

The Implications of Bitcoin Mining on the Environment “Risks and Solutions”

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Abstract: The verification of transactions that take place with the Bitcoin currency is done by a process called mining. This process requires solving complex mathematical equations that are difficult for the human mind to do. Therefore, it needs machines and equipment for mining and advanced computer processors. These equipment and machines, in turn, need high electrical energy. In a study conducted, it was stated that Bitcoin mining consumes high electrical energy that reaches from 120 to 240 billion kilowatt-hours annually, which is equivalent to 0.4% to 0.9% of the world's energy use annually. In addition to that, mining devices emit high thermal energy, in addition to that, mining devices are quickly damaged due to electrical energy and frequent use. Therefore, the failure of these devices results in electronic waste entering the environment. All this, in turn, negatively affects the environment. This is the research problem. This research aims to identify the environmental risks of mining Bitcoin, in addition to proposing solutions to address these risks. In this research, we relied on the analytical and descriptive approach to explain and describe the impact of Bitcoin mining on the environment. We divided the research into two requirements, and we devoted the first to researching the nature of bitcoin mining, and the second we devoted it to researching the risks of bitcoin mining on the environment and the proposed solutions.

Keywords: cryptocurrency, bitcoin, mining, mining hardware, environment.

Introduction: Bitcoin appeared on November 1, 2008, by an anonymous person who called himself Satoshi Nakamoto, who sent a research paper to an encrypted mailing list entitled “Bitcoin: A Peer-to-Peer Electronic Cash.” system announces that it has produced a peer-to-peer electronic cash system, through which payments can be sent via the Internet and directly to the other party without the need for an intermediary.

When sending bitcoins from one person to another, transactions are recorded in the blockchain record permanently and cannot be deleted or modified, but this process does not take place directly, but it requires first that the contract or members of the network verify the validity of the transfers that were made by the sender owning the currencies that were actually transferred, The process of validating transactions requires solving complex mathematical equations using special machines, equipment, and advanced computer processors to find out the digital signature or hash of the previous block in order to include it in the current block; If each block encrypted with a hash connects it to the previous block and is then linked to the subsequent block, then any node of the network will succeed in solving the above-mentioned equations, obtaining an equivalent of the currency in place of mining, and this process is called the mining process, which is the only way through which a currency can be produced Bitcoin and its oversupply.

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The first requirement: Introduction to bitcoin mining

We will devote this requirement to discussing the definition of Bitcoin mining and the types of mining mechanism, by dividing it into two branches, This is as follows:

First branch: Bitcoin mining definition

In this branch, we will look for the definition of the bitcoin currency in the first section, while the second is devoted to defining the bitcoin mining process, as follows:

The first section: is the definition of Bitcoin currency

The inventor of Bitcoin defined this currency as "to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution." [1] He also defined it as "an electronic payment system based on encrypted evidence rather than trust that allows any two parties to Dealing directly with each other without the need for a trusted party [2].

It was also stated in its definition that "Bitcoin is an open-source, peer-to-peer digital currency. Among many other things, what makes Bitcoin unique is that it is the world's first completely decentralized digital-payments system" [3]

In 2017, the Central Bank of Iraq defined Bitcoin as (it is a virtual electronic currency that trades online only without a physical presence and is used for online purchases and supports payment using Bitcoin cards or may be converted to traditional currencies in some cases)[4]

Therefore, we know the Bitcoin currency as the first and most famous cryptocurrency and one of the official currencies of the State of El Salvador and South Central Africa, and it is the only encrypted currency that depends on the principle of complete decentralization. It is tangible, but exists in an electronic digital form, relies on encryption in all its aspects, that can be used to purchase goods and services from the parties that accept payment.

Section Two: Definition of Bitcoin Mining

Mining is defined as "the generation and production of cryptocurrencies by solving a complex mathematical puzzle using special equipment by miners called miners." [5]

It was also said in its definition "It is the process by which new bitcoins can be added into the money supply, moreover it is a system that is safe against fraudulent transactions or double spending transactions." [6]

In light of the foregoing, we define the mining process as a mechanism for the production of cryptocurrencies and to verify the validity of transactions made by the currency in question, relying on special machines and equipment, so that it can be included in the blockchain.

Second branch: Types and mechanism of mining

In this section, we will search for the types and mechanism of the mining process, as follows:

Section One: types of mining process

There are several types through which a person can perform the mining process, including the following:

- 1) **Individual mining:** It is for a person to mine Bitcoin on his own by purchasing mining equipment and devices, but because of the high prices of mining devices and the high electrical energy they need and the heat and noise they emit, and because of the increasing difficulty of Bitcoin mining, a

person cannot alone or rely on a single device. To succeed in the mining process and solve mathematical equations, people resort to collective and cloud mining.

- 2) **Collective mining:** It means that several people participate using machines and mining equipment to increase the strength of the hashrate and thus increase the chance of solving mathematical equations and making profit, and when they succeed in the mining process, they share the profits of the currency reward for each of them according to the percentage of his participation.
- 3) **Cloud mining means:** that the person wishing to mine rents the power of the hashrate from specialized mining companies, In other words, the person in this case does not buy mining machinery and equipment, but rather pays specialized companies sums of money that rent the hash power, and in return he obtains from the company the profits resulting from the leased power. This type of mining provides the purchase of mining machinery and equipment and what you need of high electrical energy, noise and high heat[7].

Section Two: The Mining Mechanism

When sending encrypted currencies from the sender's wallet to the recipient's wallet, the process is not included directly in the distributed log technology [8], but rather requires first verifying the validity of the transaction through the mining process. Bitcoin mining depends on the Proof of work algorithm, which is one of the unanimous approval algorithms whose purpose is protecting the blockchain from cyber-attacks, solving double-spending problems, and protecting block chains from modification or deletion ([9]). This algorithm was invented in 1993 by researchers Cynthia Dwork and Leslie Lamport, but it was actually added in 2008 by Satoshi Nakamoto[10]. It is the first algorithm that has been used in the field of cryptocurrencies and the most widely used and effective. The most important cryptocurrencies used by this algorithm are Bitcoin, Ethereum, Litecoin, Ether, Bitcoin Cash and many other currencies.

Under this algorithm, when transfers are made in Bitcoin, these transfers are stored temporarily in a group called a mempool. Meanwhile, members of the Blockchain network compete to solve complex mathematical problems to reach the digital "hash" signature of the previous block when the target or the sum of the two targets is reached (if mining is collective). For the correct hash they broadcast to the network parties in order to confirm the transfers included in the mempool network and then include them in a new block if these transfers are true and reject false or previously spent. The advanced process is called mining, and it is the only way to increase the supply of Bitcoin. When it is successfully completed, the miners who have reached the correct hash will get a reward represented by parts of the Bitcoin currency called the block reward[11].

The proof-of-work algorithm is characterized by the fact that its penetration is almost impossible in practice due to its mechanism of action, as it has been applied to Bitcoin and many other cryptocurrencies and has not been hacked even once. However, it is taken from it that it consumes high electrical energy and advanced computer processors, and thus makes the mining process very expensive[12]. However, there is some jurisprudence that the high cost of this process is a safety for the Bitcoin currency[13].

The second requirement: The risks of Bitcoin mining on the environment and suggested solutions

We will customize this requirement to research The risks of Bitcoin mining on the environment and suggested solutions, in the following two sections:

First branch: Cryptocurrency mining risks to the environment

The mining of cryptocurrencies in general and Bitcoin in particular is no longer a phenomenon on a small scale and the focus of interest for those interested in cryptography, but has become widespread.

In a study conducted, it was stated that bitcoin mining consumes high electrical energy, amounting to 120 to 240 billion kilowatt hours annually, which is equivalent to 0.4% to 0.9% of energy use in the world annually [14]. The United States ranks first in terms of global activity for Bitcoin mining and other cryptocurrencies, with a total of more than 38% of global activity resulting from global electricity generation for crypto assets with the largest market capitalization 140 ± 30 million metric tons of carbon dioxide annually (Mt CO₂/y), or about 0.3% of annual global greenhouse gas emissions. It is estimated that crypto asset activity in the United States generates approximately 25 to 50 million tons of carbon dioxide annually, which is 0.4% to 0.8% of the total greenhouse gas emissions in the United States. These emissions are similar to diesel emissions used on railroads in the United States [15]. The reason for Bitcoin mining to consume high electrical energy is due to the so-called difficulty of mining. Doing the mining process, and increasing this process means increasing the processing power and this in turn made it more difficult to solve mathematical problems to create a new block and add the transactions that took place within 10 minutes and get the block reward, which made it impossible to solve complex mathematical equations depending on the CPU, which required the use of special machines for mining, and these devices and processors, in turn, need high electrical energy [16]. This, in turn, reflects negatively on the environment. On the one hand, the consumption of bitcoin mining for electrical energy is a catalyst in eliminating the limited fossil reserves, in addition to that, mining bitcoin in areas that depend on providing electrical energy on coal leads in turn to an increase in the deterioration of air quality in these areas [17], in addition to the damage of containers and mining machines from Electronic waste enters the environment, as the life of these devices is short because of the electricity they need and the high heat they emit.

Some jurisprudence responds to the advanced criticism that the high energy that Bitcoin needs is not an arbitrary and random matter, but rather a security aspect to it, as solving the proof-of-work system in order to deposit and record transactions in the blockchain record requires electrical energy and high processing power, which makes any fraudulent operation aims To deposit false transfers, a waste of resources, and the regime rejects those transfers and does not give the fraudulent miner any reward from Bitcoin [18]. Bitcoin, as we mentioned previously, is a rare currency when the maximum production is reached, which is 21 million bitcoins, not even one bitcoin can be produced.

Second branch: Suggested solutions to address the risks of mining to the environment

We believe that limiting or minimizing the above-mentioned risks is not to ban dealing with encrypted currencies in general and Bitcoin in particular, or to remain silent about them, or to suffice with warnings or national regulation; Because they are global cross-border currencies, it requires urgent international intervention by drawing up an international agreement regulating dealing with them, reducing their risks and benefiting from their advantages. We also see that to reduce the risks of mining on the environment, we can rely on clean energy sources such as solar energy, wind energy, water energy and others in mining farms to reduce pollution and preserve non-renewable energy sources. bitcoin; The Parliamentary Oil and Energy Committee confirmed that Iraq annually burns approximately 18 billion cubic meters of gas, or approximately 700 million cubic feet per day, without benefiting from it [19]. In addition, countries should provide facilities for foreign companies specialized in the production of cryptocurrency mining devices to produce mining devices that do not consume high electrical energy and do not raise heat and high sounds.

Conclusion

After completing this research, we reached several conclusions and recommendations, which we include as follows:

1) Results:

1. Bitcoin transactions are validated by the mining process, which is the only way to increase the supply of Bitcoin.
2. Because of the high electrical energy needed by Bitcoin mining machines, this in turn contributes to the elimination of non-renewable energy sources, especially when carrying out the mining process in areas that depend on these sources to finance electric energy.
3. Because of the high heat emitted by mining devices, they contribute to increasing thermal pollution in the environment.
4. Because of the loud sounds emitted by mining devices, they lead to noise pollution
5. perishable bitcoin mining hardware; Because of the high electrical energy and the high heat it emits, this leads to an increase in electronic waste entering the environment.

2) Recommendations:

1. We call upon the international legislator to regulate cryptocurrencies in general and Bitcoin in particular by law, because reducing the risks of cryptocurrencies can only be by regulating them, and national law is not enough, but an international regulation must be found because of the nature of these cross-border currencies.
2. We recommend the creation of a national and international body for control and supervision specialized in issues related to the Bitcoin currency and the rest of the encrypted currencies, including issues related to mining, and to determine the extent of the damage caused by mining to the environment.
3. We suggest that the state imposes on miners the use of clean energy to reduce waste of fossil energy and preserve the environment from pollution.
4. Reliance on wasted energy from oil wells in Iraq to mine Bitcoin.

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