



Bitcoin's role in the ESG imperative

An overview of the opportunities and creative approaches that deliver value and drive trust with key stakeholders

Note: This paper is not an endorsement of the environmental, social, or governance practices, credentials, or bona fides of Bitcoin or other cryptocurrencies, miners, or related companies.

Despite 2022 being a tumultuous year for Bitcoin, it continues to dominate the headlines, and as of July 2023, it is the best performing asset year-to-date¹. Its maturity into a traditional asset class is evident simply by seeing its ticker symbol “BTC” displayed on popular morning finance shows “Squawk Box” and “Bloomberg Surveillance” as well as the home page of the Wall Street Journal.

However, despite Bitcoin’s increased adoption, it continues to often be a misunderstood technology and asset class. At the same time, there’s a variety of impactful use cases that Bitcoin offers that have a track record in delivering value for their users and society at-large. These scenarios not only can improve the reputation of the overall ecosystem, but pave the way for greater use and adoption.

In this paper, we’ll explore these specific use cases to

- 1) Evaluate the environmental, social, and governance impact of Bitcoin,
- 2) Highlight some of the misconceptions that still thrive today, and
- 3) Showcase creative approaches for using Bitcoin throughout the ESG journey.

A quick primer: What exactly is Bitcoin mining and how is it done?

Bitcoin uses a proof-of-work (PoW) consensus mechanism which is the process of adding transactions to the blockchain by being the first to solve a mathematical problem via computation. This math problem involves repeatedly hashing a block of transactions until a specific output is achieved. Hashing is the process of taking any string of text as an input and converting it to a fixed length alphanumeric output. Given that this is a one-way function, it means that the same input will always result in the same output, but the input cannot be determined with the output alone. Solving this math problem is essentially trying to find a needle in a haystack. Miners who solve the puzzle first are awarded freshly minted Bitcoin (currently 6.25 Bitcoin per block) as well as any transaction fees which currently account for about 2–3% of miner revenue. Mining is critical to the Bitcoin protocol as it ensures that users cannot double spend coins based on timestamping and a canonical ordering of transactions in each block that ultimately helps secure the network without the need for a trusted intermediary. In order to circumvent this, an actor would need to obtain over 50% of the entire network’s hash-rate.

¹ Best And Worst Investments of 2023: Bitcoin and Tech, Forbes, July 3, 2023

Environmental: Bitcoin's impact today and role in reducing emissions

Bitcoin's environmental impact has been hotly debated for years. In particular, the energy consumption used to mine Bitcoin. Meanwhile, stakeholders—including consumers, regulators, investors, and more—are focused on driving toward Net Zero emissions. So what's the challenge and opportunity for the Bitcoin ecosystem?

On the surface, Bitcoin does not emit direct emissions (also referred to as Scope 1 emissions), much like electric vehicles (EVs) do not emit direct emissions. That's because the hardware used in mining (ASICs) runs off electricity. Note that in some instances, Bitcoin mining operations do produce Scope 1 emissions, such as those associated with repowering under-utilized generation assets or with the use of waste gas (i.e., natural gas flared as part of oil & gas production activities).

Like EVs, where its indirect emissions (referred to as Scope 2 emissions) come from, and is the primary source of debate, is the energy used to produce that electricity. Bitcoin consumes approximately 110 terawatt hours of energy per year, roughly 0.55% of global electricity use² which is equivalent to the amount of energy required to run tumble dryers. One would have expected much more electricity use given the years of criticism Bitcoin has received due to its energy consumption. Infamously, a Newsweek article in 2017 published an article titled "Bitcoin Mining on Track to Consume All of the World's Energy by 2020".

However, the use of energy is not the primary issue, but rather the emissions associated with the production of that energy such as those from the burning of fossil fuels. For comparison purposes, it's helpful to compare the emissions associated with Bitcoin's operations with the emissions of a wide range of industries and services.

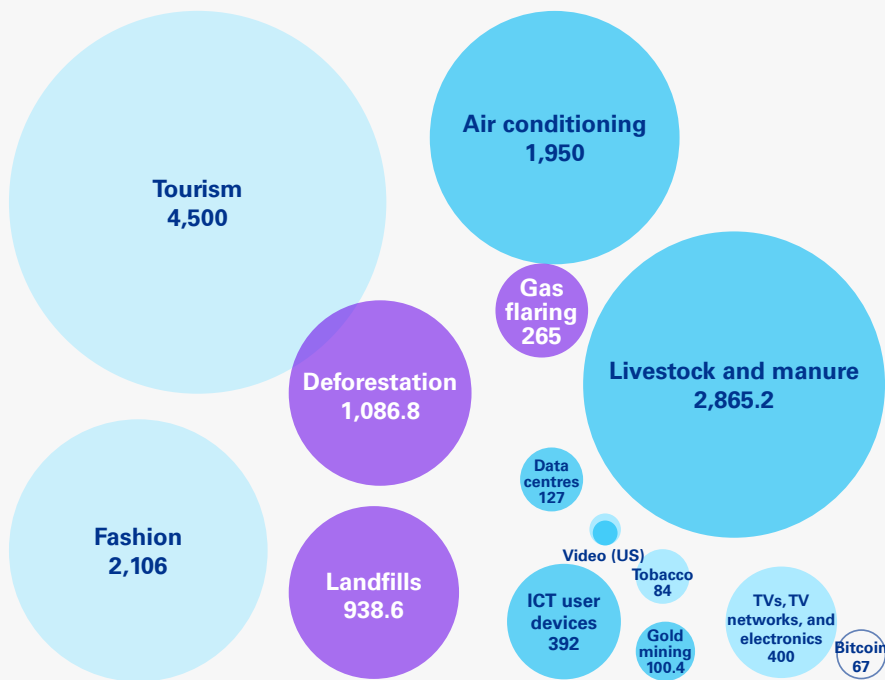


Exhibit 1

While Bitcoin's emissions may be lower than often discussed, stakeholders are focused on industries and firms achieving Net Zero. How can Bitcoin help reduce emissions to align with goals and objectives of their stakeholder groups?

(MtCO₂e)

- Recreational
- Common uses
- Loss and waste

Source: Cambridge Bitcoin Electricity Consumption Index.

² How Much Energy Does Bitcoin Actually Consume?, Harvard Business Review, May 5, 2021

4 Strategies to reduce carbon footprints



Use of renewable energy

to lower cost and incentivize further production

01

Bitcoin mining pools worldwide split the block reward in proportion to their computing power. Since these specialized computers (ASICs) are widely available and produce Bitcoin at the same rate, regardless of location, the Bitcoin mining industry has become extremely competitive.

Given this competitive landscape, miners are incentivized to streamline their operations and carefully manage their production costs. As electricity is the largest on-going input cost affecting operations, miners are constantly searching for the lowest cost sources of electricity, which is often tied to under-utilized hydro, wind, or solar.

However, wind and solar have limitations. The sun is only out for a portion of the day and wind output is variable, often peaking during the evening. Additionally, renewable energy facilities are incentivized to produce at their maximum capacity to deliver electricity in a manner consistent with their contractual agreements. This can leave utilities with an excess supply of electricity, which if coupled with a supply and demand mismatch, can lead to low, and even negative, electricity prices.

Bitcoin miners can setup anywhere, including co-locating around these renewable energy sources, offering a flexible load that can work in harmony with supply and demand patterns.

This ability for Bitcoin miners to dynamically flex their power consumption during periods of excess supply and/or low market demand can provide additional incentive to the buildout of additional renewable energy capacity. These non-core load

centers improve the economics of renewable energy projects by allowing their developers to facilitate further expansion of their operations. Former CEO of ERCOT, which operates the bulk energy system in the state of Texas, Brad Jones, stated in a recent public appearance that “Bitcoin allows those renewables to earn money during those times rather than having to shut off their service, or even having to pay customers to use their power” and “Bitcoin mining helps to sustain those markets for renewables and drives more renewables.”

It’s worth noting that Texas produces far more renewable energy than any other state in the country, having produced over 136,000 gigawatt hours of wind and solar energy in 2022³. As a result, it’s not surprising that Texas has become a popular destination for Bitcoin miners and represents approximately 59% of the total Bitcoin hash rate volume in the United States.

The notion that Bitcoin mining can incentivize increased integration of renewable energy into the grid was highlighted in a 2022 article by the World Economic Forum (WEF), which stated “crypto mining can be a catalyst or market driver for new renewable energy projects” and “There are many remote geographic areas where the energy demand market is not large enough to support a utility scale renewable energy site.”⁴

Bitcoin mining has shown an ability to help balance electrical grids given its ability to quickly curtail its energy use during times of high demand.

³ One State Generates Much, Much More Renewable Energy Than Any Other – and It’s Not California, Inside Climate News, March 9, 2023

⁴ Crypto mining can retire fossil fuels for good. Here’s how, World Economic Forum, August 10, 2022



Demand response

02

In addition to being a buyer of last resort when demand is low, Bitcoin miners have the opportunity to serve as a flexible load through participation in demand response programs that help balance electrical grids. This is accomplished by the interruptible nature of mining operations in that they can curtail their power usage at a moment's notice in order to give that power back to the grid in the event that demand exceeds available supply.

During Winter Storm Uri, which took place in Texas in February 2021 and saw temperatures get down as low as -14 degrees, Bitcoin miners in Texas were able to curtail their energy consumption which resulted in approximately 1,500 megawatts being given back to the grid⁵.

Recycled heat

03

Bitcoin mining rigs, which are the specialized hardware devices used to perform the actual mining (e.g. ASICs), create significant heat while in use. Some Bitcoin miners have begun to recycle this heat for other purposes such as heating homes, commercial buildings, greenhouses, and even swimming pools. This is often accomplished by co-locating next to a building or greenhouse and tapping into the existing duct work that allows the miners to transfer the heat being produced, allowing these facilities to leverage existing heat sources. Additionally, the use of a heat exchanger can transfer this heat directly from the mining rigs into heat pumps for swimming pools.

For example, Canadian-based company MintGreen, has partnered with a local energy utility company, Lonsdale Energy Corp, to offer their proprietary "Digital Boilers" that convert heat from Bitcoin miners into sustainable heat. The company is piloting a project to heat 100 commercial and residential buildings in the City of North Vancouver⁶. This in turn has made them the first city in the world to leverage this technology to heat parts of the city in an effort to reduce greenhouse gas emissions.

Can Bitcoin mining's role in heating commercial and residential homes in a sustainable way continue to expand?

⁵ 1.5M houses could be powered by the energy Texas miners returned, Cointelegraph, January 6, 2023

⁶ North Vancouver to be World's First City Heated by Bitcoin, Bitcoin Magazine, October 14, 2021



Methane reduction

04

One of the biggest contributors to climate change is methane (CH₄) which is a greenhouse gas emitted from a range of sources such as coal mines, landfills, and industrial processes such as oil and gas extraction. According to the United Nations Environment Programme, methane is about an 80 times more potent greenhouse gas than carbon dioxide (CO₂) over a 20-year period and accounts for approximately 30% of global warming impacts. Rather than releasing this methane directly into the atmosphere, it is often burned, a process known as gas flaring, and reduces the impact of methane being released directly.

A 2021 study found that capturing the potential energy of flared gas in the United States and Canada alone would be sufficient to power the entire Bitcoin network⁷. Companies such as Crusoe Energy, who specialize in building modular data centers powered by stranded natural gas, are now partnering with oil and gas companies, like Exxon, to convert flared gas into electricity used for Bitcoin mining. This provides the benefit of both reducing emissions as well as creating an additional revenue stream to monetize what would have otherwise been wasted energy. Furthermore, Crusoe Energy's ability to reduce emissions through their use of gas flaring was recently highlighted in a video produced by the World Economic Forum (WEF)⁸.

As noted in Exhibit 1 above, landfills are a significant contributor to emissions given the immense amount of methane they release as part of the decomposition process. Vespene Energy, who is a methane

mitigation startup that mines Bitcoin at municipal landfills, uses vented methane that would otherwise have been released into the atmosphere. The U.S. Environmental Protection Agency (EPA) estimates that landfills account for approximately 14.3% of fugitive methane emissions in the United States⁹. Many have actually argued that the EPA is underestimating this percentage as a result of an outdated approach to measure methane emissions. Investments by Bitcoin mining operations, such as Vespene Energy, are a valuable resource to enabling landfill operators to capture and convert their fugitive methane emissions into useful electricity, reducing the environmental impact of their facilities.

Bitcoin miners are identifying new and creative ways to source their power which has also resulted in the reduction of methane that enters the atmosphere.

Between Bitcoin's flexible demand load, ability to co-locate next to renewable energy sources, use of under-utilized energy supply, and its ability to assist in reducing emissions, Bitcoin miners can be a useful ally in the transition to more renewable energy sources and reduce emissions, despite its significant energy consumption.

⁷ How Much Energy Does Bitcoin Actually Consume, Harvard Business Review, May 5, 2021

⁸ How Crusoe Energy Catches Waste Methane to Power Data Centers, World Economic Forum

⁹ Frequent Questions about Landfill Gas, EPA.gov



Social

Tackling the illicit use challenge, while also creating opportunities to drive a more inclusive economy

Concerns of Bitcoin use often raise the risk that it helps facilitate illicit/illegal activity. Given that there's no Know Your Customer (KYC)/Anti-Money Laundering (AML) requirements to transact in Bitcoin, and wallet addresses are pseudonymous, it seems like a perfect medium of exchange to use for nefarious purposes.

But according to a 2022 Chainalysis report, illegal and illicit use of crypto only accounted for 0.24% of total

transaction volume in 2022. By way of comparison, according to the United Nations' Office on Drugs and Crime, it's estimated that between 2%–5% of global GDP is used for money laundering alone¹⁰. To go a step further, Bitcoin's role in illegal/illicit activity such as money laundering was significantly less concentrated overall, relative to other assets like Ethereum, stablecoins, and altcoins.

Money laundering concentration: Share of total illicit value received by top deposit addresses by asset | 2021

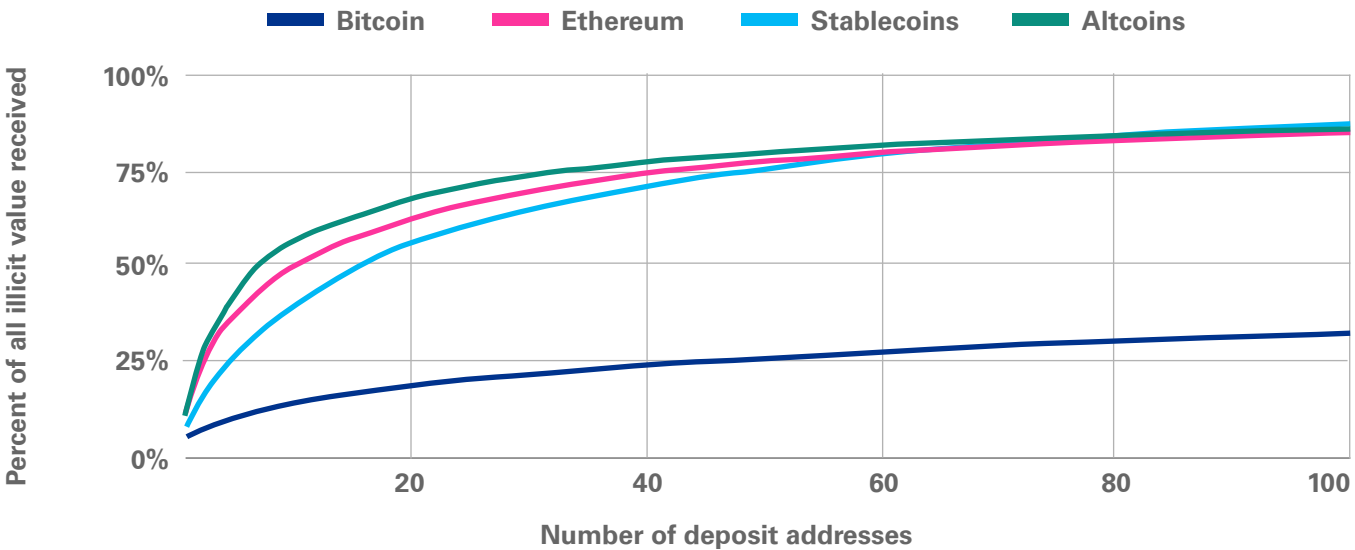


Exhibit 2

Source: Chainalysis 2022 Crypto Crime Report

¹⁰ Overview, Office on Drugs and Crime, United Nations

It can be postulated that conducting illegal activity with Bitcoin is a difficult task given that any transfer from one wallet to another is tracked on an immutable ledger that is open and transparent to the public. The Department of Justice (DoJ) has acknowledged this on numerous occasions stating “crypto provides law enforcement with ample information about how, when, and how much cryptocurrency is being transferred...no subpoenas or warrants are required to obtain it.” Additionally, given the KYC and AML requirements for exchanges, converting Bitcoin back into local currency can prove to be very difficult.

Tackling illicit activity is an essential objective for the industry; however, various companies offer sophisticated blockchain analysis tools that can help prevent cryptoassets like Bitcoin from being used in illegal or illicit activity. The Bitcoin ecosystem should engage these groups, assessing their overall strategy to tackle illicit activity.

At the same time, there are also other opportunities to help drive value within the Social pillar of ESG. Here are four examples of the public utility that Bitcoin can offer.

Bitcoin opportunities to advance inclusion

01 Payments

One of Bitcoin’s benefits to society has been through its ability to replace cross-border payments via money transmitters like Western Union and MoneyGram. While many of us in the West often take these payment rails for granted, many developing countries like Honduras, Haiti, Jamaica, El Salvador, etc. are not so fortunate. Inbound remittances from family members living abroad make up a significant portion of Gross Domestic Product (GDP) for these countries (over 20%).¹¹ Additionally, many residents of these countries who rely on these remittances often times have to travel hours to the nearest location, pay high transaction and currency conversion fees, and are further exposed to the risk of gang members who notoriously wait outside these money stations to target victims. On top of that, there are logistical challenges with how long the money can take to arrive and issues with the money becoming lost in the process. Bitcoin provides the ability for these payments to

take place nearly instantly so long as users have a cell phone and an internet connection, and with far cheaper transaction fees.

02 Ukraine fundraising

In addition to remittances, Bitcoin played a significant role in helping to raise funds for Ukraine at the start of the war with Russia. Two days into the invasion in February 2022, Twitter accounts tied to the Ukrainian government began to solicit cryptoasset donations, which ultimately resulted in nearly \$70 million in funding.^{12,13} This allowed the Ukrainian government to take possession of these funds nearly instantly compared to using legacy financial rails which would have taken days, even weeks, to clear and settle given the various restrictions imposed as a result of the war. The Ukrainian Deputy Digital Minister, Alex Bornyakov, stated “We were able to secure the purchase of vital items in no time at all via crypto, and what is amazing is that around 60% of suppliers were able to accept crypto, I didn’t expect this.” Bornyakov further went on to conclude that the fundraising was “an absolute success, not just from a standpoint on how much money that has been raised, but also from the procedure, the efficiencies and speed of access funds through crypto.”

03 Access to electricity in rural Africa

It’s estimated that approximately 770 million people around the globe do not have access to electricity. The majority of this figure comes from those living in sub-Saharan Africa.¹⁴ A lack of infrastructure is one of the driving forces behind this, and for electrical grids that do exist, they often fail to reach those in rural locations. It’s common for these areas to rely on microgrids which are small electrical grids that operate independently and pull energy from a variety of sources such as wind, solar, and hydro to provide electricity to a localized area. However, many of these microgrids are initially funded through organizations like USAID and subsequently struggle to remain financially viable, again, due to supply and demand mismatches. Bitcoin miners are able to co-locate within these microgrids and allow the operators to monetize what would otherwise have been wasted

¹¹ Remittances to Reach \$630 billion in 2022 with Record Flows into Ukraine, The World Bank, May 11, 2022

¹² Ukraine has raised more than \$54 million as bitcoin donations pour in to support the war against Russia, CNBC, March 3, 2022

¹³ Ukraine buying military equipment to fight Russia partly using crypto, claims minister, Yahoo finance, February 24, 2023

¹⁴ SDG7: Data and Projections, IEA, 2022

energy. This in turn has provided more consistent and less expensive electricity to residents by increasing the useful load factor on the local grid and decreasing the cost per kWh by increasing total sales. A company called Gridless has been at the forefront of this opportunity and working in rural areas of Kenya and Malawi to provide modular mining operations that help stabilize these microgrids being used—and in turn—creating a balanced grid and steady stream of electricity to local residents at reduced rates; one estimate showing a 30% reduction in the cost of power¹⁵.

04 Financial inclusion

The World Bank estimates that nearly 1.4 billion people around the world do not have access to financial services such as bank accounts¹⁶. In Afghanistan, where women are often prevented from having bank accounts, Roya Mahboob, an Afghan entrepreneur, technologist, and women's rights activist started Citadel Software and went on to become the first female tech CEO in Afghanistan. She began paying many of her female employees in Bitcoin, many of which did not have bank accounts. This approach was preferred as the money could not be taken by their husbands or other family members. In 2016, one of Roya's employees, Laleh Farzan, began to receive threats from the Taliban and ultimately decided to sell her possessions and flee the country. Given the long and treacherous journey, many of the belongings she took, including cash, were all stolen through various contacts that were relied upon to get her out of the country. However, she was able to successfully transport her Bitcoin given the ease at which she could hide her seed phrase (i.e. the 12 word phrase used to spend Bitcoin). Without Bitcoin, she would have lost everything she owned. These experiences, along with Roya's role in standing up the Digital Citizen Fund, would earn Roya a spot in Time magazine's 100 Most Influential People in 2013.

The ability to escape authoritative and corrupt government regimes has proven to be difficult over the years due to a variety of restrictions imposed such as capital controls, limits on withdrawals, etc. This has been evident in countries like North Korea, Venezuela, Russia, etc. These restrictions are often put in place to keep their citizens from using foreign currencies and to keep them using the failed currencies of those countries. In Q1 2021, following a crashing Turkish

Lira, Chainalysis reported that cryptoasset transaction volume in Turkey ranked 4th globally. This correlation was evidence of cryptoassets being an exit ramp to hyperinflation that would otherwise erode people's savings and purchasing power.

Can Bitcoin's adoption as a medium of exchange continue despite its volatility?



¹⁵ Jack Dorsey's Block backs bitcoin mining company that wants to bring 25-cent electricity to rural Africa, CNBC, December 6, 2022

¹⁶ COVID-19 Boosted the Adoption of Digital Financial Services, The World Bank, July 21, 2022



Governance

One of Bitcoin's most prominent features is its decentralization, which removes the need for a trusted intermediary. This is accomplished via a network of thousands of participants (or nodes) who each run the same version of the Bitcoin software. This process is similar to how the TCP/IP protocol allows individuals around the globe to communicate seamlessly with each other over the internet. However, any changes to the protocol would adversely impact our ability to send and receive content via the internet. Similarly, Bitcoin's system rules such as its 21 million coin limit, difficulty adjustment, block size, etc., are built into the code used to manage the network. If a participant attempted to modify these rules, they would effectively be running a different version of Bitcoin, or an entirely different protocol, and in turn, would be unable to participate or transact on the network. As a result, Bitcoin's robust and highly redundant governance is an inherent feature of its design. No individual or even group of individuals can make changes to the protocol's rules without splitting or "forking" off from the main network.

Evidence of these features was best demonstrated in 2015 during what is now colloquially known as the Block Size Wars. During this period, a number of individuals and entities such as exchanges, miners, etc., thought that Bitcoin's future success was contingent on increasing its block size to 8MB in order to allow for more transaction throughput which would help scale the network as user adoption

increased. However, given that no one has control over the protocol, Bitcoin's rules were never modified. Instead, changes to the block size were made which resulted in a hard fork and an entirely new protocol asset called Bitcoin Cash (BCH). As of this writing (July 2023), BCH has failed to gain market adoption compared to Bitcoin as evidenced by Bitcoin's market cap of approximately \$584 billion and BCH's market cap of approximately \$2.5 billion¹⁷.

Additionally, the transactional data that resides within the Bitcoin ledger (blockchain) is immutable (i.e., it cannot be changed once written) and secured via cryptography. Given that each network participant maintains a local copy of all transactional data, changing any of the transaction details locally would only impact that user's copy of that data. As it is nearly impossible to make changes across the wider network of nodes once a transaction is finalized, details can readily be cross-checked and verified across a range of nodes, ensuring the fidelity of the data and providing a high degree of confidence in the overall system.

Bitcoin's governance is built into the system by design through rules that are coded into the protocol. This results in a system that cannot be abused or misused by those in power or even individuals with ulterior motives due to its decentralization.

¹⁷ Coinmarketcap.com

Conclusion

In closing, Bitcoin appears to provide a number of benefits across an ESG framework. Throughout its short history, new and innovative ways of leveraging the network and its native asset continue to emerge, such as helping to stabilize energy grids, reduce greenhouse gas emissions, and even assist with providing sustainable heat to commercial and residential properties. Time will tell what Bitcoin's role may look like in the transition to renewable energy and how it may serve as a financial tool to those in authoritative regimes or those experiencing significant inflation.

Key questions for players in the Bitcoin ecosystem

- Have you conducted the necessary benchmarking, gap assessments and analysis of best practices to develop your ESG strategy?
- How are you engaging the broader ecosystem? Have you assessed your relationships and expectations with miners, users, partners, service providers, and connected organizations within your community to identify opportunities to advance an ESG strategy?
- Given the many creative approaches to delivering value within the Bitcoin ecosystem, how are you engaging within that community to learn, collaborate and partner in ways that advance sustainability?

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