPILED FROM BMC ADVISORY COUNCIL MINERS. ANNUALIZED PRIMARY ENERGY USE.<sup>ii</sup> ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON BMC ANALYSIS, ASSUMPTIONS AND EXTRAPOLATION. (June 30, 2023)<sup>iii</sup> 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).
- 5** <sup>i</sup> BMC ESTIMATED BITCOIN MINING ENERGY USE (June 30, 2023). ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY & ELECTRICITY USE.<sup>ii</sup> 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 & 7** <sup>i</sup> DATA COMPILED FROM BMC ADVISORY COUNCIL MEMBERS. ANNUALIZED VALUES ARE USED FOR BITCOIN MINING ENERGY AND ELECTRICITY USE.<sup>ii</sup> ESTIMATED GLOBAL BITCOIN NETWORK ANNUALIZED POWER BASED ON BMC ANALYSIS, ASSUMPTIONS AND EXTRAPOLATION.<sup>iii</sup> As of Q4-21, BMC SUSTAINABILITY ELECTRICITY VALUE NO LONGER TAKES INTO ACCOUNT RENEWABLE ENERGY CREDITS (REC).
- 8** <sup>i</sup> 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