Blockchain and Cryptocurrency Challenges: Toward Environment-Friendly Mining Process

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Introduction

Blockchain technology is one of the most disrupted innovations developed in the 21 century. It was basically proposed by Satoshi Nakamoto in 2009 as a solution to the double-spending risk associated with peer-to-peer payment systems[2]. The mechanism of blockchain technology relies on a chain of digital signatures that uses the private and public keys to secure transactions between two parties in the form of blocks. Each block hashed into the blockchain based on the proof of work concept, which is basically a vote of a group of participant nodes (CPUs). Nevertheless, to maintain the continuity of blockchain, a reward system in the form of bitcoin has been developed to motivate miners to execute transactions, which leads to high energy consumption and related environmental impacts present an imminent threat to blockchain survival. This research project aims to further investigate this challenge and provide a scientific-based solution that could help reduce the environmental impact of mining while maintaining the prosperity of blockchain technology.

Problem Statement

The existence of bitcoin circulation are relied on the proper functioning of a network of mining devices. It requires high computing power that involved the use of CPU and GPU (2009-2011), and lately ASICs devices. These devices work under the proof of work (PoW) scheme in order to provide a valid transaction and work to secure the network against cyber-attacks. However, the energy-intensive consumption nature of these equipment has imposed an environmental impact that is represented by high electricity demand. According to two energy consumption indexes, Cambridge Bitcoin Electricity Consumption Index (CBECI) and Bitcoin Energy Consumption Index (BECI), the network annually consumed between 73.1 [53] and 78.3 terawatt-hours (TWh) of electricity in 2019 [3]. A single Bitcoin transaction has an average carbon footprint of approximately 500 kg CO2, the equivalent of roughly 90,000 h of watching YouTube. However, while renewables are an intermittent source of energy, Bitcoin miners have a constant energy requirement. A Bitcoin ASIC miner will once be turned on, not be switched off until it either breaks down or becomes unable to mine. Bitcoin miners have historically ended up using fossil fuel-based power. Therefore, a sustainable energy solution that satisfies miners' requirements should be adopted to minimize the environmental impact.

Current Status:

At present (August 2021), using 100-TH/s, 3,000-W hardware, a miner earns less than US$50 per day (at a Bitcoin price of approximately US$54,000); this miner's daily energy consumption is 72 kWh, inducing an expense of nearly US$9/day. The hardware's fixed cost is several thousand U.S. dollars. Miners most often use racks consisting of a plurality of such hardware devices, thereby increasing energy consumption even more. As energy-hungry as each mining operation is, multiply that by the number of mining nodes in the network (estimated to be more than one million nodes) to understand how the total electrical power consumption reached 135 TW/h in 2021.

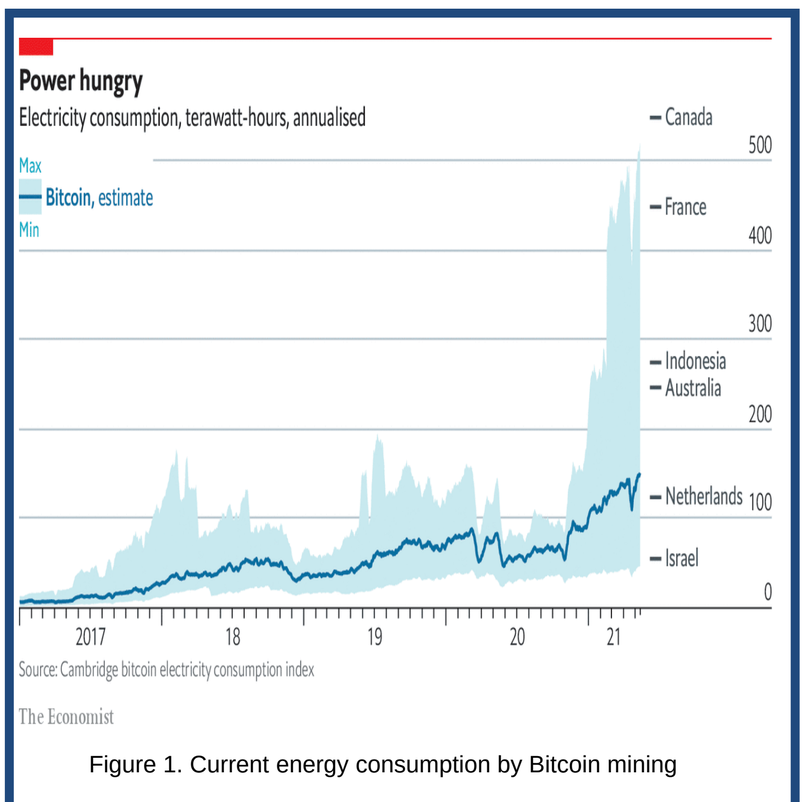

Figure 1. Current energy consumption by Bitcoin mining

Discussion:

Since the mining process is massive power consumption. We have to find a way to save energy to make the mining process more profitable and reduce CO2 emissions. So, we can use many renewable energy resources to produce electricity such as wind turbines, hydroelectric, solar PV, and thermoelectric generators (TEG). Nowadays, solar PV is used widely to produce electricity for residential, commercial, and industrial consumers to cut their electric bills. The span life of a solar PV system is around 25 years. It is a cheap clean energy source. So, using solar energy to produce the electricity needed to power mining machines is a very important step to reach a green mining process. However, since the mining process required a constant power supply to maximize the profit, the direct clean energy sources may not consider a reliable solution. Therefore, we propose an indirect clean energy source that addresses two main problems, the high non-renewable energy consumption, and the cost of mining electricity bills. As shown in figure 2, the mining plants could build a solar PV plant to feed the public energy network and cover reduce the need for extra fossil-based fuel power, the generated clean power can be used to provide supply to other places such as houses and commercial. While maintaining constant power to run the mining facility, the costs of electricity will decrease as a result of exchange the of benefits between the electricity company and the mining facility. Also, the CO emissions will not increase due to the establishment of a mining facility within the service area.

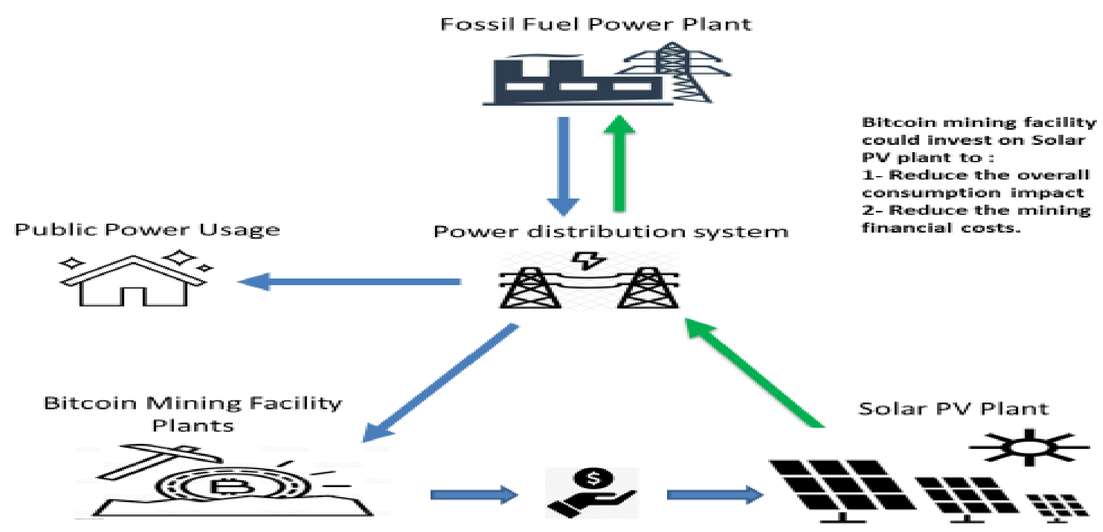

Figure 2. a proposed Model to Reduce Mining Energy Consumption

Conclusion:

The high energy consumption by the Bitcoin mining process raises concerns about environmental impacts. It relies on unsustainable solutions that have remarkable effects on global efforts against climate change. We propose a practical, yet easy-to-adopt solution that takes into consideration these concerns and the ability of miners to maintain their crucial role in supporting this new technology.

References

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