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# CRYPTOCURRENCY AND CLIMATE CHANGE: AN OVERVIEW

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***Research Article***

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**ABSTRACT**

Although cryptocurrencies have become a cutting-edge way to conduct financial transactions online in recent years, experts are concerned about how they may affect the environment. The massive demand that cryptocurrencies exert on the energy grid raises carbon emissions, which in turn contributes to the overall impacts of global warming. However, future use of blockchain technology—which drives bitcoin—should be taken into account. The use of cryptocurrencies poses a risk to the environment because of their potential to be widely incorporated into existing technologies and the significant carbon footprint left by such a tiny percentage of worldwide cashless transactions. With an emphasis on climate change (global warming), this research investigates how cryptocurrencies affect the environment. Even though the future of bitcoin is presently uncertain, it can be predicted that if its pace of adoption is increased, its power consumption might generate enough emissions to cause global warming to exceed 2°C in a few decades. The study suggests that in order to prevent the potentially depressing effects of 2OC of global warming, future cryptocurrency development should analytically aim to lower power demand.

**Keywords:** Cryptocurrency; Climate Change; Block Chain.

## INTRODUCTION

As of right now, bitcoin has been around for ten years, which is a significant accomplishment for a technology that was thought to never gain traction. Nevertheless, despite the significant advancements made by the most well-known cryptocurrency in the world, many worries have been expressed about the high hardware and power needs of Bitcoin mining and the ensuing environmental effects (Lin et al., 2017). Because of the excessive amount of energy needed to produce it, bitcoin has drawn a lot of criticism throughout the years. Stephen (2017) claims that bitcoin is quickly turning into an actual environmental catastrophe. The expense of the bitcoin mining process, which required more than $150,000 in power per day, was the basis for this claim. As more coins are mined—from around 11 million in 2013 to over 17 million as of 2018—the criticism has been increasingly vocal. Since 2015, it has been noted that the power usage of Bitcoin mining has been higher than that of other traditional digital financial or monetary operations. Christopher (2017) asserts that the price of Bitcoin in dollars is closely correlated with the cost of power needed to mine it economically.

The Wall Street Journal claims that while Bitcoin is the most popular currency in the world, nobody is using it. Bitcoin's value has previously reached $10,000 per coin and, at one point, $11,000. However, local and traditional retailers have been sluggish to accept bitcoin as a form of payment despite the increase in its value. Because of this, commentators are gloomy about this tech-hipster cryptocurrency, which has very little chance of displacing the conventional currency despite its popularity and controversy. The paper claims that bitcoin and similar currencies may never become widely accepted conventional currencies because they would lose their value as investment assets if they do. This is a significant issue as we still have to pay for them even if no one is using bitcoin. In just two months, the estimated annual energy depletion of bitcoin increased from 25 Terawatt hours to 30 Terawatt hours, which is equivalent to the energy consumption of over 19 European countries (Dwyer & Malone, 2014) and roughly 0.7 percent of the total energy requirement in the United States,

which is equivalent to the energy consumption of 2.8 million U.S. households (Atkin, 2017), according to reports by bitcoin analyst Alex de Vries, also known as the Digiconomist.

Large quantities of power are needed to mine bitcoin, which causes a significant quantity of CO2 to be released into the environment. Bitcoin mining was responsible for almost 69 million metric tons of CO2 (carbon dioxide) emissions in 2017 alone. In addition to the roughly 300,000 transactions that are completed every day, one blockchain mining transaction may take as much energy as a whole home needs in a week. Fossil fuel energy sources, which pollute the air and water and produce greenhouse gas emissions that contribute to climate change, are increasingly often used to meet this high energy demand.

## 1. CLIMATE CHANGE AND ITS EFFECT

The earth's surface temperature is determined by the energy balance between solar radiation from the sun and thermal radiation from the ground. The earth's distance from the sun and solar output determine the incoming solar radiation, which is unaffected by the earth's surface temperature. However, the earth's surface temperature has a significant impact on the thermal radiation that the planet emits. The energy balance would regulate the earth's surface temperature to around -6°C if the atmosphere was made entirely of nitrogen and oxygen molecules, which do not absorb thermal radiation. A large portion of the earth would be frozen at this surface temperature. A new energy equilibrium with a surface temperature of around 15°C is created when part of the outgoing thermal radiation is trapped by the naturally occurring abundance of greenhouse gases in the atmosphere, which are mostly composed of carbon dioxide, methane, and water vapor. This process, which causes the earth's surface to warm by 21°C, is sometimes referred to as the natural or positive greenhouse effect.

Human activity results in the emission of greenhouse gasses. The first and most noticeable greenhouse gas on the list is carbon dioxide. Carbon generation is mostly caused by the excessive combustion of fossil fuels like coal and petroleum. The significant amount of carbon dioxide in the atmosphere is also a result of deforestation, or the removal of trees in order to get land for industrial and agricultural uses. Because carbon dioxide and lime are produced when calcium carbonate is heated, the production of cement also raises atmospheric carbon dioxide levels. The second greenhouse gas in the atmosphere is methane, sometimes referred to as natural gas. It is created by farming practices including using farmyard waste and growing paddy rice. Inadequate garbage management also contributes to its production. Fertilizers are the primary source of nitrous oxides. Furthermore, gases like chlorofluorocarbons (CFCs) are produced by a number of industrial activities, including refrigeration. Burning fossil fuels is one of the main factors for the earth's atmosphere to absorb more carbon dioxide. The use of fossil fuels releases 5.4 billion metric tons of carbon into the atmosphere each year. Additionally, 1.6 billion metric tons of carbon are released into the environment as a result of deforestation.

Global warming is mostly caused by greenhouse gasses. Compounds containing chlorine and bromine also contribute to the greenhouse effect, in addition to the main greenhouse gases (methane, CO2, and nitrous oxides). The Earth's surface and lower atmosphere gradually warm as a result of the buildup of these gases in the atmosphere, which changes the radiative balance in the thermosphere. This is because a portion of the radiation that leaves Earth is absorbed by greenhouse gases, which then direct it back toward the surface. It has been noted that between 1850 and the end of the 20th century, the net warming was close to 2.5 W/m2, with carbon dioxide accounting for about 60%, methane for about 25%, and halocarbons and nitrous oxides for the remaining portion.Ozone levels in Antarctica began to decline in the early 1980s, according to a 1985 report written by Joe Farman of the British Antarctic Survey. As a result, global scientific initiatives were started. These research initiatives determined that the primary source of the issue was Chloro-Floro Carbons, which were mostly used as

industrial cleaning fluids and aerosol propellants in refrigeration equipment. This prompted swift worldwide action to reduce CFC emissions. It was also determined that the ozone layer's thinning is the second main factor contributing to global warming, behind CFCs.

Increased atmospheric concentrations of greenhouse gases, such as CO2, methane, water vapor, and others, have warmed the Earth and lower atmosphere, contributing to current global warming. The IPCC declared in 2014 that greenhouse gas concentrations in the atmosphere were higher than those found in ice cores that date back 800,000 years. However, because of its part in both the greenhouse effect and the human economy, carbon dioxide is the most important of these gases. When the industrial revolution began in the middle of the 18th century, estimates indicate that the concentrated quantity of carbon dioxide in the atmosphere was around 280 parts per million (ppm). However, as of 2018, they have increased to 406 parts per million. It is predicted to rise to 550 parts per million by the middle of the twenty-first century, and if fossil fuels are consumed at the present pace, carbon dioxide concentrations would double in 300 years.

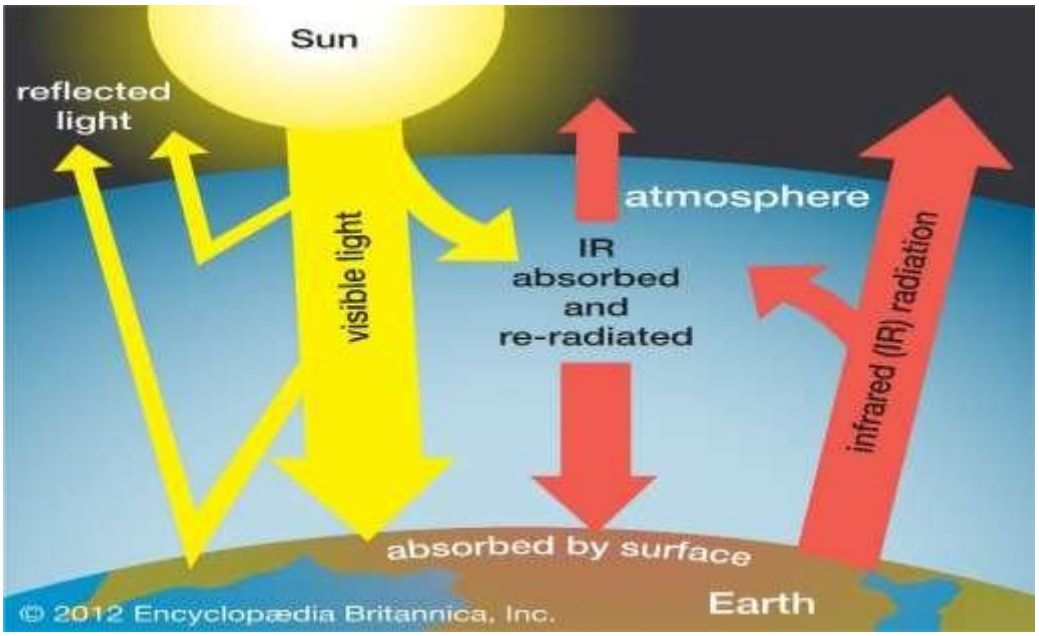



**Figure 1** The Green House Effect on Earth.

Source: https://www.britannica.com/science/global-warming

The earth's surface reflects incoming sunlight, but the majority of it is absorbed by the warmer atmosphere. The earth's surface then releases infrared (IR). While some infrared light escapes into space, others are absorbed by greenhouse gases in the atmosphere, including carbon dioxide, water, and methane. These gases are then redirected in different ways, some of which go into space and others of which return to the earth's surface, where they warm the lower atmosphere.

Global warming is a negative phenomena in terms of climate change. A research from the University of Hawaii at Manoa claims that if bitcoin keeps growing, it may produce enough emissions to cause global temperatures to rise to 2 degrees Celsius by 2033. Even if Bitcoin is embraced at the slowest pace compared to other technologies, this is still possible. After analyzing the power efficiency of application-specific integrated circuits (ASICs), which are currently used for Bitcoin mining, the researchers took into account the locations where Bitcoin is most likely computed and the corresponding CO2 emissions, taking into account the fuels used to produce electricity in those areas. According to information gathered, a 2 degree Celsius increase in climate could cause catastrophic and irreversible changes on Earth.

Because the natural processes that cause sea level rise, rain, snowfall, and hailstorms rely on a wide range of variables, climate experts find it challenging to forecast the effects of global warming. Furthermore, governmental policies and technical developments have a significant effect in determining future greenhouse gas emissions, making it challenging to forecast their magnitude. Global warming has a number of detrimental repercussions. First of all, heavy and frequent precipitation brought on by more water vapor in the atmosphere causes floods in many parts of the globe. In regions where increased evaporation is not offset by greater precipitation, warmer weather increases evaporation from both land and aquatic bodies, resulting in drought. In certain regions of the globe, especially those with greater temperatures, this leads to crop failure and famine. Additionally, this results in more water vapor in the sky falling as rain, which perpetuates floods. Due to the rapid shrinkage of glaciers worldwide and the faster-than-expected melting of ice, areas that rely on the water from snow-covered mountains may face drought and a lack of water. About one-sixth of the world's population lives in these regions, which would be impacted by a decrease in melting water, according to data from the Intergovernmental Panel on Climate Change (IPCC). In addition to more intense rainfall, strong hailstorms, and thunderstorms, warmer temperature locations are likely to have more heat waves. Sea level rise is one of the most disastrous consequences of global warming. As a result of the ice and glaciers melting quickly due to the temperature increase, the water levels in rivers, lakes, and seas rise, causing catastrophic floods (British Geological Survey, 2015).

The consequences of global warming may have a serious impact on living beings' health. Stress brought on by extreme heat raises blood pressure and increases the risk of heart disease. Additionally, the human body's resistance to viruses and diseases declines as a direct consequence of agricultural failures and hunger brought on by global warming. As a consequence of global warming, individuals are moving from areas with greater temperatures to areas with comparatively lower temperatures, increasing the spread of certain illnesses to other areas. Because of warmer surface waters, eating certain seafood may lead to cholera epidemics and other dangerous diseases.

## 2. CRYPTOCURRENCY MINING AND ITS EFFECTS

Blockchain technology was created on the spur of the moment, and while many people are aware of it, many others are still unaware of how it directly or indirectly impacts them. Many people are still unaware of how cryptocurrency mining affects global warming. The blockchain is the database technology that underlies cryptocurrencies like Bitcoin, Ethereum, and others. Since its launch, it has changed the direction of several businesses, and attempts are underway to incorporate this technology into payment and banking systems. However, there is a drawback to this technology, which is its detrimental effects on global warming and our environment.

In general, bitcoin mining is the automated process of identifying a certain hash value that resolves a block of transaction data and appending it to the expanding blockchain. This distributed ledger of transactions is secured by mining, but the process is expensive. The majority of prosperous bitcoin miners continuously operate warehouses full of specialized, high-power devices. It is a potentially profitable endeavor since the miner receives some fresh bitcoins in exchange for solving these challenging mathematical puzzles. For every bitcoin transaction, miners get between $7 and $9 USD. They need a significant amount of electricity to do this. The anticipated power consumption of bitcoin mining points to both an environmental catastrophe and an unsustainable future for the cryptocurrency. Byzantine fault tolerance is an issue that Bitcoin is praised for solving (Castro & Linkov, 2002). It is built with a solution to the issue of trust between transaction parties. The energy required to mine virtual currency is enormous. Climate change is further exacerbated by the energy-intensive

process of creating new bitcoins and other cryptocurrencies. Bitcoin mining uses an incredible 2.55 gigawatts, which is equal to Ireland's yearly energy use, according to the first peer-reviewed research published in Joule. Even worse, this number doubles every six months, which means that by the autumn of 2018, it will account for around 0.3% of the world's energy consumption.

Put another way, mining cryptocurrencies is negatively impacting global warming without offering a significant benefit to the general people. The primary cause of the excitement around Bitcoin and other cryptocurrencies is the belief held by the majority of its supporters that the crypto governance system may benefit the environment and that it has the potential to become a widely accepted money in the near future. However, the market for cryptocurrencies is still unstable and has an uncertain future. One drawback of bitcoin is that, in contrast to cash, cryptocurrencies are only available digitally and cannot be printed. Mining is a power-intensive process that involves a computer on the bitcoin network solving a challenging mathematical problem in order to produce bitcoin. Nevertheless, there are only 21 million Bitcoins that can be mined, and the more Bitcoins are mined, the more intricate and challenging the mathematical issues are. As a result, computers need more power to analyze more data, which means they must work harder to solve the challenging mathematical puzzles that enable the creation of new bitcoins.

Bitcoin mining was once possible with mid-range home PCs. However, due to the intricacy of the mathematical issues, crypto mining presently requires specialized computer hardware called Application Specific Integrated Circuits (ASIC). These mining devices are big and produce heat, and the amount of power needed to operate them puts a heavy financial strain on the people or businesses who mine cryptocurrencies. In 2015, Vice reported on a Chinese Bitcoin mining operation that produced 4,050 bitcoins in a single month by spending $80,000 on energy for these ASIC miners (Atkin, 2017). Due to the availability of inexpensive electricity, China accounts for 58% of Bitcoin mining, according to a University of Cambridge report published earlier this year. The majority of these inexpensive energy sources are unclean, and miners in China use inexpensive coal generators. One Chinese cryptocurrency mine with a massive carbon footprint released carbon dioxide at the same rate as a Boeing 747 jumbo plane, according to an investigation by De Vries.

A catastrophic acceleration of climate change is threatened by the increasing usage of bitcoin. A University of Hawaii Manoa team's research of the power efficiency of computers used for bitcoin mining revealed that the activity was responsible for 69 million metric tons of CO2 emissions in 2017. According to their projections, bitcoin may raise global temperatures by 2OC over the next 22 years at a conservative pace, or even within 16 years in an extreme case, if it is adopted at rates comparable to other cutting-edge technologies. The research, which was published in Nature Climate Change, also showed that, apart from the effect of cryptocurrencies on global warming, emissions from the housing, food, and transportation sectors are thought to be the primary causes of the current unfavorable climate trends.

## 3. CONCLUSION AND RECOMMENDATION

Randi Rollins, a researcher who studied how cryptocurrencies affect the environment, claims that while cryptocurrencies are an intriguing and novel technology, its mining technique needs to be changed. He went on to say that bitcoin draws attention to a larger problem that involves developing sectors and technology making wise choices for growth while being conscious of the effects of emissions on the environment. Therefore, the use of green sustainable energy would enable cryptocurrencies to exist without having a negative impact on the environment.

These days, the environmental risks brought on by global warming are terrible. The main sources of these risks are the over use of fossil fuels including coal, oil, and natural gas. Fossil fuel consumption should be discontinued right now. It is recommended to use alternative

clean energy sources including solar, wind, biomass, geothermal, and hydro. These energy sources don't release harmful gasses that contribute to pollution and global warming. The natural equilibrium of the ecosystem is not endangered by these eco-friendly energy sources. However, the significant setup and installation costs associated with their utilization present a problem for both consumers and energy providers. Most importantly, the progressive depletion of fossil fuels requires a transition to renewable energy sources. Therefore, switching back to alternative renewable energy sources is the last step needed to stop global warming. The general public should exercise responsibility while choosing energy-saving techniques. For our future generations, this will guarantee a steady climate and a healthy atmosphere. Governments should create and enact laws that promote the use of renewable energy in place of conventional energy by energy businesses and the general public.

According to this paper, the idea of bitcoin and the technology that underpins it do not endanger the environment; rather, the issue stems from the enormous amount of energy required to process it. The amount of greenhouse gases released into the atmosphere has to be significantly decreased in order to properly manage the risks associated with climate change and global warming. This may be accomplished by increasing the production and conservation of energy as well as the effective use of non-fossil fuels. Using high-tech engineering and involving business and political entrepreneurs may significantly increase the usage of non-fossil fuels. This might expedite the shift away from fossil fuels and toward increased usage of non-fossil fuels and renewable energy sources. Developing nations may be able to escape the carbon-intensive energy production stage of industrialization via technological advancements focused on energy efficiency, renewable resources, and non-fossil fuels. of the short to medium term, this strategy may decrease global warming and climate change by concurrently reducing the disproportionate energy use of developed nations. Stricter regulations for power plants, the creation and promotion of highly efficient but reasonably priced cars, and the offering of financial incentives for energy efficiency in households and businesses are further strategies to lower carbon dioxide emissions.

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