

A Comparative Study on the Energy Consumption Versus Market Price of Ethereum

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Abstract— Blockchain mining came into picture after 2009 which had major effects on different types of cryptocurrency. Ethereum is one of the cryptocurrencies which has had a major contribution in cryptographic transactions. Value of cryptocurrency is increasing day by day. Blockchain mining needs a very high processing capacity and hence a very sophisticated hardware components/architecture. The processors consume a huge amount of electricity (TWh) as it needs a lot of processing time to mine a single cryptocurrency which leads to energy consumption and a rise in temperature. The total heat emitted by the hardware involved, is significant. This paper analyzes the relation between cryptographic share price and the energy consumption. In this paper an extensive survey of work related to energy consumption analysis in the block chain system is done. Specifically, this paper also conducts a survey of work related to energy consumption analysis in the Ethereum block chain. The correlation between energy consumption by Ethereum blockchain, the price of Ethereum and availability of Ethereum in the market is evaluated in this paper. The correlation between energy consumption by Ethereum blockchain mining and the price of Ethereum and availability of Ethereum in the market is also described in this paper.

Keywords— *Blockchain mining, Energy consumption, Ethereum, Cryptocurrency, Electricity (TWh)*

I. 1.INTRODUCTION

Blockchain is the most secure way known as of date for transparent transactions. Blockchain not only holds the financial transactions but it can hold the private information too. The basic principle of blockchain is that it consists of blocks holding each other but not having access to each other. A person has got an access for a block which can be given by the admin of the block or he himself has to create the block and access the same. Afterwards, the block is secured and its contents cannot be accessed by other users in the blockchain network unless he has the hash code for the specific block in the network. A new block is created for a set of network transactions. This phenomenon leads to expansion of the blockchain. The mining process is done only with the help of highly sophisticated hardware component/architecture. The hardware requires continuous supply of electricity to run the powerful algorithms on blockchain to generate respective cryptocurrency. In return the hardware heats up and emits heat and carbon by-products in the environment. The cryptocurrency, as it is the secure way for transaction has gearing up in the market. The market price of established cryptocurrencies (Bitcoin, Ethereum, etc) is increasing day by day. New cryptocurrencies are capturing small markets as they are growing slow. One more reason behind slow capture is that the numbers, of newly developed

currencies are more in number so competition for establishment is fierce. The mining process directly affects the market price of the cryptocurrency.

II. ENERGY CONSUME

In 2008, Bitcoin mining began and continues till date.[1] CPUs and GPUs were used for mining digital currencies other than bitcoin as well. Ethereum mining uses GPUs which can be found in every home computer [2][3]. The energy consumed by Ethereum mining is comparatively less than the energy, consumed by bitcoin mining. Ethereum mining is currently working on Proof-Of-Work algorithm which is very much efficient and effective, but costly on energy front. The Proof-Of-Work algorithm consumes more energy to optimize the full strength of processors which releases more heat and carbon by-products. Approximately, 1.02 KWh of energy that could easily power multiple U.S. households for one full day consumed are by Ethereum for its single transaction [2]. 60 percent of mining revenue is likely to go towards miners' electricity bills. To overcome this loss the miners now first calculate the total mining revenue and then convert it into USD. Resulting number is easily converted to kilowatt-hours by dividing it by the average price per kilowatt-hour. The energy (Electricity) consumption of blockchain for mining techniques cause the peer pressure on the energy generation plants. The natural as well as artificial sources are been used for generating ample amount of electricity for the mining. The electricity cannot be stored. Continuing supply of electricity is required to run the algorithms as a result the energy generation has to be continued. In day to day life we can save electricity by not using many devices which run implicitly on the electricity results, the energy gets saved as the production is in limited form. The natural resources used for electricity production are better than artificial resources. Natural resources like air water are in ample amount, so use of that in appropriate manner results, in a better source for energy generation. The electricity consumed by blockchain mining causes problems like heat generation carbon by-products which leads to a rise in temperature in the environment. Now a days, the temperature of the earth is increasing due to various reasons and is resulting in global warming. Blockchain mining is increasingly becoming a major contributor major to the rise in global temperature. While the major contributor is bitcoin, Ethereum is not far behind. The algorithm that is used for mining for bitcoin as well as Ethereum, is the Proof-Of-Work(POW). This algorithm works continuously by trying permutation and combination of a hash till the correct one to solve the cryptographic puzzle is obtained.

The maximum use of processor as well as GPU is done by this algorithm.

III. VALUE OF A COIN

In the modern age, the form of currency is changing from metal money, paper money to digital money. Cryptocurrency is not a physical currency, it is a virtual currency which cannot be seen. The currency cannot be destroyed and it gets transferred from one user to another. The currency get generated by mining block in blockchain. Significant mining effort goes into generating 1 unit of crypto. Every Currency has its own blockchain so, every currency has its own miners. The more the complex blockchain more efforts are taken to mine a coin. The creator of the currency maintains the supply in blockchain. The currency is of limited volume. In other words, the maintaining blockchain secure, reward is a cryptocurrency of respective currency blockchain. Users can buy the cryptocurrency directly from the official sites provided by every cryptocurrency. Use of cryptocurrency is limited in the domain of specific currency blockchain. Exchange of currency in return of new currency can be done, but with the same domain as the currency is not valid for other blockchains. In other word, Each country has its own currency but there is no single currency which is appreciated and accepted world-wide for transactions, so for that conversion of currencies is done for transactions. Bitcoin and Ethereum are two most popular cryptocurrency in open source domain. The Bitcoin has a lower coin supply and is more liquid than Ethereum, but Ethereum has better technology and provides more uses than Bitcoin does[5]. Bitcoin is most popular because of its anonymity while Ethereum does not have this feature. The market is not directly associated with any of the stock companies, which are in the market. The market for cryptocurrency is also not associated directly with any cryptocurrency. The effect of fluctuation and use of cryptocurrency affects the market price of cryptocurrency.

IV. COMPARATIVE STUDY

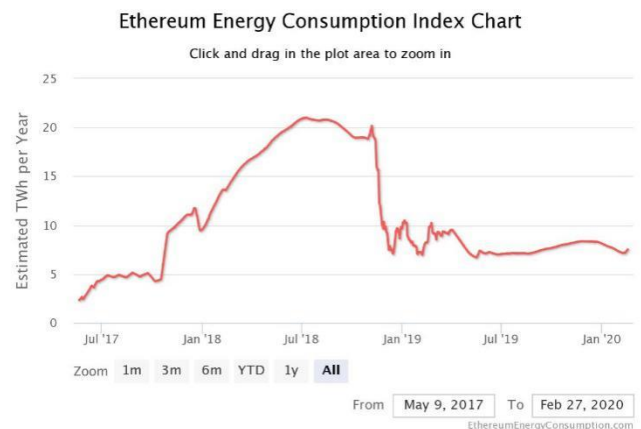
The paper talks about the direct comparison of the Energy consumption for mining Ethereum coin and the market price of Ethereum which depends upon the transaction of Ethereum. Ethereum was established in 2015[6]. Within one year the blockchain was established and started its transaction and currency generation. In 2016 Ethereum was recognised worldwide and its records were noted worldwide. Ethereum currency saw a fast price rise in comparison to other currencies, however Bitcoin always held the first position. Ethereum mining is proportional to energy consumption for mining a Ethereum. The Energy consumption for Ethereum mining has maintained its trend. The gradually increasing graph of Ethereum Energy consumption index (EECI) reached to 21.01011718583486 TWh on July 9,2018 [7]. The trend of increasing graph of Ethereum Energy consumption index (EECI) saw a sudden fall after November 7,2019. Thereafter, the graph also hit its lowest point till date recorded on February 6, 2019 and the minimum energy consumption has been recorded as 6.954909097083333 TWh. The Electricity which was consumed after the drop remained in the range of 7-11 TWh. The energy consumption trend still continuous in the same range.

Now, talking about the transactions which had been made in the same time-period, the trend in the transaction shows the same

features which Ethereum energy consumption index(EECI) shows. The Transaction records of Ethereum states the max threshold till now is on January 4,2018 which is 1349890 transactions[8].After January 4,2018 drastic growth in EECI(Ethereum Energy Consumption Index) is observed. It clearly signifies the demand of Ethereum, in the market. Minimum transactions in 2018 is on July 6,2018 which is 459075, demand the maximum amount of Ethereum in the market for transactions as a result maximum consumption of electricity on July 9,2018 is observed. The market of Ethereum also fluctuate by transaction count of Ethereum. The price of the Ethereum in real world, also fluctuates as the usage of Ethereum fluctuates.

Graphical representation

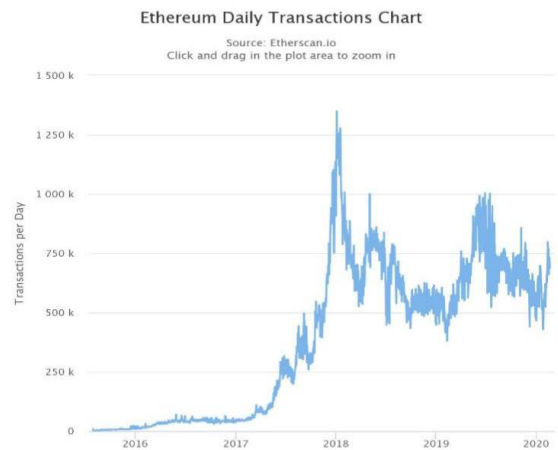
a) *Ethereum Energy Consumption Index (EECI) chart:* This Graph reveals the insights of the data of energy which is consumed for mining a ethereum coin.The energy is measured in TWh (Terawatt hour).The graph is of Energy consumed (TWh) verses Timestamp.



a. Image [2]

Fig. 1. Ethereum Energy Consumption Index (EECI)

b) *Ethereum Daily transaction chart:* Graphical representation of transactions of Ethereum per day. Each value here holds the features like average difficulty, estimated hash rate, average block time, average block count, total uncles count, new address seen.



b. Image [6]

Fig. 2. Ethereum Daily Transaction Chart

C) *Price of Ethereum in U.S Dollar:* The price of Ethereum per month is been noted in the graph. The price of the Ethereum depends on external and internal factors. The topic of the paper is talks about the internal factors.

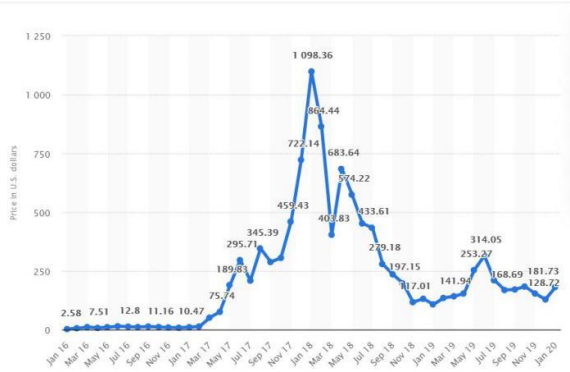


Fig. 3. Ethereum monthly price (U.S Dollar)

Image [7]

V. DEMAND-SUPPLY PRINCIPLE

Demand-Supply is a basic inverse relationship between the buyer (Consumer) and the seller (Producer). The demand of any product is more when the ample number of buyers are available or present in the market. For fulfilling the demand, the seller(producer) increases the supply in the market. Buyer consumes the product, Results the demand for that product is getting decreasing day by day as each buyer is getting satisfied. The producer keeps producing product for fulfilling the demands. At a point most of the buyers are satisfied but producer keeps producing same amount/quantity of product irrespective of demand which results in a smaller number of buyers in market but supply is very high. Vice a versa, the seller(producer) keeps the supply of product very low in market irrespective to buyers, the Demand is very high in market. The relation is inversely proportional, this affects the price of the product. As the demand is high supply is low price range of product increases. Supply is high and demand is low, for selling product seller affect the price as the price range gets low. This relationship can be seen in any kind of market. This principle is many times use as the Strategies for many markets.

VI. FUTURE WORK

Cryptocurrency is new secure way of transaction. Cryptocurrency which is mined in blockchain. The side effects of the blockchain like global warming, storage problems are going to increase in future. Maintaining the ample amount of cryptocurrency in the market leads to less mining demand. The algorithm that used currently is Proof-of-Work Which consumes more energy, to Overcome this problem new algorithm is suggested that is Proof-of-Stake. Implement proof-of-Stake for mining as soon as possible so to overcome with temperature crisis.

CONCLUSION

Ethereum is the second most popular cryptocurrency. The count of Ethereum is not defined by its creator. Thus, this paper demonstrates the direct correlation between Ethereum price, Ethereum energy consumption & Ethereum Transactions. The Demand and supply trend are as followed in the market of Ethereum also.

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REFERENCES

- [1] Sustainability of bitcoin and blockchains by Harald Vranken. Digiconist, [<https://digiconomist.net/ethereum-energy-consumption>] Accessed on 23-02-2020 14:00
- [2] Blockchain: A technological tool for sustainable development or a massive energy consumption network? Nicolas Serrano Palacio
- [3] Ethereum vs Bitcoin: Is Ethereum a Better Bitcoin Alternative? [<https://www.bitdegree.org/tutorials/ethereum-vs-bitcoin/>] Accessed on 23-02-2020 14:00
- [4] Ethereum official website, [<https://ethereum.org/what-is-ethereum/>], Accessed on 23-02-2020 14:00
- [5] Etherscan , [<https://etherscan.io/chart/tx>], Accessed on 23-02-2020 14:00
- [6] Statista, [<https://www.statista.com/statistics/806453/price-of-ethereum/>], Accessed on 23-02-2020 14:00