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Carbon Emissions Report

BTCetc | DE000A27Z304 | A27Z30 | BTCE

CCRI

Crypto Carbon Ratings Institute

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Carbon Emissions Report of BTCetc

ISIN: DE000A27Z304 | WKN: A27Z30 | Ticker: BTCE

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Preamble

This report is prepared by the Crypto Carbon Ratings Institute (CCRI) for ***ETC Group.***

Executive summary

- Bitcoin has followed an unparalleled rise in market cap over the past years
- In light of the imminent climate crisis, there is raised attention towards Bitcoin's electricity consumption and carbon footprint
- Bitcoin's electricity consumption and the corresponding carbon footprint is influenced by a complex interplay of market prices, hardware efficiencies and electricity prices
- To calculate the CO_2e emissions related to a specific Bitcoin holding, we determine the electricity consumption, translate this to CO_2e emissions and allocate it to the holding on the basis of several scientific publications
- We derive the total amount of CO_2e emissions that needs to be allocated to the Bitcoin holdings of ***BTCetc (ISIN: DE000A27Z304 | WKN: A27Z30 | Ticker: BTCE)*** to be at 38,678 tones (over the period from June 5th, 2020, to June 8th, 2021)

1. Aim and scope

This report calculates the amount of CO_2e emissions corresponding to the ***BTCetc*** fund. To do so, we provide comprehensive background information as well as a detailed calculation of the amount of CO_2e emissions estimated to be allocated to the holdings. This report is prepared on the basis of several scientific publications which explored the energy consumption and corresponding CO_2e emissions. The results of this report provide a solid indication of the amount of CO_2e emissions that ***ETC Group*** needs to offset in order to claim their fund carbon neutral.

The report is structured as follows: We outline background information with regard to Bitcoin's market rise and the corresponding energy consumption and carbon footprint in section 2. Section 3 explains the economics of Bitcoin mining to provide an understanding of the underlying mechanisms. In section 4, we show our methodology to calculate the carbon footprint of the Bitcoin network and how to allocate emissions to a specific Bitcoin holding. Section 5 presents the results.

2. Background

Bitcoin has followed an unparalleled rise in market cap over the past years. In the last year alone, the market price has increased six-fold from just under USD 10,000 to as much as USD 60,000 at its peak.[1] This has increasingly sparked the interest of investors from all over the world. In January 2021, electric car manufacturer Tesla became the first company listed on the S&P500 stock market index to buy the digital currency Bitcoin.[2] As Bitcoin becomes more salient in the global financial system, there is raised attention towards the major concern related to Bitcoin which is the electricity consumption and the associated CO_2e emissions. Previous research has shown that the electricity consumption of the Bitcoin network translates to annual CO_2e emissions in the ballpark of entire countries.[3] In light of the imminent climate crisis, investments in line with portfolio decarbonization efforts are becoming increasingly important. The financial sector has a critical role in achieving net zero by mid-century as huge amounts of capital needs to be redirected at decarbonizing the economy.[4] Thus, Bitcoin's environmental impact is increasingly acknowledged in investment decisions. For instance, Tesla suspended the purchase of vehicles using Bitcoin over environmental concerns just 50 days after first enabling this practice. In accordance with this, carbon-neutral Bitcoin funds are gaining increasing traction.[5]

3. Economics of Bitcoin mining

Bitcoin's blockchain uses a "Proof of Work" consensus mechanism to avoid double spending and manipulation of the underlying ledger. The validation of ownership and transactions is based on a computationally extensive algorithm which needs to be performed by network participants in order to add valid blocks to the chain. This process is called 'mining'. The network participant that succeeds in adding a new block receives the block reward as well as the corresponding transaction fees. On average, every ten minutes a new block is added to the blockchain. To keep these 10-minute intervals constant and account for a rising hash rate, the difficulty for adding a new block to the blockchain is regularly adjusted. In times of rising market prices, miners have an incentive to add new capacity to the network.[6] Growth in the network (i.e. a rising hash rate) can cause higher electricity consumption of the Bitcoin network unless the effect is balanced by improved hardware efficiency. Consequently, the electricity consumption and the corresponding carbon footprint of the network is influenced by a complex interplay of market prices, hardware efficiency and electricity prices.

4. Methodology

To calculate the CO_2e emissions related to a specific Bitcoin holding, we take three steps. First, we determine the electricity consumption. Second, we translate this amount to CO_2e emissions. Third, we allocate Bitcoin's total carbon footprint to the holding.

For the electricity consumption, we rely on the Cambridge Bitcoin Electricity Consumption Index (CBECI). The team behind CBECI had reached out to us in the design phase to improve methodology and representation of results. Since then, we have discussed trends and current developments on several occasions. CBECI takes a bottom-up approach by accounting for hardware efficiencies, profitability considerations as well as the current hash rate. It provides a lower-bound, an upper-bound and a best-guess estimate. We consider the best-guess estimate provided by the CBECI the most accurate and up-to-date estimate available for Bitcoin's electricity estimate as it considers a balanced mix of profitable hardware types.

For CO_2e emissions, we apply the average carbon intensity which we derived in our study from different methodological approaches. We locate mining facilities in the Bitcoin network by localizing pool server IP and device IP addresses. The resulting intensity is established in the crypto community

and is frequently cited and relied on to translate electricity consumption into emissions (e.g., only recently by Ripple's CEO[a]).

For the allocation, we determine the share of the Bitcoin holding of the entire Bitcoin network and assign emissions proportionately. This a common approach setout by the Greenhouse Gas (GHG) Protocol, which is the world's most widely used standard to account for corporate emissions, and can be directly transferred to crypto investments.[7] We calculate the share of the Bitcoin holding on a daily basis to account for changes in the holding as well as the growth of the Bitcoin network caused by newly mined bitcoins. Additionally, we factor in that approximately a fifth of all bitcoins may be permanently inaccessible and thus adjust the size of the Bitcoin network accordingly.

5. Results

Based on the outlined methodology and the data provided by ***ETC Group,*** we derive the amount of CO_2e emissions that needs to be allocated to the Bitcoin holdings of ***BTCetc*** over the period from June 5th, 2020 to June 8th, 2021 at 38,678 tones. ***BTCetc*** holds on average a share of 0.0716% of the Bitcoin network over that period. The average annual electricity consumption of the Bitcoin network amounts to 90 TWh. The applied emission intensity of Bitcoin lies at 0.49 Mt CO_2e/TWh.

6. References

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7. Vries, A. de, Gallersdörfer, U., Klaaßen, L., and Stoll, C. (2021). The true costs of digital currencies: Exploring impact beyond energy use. One Earth, *4*(6), 786–789.

[a] See https://twitter.com/bgarlinghouse/status/1377459532775878657

About CCRI

The ***Crypto Carbon Ratings Institute*** *(CCRI)* provides carbon estimates for investments in cryptocurrencies and technologies such as Blockchain and distributed ledger technologies (DLT). We have built a multi-year research track record with a specific focus on Bitcoin and its environmental impacts. We published comprehensive and formerly peer-reviewed studies on Bitcoin's carbon footprint in the renowned scientific journals. Our research has been covered by major media outlets, such as CNN and The New York Times, and has been appraised as very good estimate by major organizations, such as the IEA.

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Ulrich Gallersdörfer is a research associate in the Department of Informatics at the Technical University of Munich. His research focuses on identity management in blockchains. His interest extends to further aspects of the technology, ranging from environmental implications to data analytics applications.

Lena Klaaßen

Lena Klaaßen has a background in Management and Technology with a particular focus on finance, power engineering and energy markets. She has conducted research on carbon accounting in the corporate and cryptocurrency space at TUM and MIT. She now focuses on research in the field of climate finance at ETH Zurich.

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Christian Stoll conducts research at the Center for Energy and Environmental Policy Research at the Massachusetts Institute of Technology and at the Center for Energy Markets of the Technical University of Munich. His research focuses on the implications of climate change from an economic point of view.