Source Evaluation #1

**Citation:**

STOLL, CHRISTIAN, et al. The Carbon Footprint of Bitcoin. MIT Center for Energy and Environmental Policy Research, 2018, http://www.jstor.org/stable/resrep34616.

**Information on the Author:**

Christian Stoll is currently working as a researcher at the Massachusetts Institute of Technology's (MIT) Center for Energy and Environmental Policy Research. He specifically focuses his research on climate change. Lena Klaaßen is a member of ETH Zürich's Climate Finance and Policy group as a PhD candidate, and she conducts research on finances and investment in low-carbon technology. Ulrich Gallersdörfer is a research associate at the Software Engineering of Business Information Systems (SEBIS) at the Technical University of Munich (TUM). His research focuses on the data science behind public Blockchains. Altogether, their paper has gathered over three billion visits globally.

**Summary of Paper:**

Stoll, Klaaßen, and Gallersdörfer's central argument regards the carbon footprint of cryptocurrency and its electrical consumption. They approach their argument, which is how negative cryptomining is for our environment, by addressing each method in which this is true. The authors explain that cryptomining attracts a wide range of individuals and mining methods, all of which are contributing globally to rising carbon emissions. First, the authors identify different mining methods and facilities, and show how power efficient and how much usage each method generates. Using this information, the authors then present their methods of how they calculate the range of power consumption and approach their final values. Lastly, they consider the social cost and benefit of crypto mining, and what crypto technology policy designers should implement to negate a carbon imbalance. Although the authors only consider Bitcoin, they extrapolate their findings to other applications on the blockchain besides cryptocurrencies.

**Key Terms and Concepts**

1. Blockchain: Blockchains are known mostly for their implementations in cryptocurrencies such as Bitcoin. A blockchain is a type of database that stores values in an electronic format, but the difference between a blockchain and any other database is how the values are structured. Each "block" in the "chain" contains a precise timestamp of when it was added to the chain. As new data is freshly mined, it is represented as a new block. Once the block is filled with data, it chains to the previous block. Blockchains are the foundation on which Bitcoin and all other cryptocurrencies are based on. Since these blockchains are decentralized, all timestamps are permanent and can be viewed by anyone.
2. Cryptomining: Crypto mining is a method of creating new units of a cryptocurrency. Powerful hardware and software are given complex mathematical problems and the computers to complete these problems are rewarded in cryptocurrency rather than a centralized currency, like U.S. Dollars. The math problem specifically is the encrypted serial number of the next block on the block chain. Decrypting it, which takes lots of effort, time, and energy, unlocks the bitcoin.

**Quotes, Paraphrases, and Analyses**

When describing the typical mining scenarios, the authors of the paper bring up some examples,

There is no typical size of cryptocurrency mining operations, but a wide scale ranging from students who do not pay for their electricity (some of whom applied to support this research), to gamers who leverage their graphics cards whenever they are not playing (sales allocated to crypto), all the way up to dedicated, large-scale crypto-mining farms (for instance, in abandoned olivine mines in Norway). (Stoll et al. 4)

Cryptomining comes in all shapes and forms. Many crypto miners are those that can freeload on electric bills, computer gamers looking to make their computer's investment worthwhile, and businesses that run large cryptomining farms in secluded areas. The authors are trying to illustrate that no one entity is responsible for Bitcoin's (or any crypto coin) affect on our global environment. Many people around the globe each pose a miniscule, insignificant slice of the blame. Cryptomining is so popular and widespread now that its success led to the eventual downfall of our Earth's resources.

The authors of the paper include a technical overview of cryptomining to address why Bitcoin's impact on the environment has only recently become so profound,

The difficulty of these puzzles adjusts regularly in order to account for changes in connected computing power and to maintain approximately ten minutes between the addition of each block. During 2018, the computing power required to solve a Bitcoin puzzle increased more than threefold, and heightened electricity consumption accordingly" (Stoll et al. 1).

Bitcoin's mining difficulty increases as more and more miners join in on breaking down Bitcoin's hashes. To ensure that each block takes around ten minutes to mine, hashes become more complex. This results in more mining power being needed to receive the same amount of repayment. What this ends up doing is while demand for Bitcoin increases, the demand and profit of mining increases as well. This means that more miners are introduced to mining Bitcoin, resulting in an overall greater carbon footprint.

"The magnitude [of] carbon emissions, combined with the risk of collusion and concerns about control over the monetary system, might justify regulatory intervention to protect individuals from themselves and others from their actions" (Stoll et al. 2). A standardized ruleset or even a set of enforced legislation may be required to keep cryptomining at bay, given the amount of harmful carbon emissions it generates. There is also the factor that the currency is decentralized, giving strength to any risks of conspiracy. The fact that the currency is decentralized also lends itself to idea that no government or entity can take control of Bitcoin, other than the developers of Bitcoin itself.

**Overall Evaluation of Source**

Stoll, Klaaßen, and Gallersdörfer's paper is convenient for my research project. They not only give a complete overview of how Bitcoin works as a decentralized currency and how mining and hashing has developed into a worldwide cause for concern, but also go into the details on where these mining operations are being held and for what purposes. Although a lot of the paper explains their algorithms and methods used to calculate exactly how they came up with final values for carbon emissions per dataset group, there is still a lot of useful information and understandings established throughout the paper. The source is fairly recent, published in late 2018, around a decade after Bitcoin was established. I expect that the values of carbon emissions today are much higher than what the authors of this paper could have anticipated because of the pandemic's lockdown exciting sales of mining and gaming hardware. This source cites a multitude of sources, thirty-five in all. These sources include technology journalism and economical/business papers, as well as papers lending information on the inner workings of Bitcoin. Some of these sources could be useful to me if I wanted to explore more on how or why Bitcoin is so influential in the modern era, and why so many individuals seek to mine it without regard for our planet's resources. Some new questions I have include the aforementioned idea, as well as if attempts on regulating these practices have already been made, and if there are any decentralized currencies that have the topic of environmental harm in mind.