



COMPARISON OF CARBON FOOTPRINTS OF DIGITAL CURRENCY (BITCOIN) AND GOLD: DETERMINATION OF THE CRITICAL EXCHANGE RATE

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OUTLINE

- Motivation
- Methodology
 - **LCA**
- Results and Implications
 - Carbon footprints of Bitcoin and gold production
 - Critical exchange rate
- Questions and Answers





Cryptocurrency market



Reference: https://doi.org/10.1016/j.physrep.2020.10.005





Reference: https://bitrazzi.com/3-biggest-cryptocurrencies/





Concerns about Bitcoin's environmental impact

The Graphic Truth

Crypto-mining sucks up lots of power

Electricity usage (TWh, annualized)



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Then Elon Musk further stirred things up...



Tesla & Bitcoin

Bitcoin. We are concerned about rapidly increasing use of fossil fuels for Bitcoin mining and transactions, especially coal, which has the worst emissions of any fuel.

Cryptocurrency is a good idea on many levels and we believe it has a promising future, but this cannot come at great cost to the environment.

Tesla will not be selling any Bitcoin and we intend to use it for transactions as soon as mining transitions to more sustainable energy. We are also looking at other cryptocurrencies that use <1% of Bitcoin's energy/transaction.

(1)

1:06 AM · May 13, 2021

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Reference: https://twitter.com/kuriharan/status/940239505914826752/photo/1



What is the functional unit?









- A functional unit is a quantified description of the function of a product that serves as the reference basis for all calculations regarding impact assessment.
- A function may be based on different features of the product under study, such as performance, aesthetics, technical quality, additional services, costs, etc.



- There is only one function of digital currency: its purchasing value
- Thus, we compared the environmental impacts of Bitcoin and gold per unit value (\$) to see which one is more impactful.



When it comes to environmental impact,



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LIFE CYCLE ASSESSMENT

- Life-cycle assessment or LCA (also known as lifecycle analysis) is a methodology for assessing environmental (and if desired, economic and social) impacts associated with all the stages of the life-cycle of a commercial product, process, or service.
- The following stages are usually taken into account:
 - Raw material acquisition
 - Production
 - Storage (if applicable)
 - Use (operation)
 - End-of-life-treatment







LIFE CYCLE ASSESSMENT

- We considered the following inputs:
 - Electronic components for Bitcoin mining
 - Electricity required for Bitcoin mining
 - Material and energy input for gold mining
 - Transportation of gold

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- Four different locations were studied:
 - Turkey (where this paper was written)
 - Poland (relies heavily on coal)
 - Denmark (high share of renewables)
 - France (nuclear is by far the biggest energy source)











- Even if the entire energy for mining comes from photovoltaic panels, the value of a single Bitcoin should be around \$196,000 so that gold and Bitcoin would have equal carbon footprints.
- The highest ever price of Bitcoin was around \$60,000.
- Therefore,

BITCOIN IS INDEED ENVIRONMENTALLY HAZARDOUS



• Bitcoin transactions should be subject to a carbon tax.

OR

• Companies should stop accepting Bitcoin as a valid means of financial transaction.





- More locations could have been studied (lack of data)
- Quantifying the environmental impacts of gold mining only in terms of its carbon footprint might be interpreted as missing the big picture. The following impacts could have been taken into account:
 - land transformation as a result of deforestation due to mining activities
 - human toxicity potential due to the use of cyanide for leaching
 - photochemical smog formation due to the transportation of gold via internal combustion engine-powered means of transportation



• Thank you for listening!

Any questions?