

Can a Blockchain be Green?

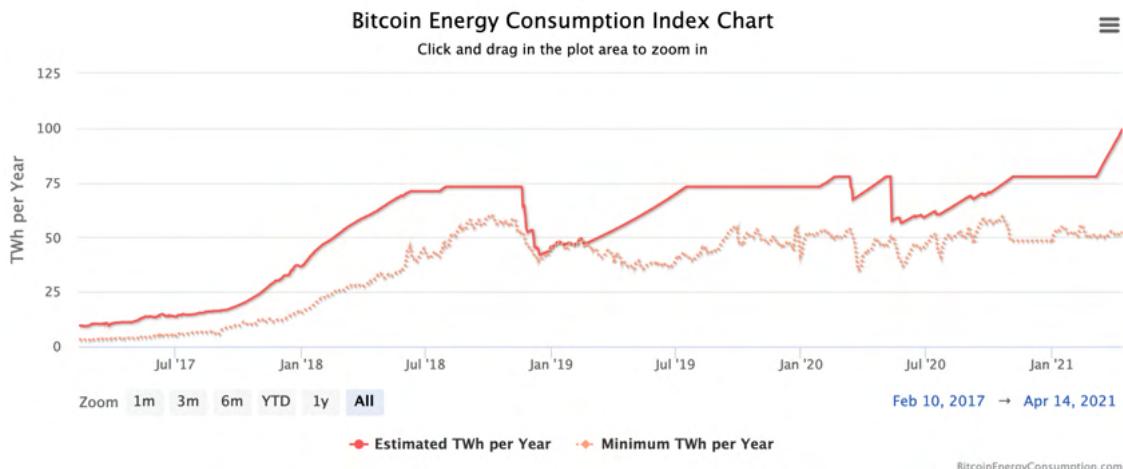
A look at the sustainability of
decentralized networks – Bitcoin,
Ethereum, & Hedera Hashgraph

The decentralized web promises a return to privacy, self-sovereign control, security, and trust. Thus far, this new world view has come at a significant cost – the environment.

Today, the world is at a climate crossroads. The Paris Agreement was signed in 2015 by 196 parties to limit global warming to under 2°C aiming for a climate neutral world by mid-century. The world's largest corporations are on board. Facebook has reached net-zero emissions, Apple, Microsoft, and Google plan to be carbon neutral by 2025, Amazon by 2040.

At the same time, the two most widely known blockchain networks, Bitcoin, and Ethereum are a massive use of energy due to their reliance on the compute-intensive proof-of-work. For bitcoin, this is likely never to change. Ethereum thankfully promises greener pastures, as Ethereum 2.0 seeks its planned move to being a proof-of-stake network.

Suppose these popular blockchain networks do not change, or developers and consumers don't make more sustainable choices. In that case, I'm afraid of the impact this promising technology will have on our climate. By some projections, blockchain use is expected to grow by 67% annually if Ethereum and Bitcoin meet those expectations they will, combined, be consuming as much energy as the entire United Kingdom by 2023 and the United States by 2028¹.



1 <https://www.finextra.com/blogposting/19679/blockchain-trends-in-2021-expect-the-unexpected>

2 https://en.wikipedia.org/wiki/List_of_countries_by_electricity_consumption

Despite the inefficiencies and associated costs, guilt-free innovation and entrepreneurship can still come from a public ledger and blockchain today.

Power Transition is one such organization aiming to make headway while making sustainable decisions from our business to the technology that powers it. Power Transition is helping the world transition to more sustainable use of energy through blockchain-like technology.

Our energy microgrid solution has successfully provided more efficient energy to 48 homes and apartments in the United Kingdom, with immediate energy savings of 30-40% per home.



In another proof of concept for EV charging networks, Power Transition reduced charging costs by up to 50%.

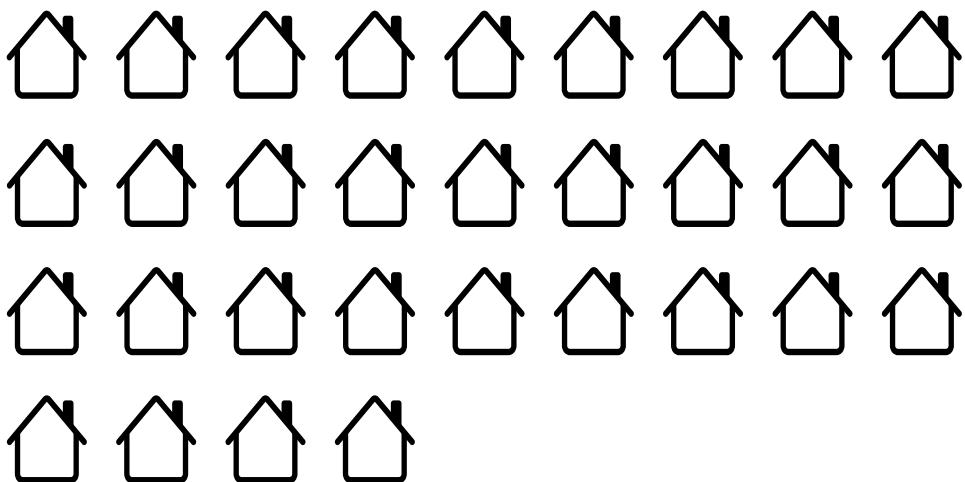
In this report, we'll review the consumption by leading blockchain networks, the factors to make a network sustainable, and understand how Hedera Hashgraph can be the answer to a more sustainable way forward.

Seeking sustainability

Each purchase or transfer of bitcoin you make takes the equivalent of 31 days of energy consumed by the average US household. For Ethereum, it's over 2 days worth of household energy³.

What's the cost of bitcoin?

Each transaction requires the energy of 31 US households.



While these numbers can be startling and may cross your mind the next time you visit Coinbase, for most people, we aren't making technology or investment decisions based on them.

We should.

For developers, entrepreneurs, and businesses looking to build on this exciting technology, I advise you to look not only at energy consumption but examine the long-term sustainability of the world's most critical infrastructure since the internet itself.

Sustainability is not about a single point in time but an enduring state of a living and changing thing.

Defining sustainability

In 2016 the United Nations Global Compact put into motion Sustainable Development Goals (UNSDG), a set of 17 goals to be on the 2030 Agenda for Sustainable Development.

The UNSDG articulates sustainability as having three pillars:

- Environmental
- Social
- Economic

The foundation of these pillars, what keeps them upright, is governance. We must use this lens in its entirety to understand the long-term viability and sustainability of our actions and how it can be applied to our technology decisions.

Is the blockchain you're choosing sustainable?

Environmental

Energy costs per transaction on a decentralized network are a preliminary step in determining whether a network can successfully achieve long-term sustainability. The biggest impact on a network's energy use is how it achieves consensus, or how the set of computers work together to update its public ledger.

The two most common options are proof-of-work and proof-of-stake. Initially introduced by Bitcoin, proof-of-work is extremely expensive and damaging to the environment. Proof-of-work forces computers to work increasingly harder to solve mathematical problems in order to 'win' the reward to add a block. Proof-of-stake on the other hand doesn't force the computers to do this excess and unnecessary work but relies on the cryptocurrency held by the computer to determine how reliable and how much power the computer should hold. Proof-of-stake is one of my anticipated items for the upcoming Ethereum 2.0.

Today, Bitcoin and Ethereum use proof-of-work to secure their networks. Using an insane amount of energy. To understand this amount we can compare to a centralized process that most of us interact with on a near daily basis, VISA.

Per VISA, the network takes 740,000 Gigajoules of energy to power each year and processed 138.3 billion transactions in 2019 . This amounts to approximately 0.002 kWh every time you swipe your VISA card⁴.

There are more efficient blockchain and proof-of-stake networks available today. For example, Hedera, uses a new blockchain alternative called hashgraph, which at times requires 600,000 times less energy per transaction than Ethereum and a whopping 5 million times less than Bitcoin.

Network	Annual Energy (kWh)	Annual Transactions	Energy per transaction (kWh)
VISA	205,555,556	138,300,000,000	0.001486
Bitcoin	99,630,000,000	112,553,498	885.179064
Ethereum	35,500,000,000	344,766,800	102.968151
Hedera	74109.6	435,623,029	0.000170

The efficiency gained by hashgraph places the energy consumption on a per-transaction basis on par with perhaps a more familiar distributed payments network, VISA. In more tangible terms, this energy is the equivalent of a single bitcoin transaction producing the carbon emissions a car produces to drive 1,577 miles versus, Hedera producing the equivalent of 0.0003 miles⁵.

⁴ <https://usa.visa.com/dam/VCOM/download/corporate-responsibility/visa-2019-corporate-responsibility-report.pdf>

⁵ <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

It is important to call out that there are inherent technical and design differences between these networks. Bitcoin conducts basic cryptocurrency transfers between two accounts, Ethereum is smart contract-based, and although the general-purpose Hedera network supports smart contracts the vast majority of its transactions are cryptocurrency transfers or messages using Hedera Consensus Service.

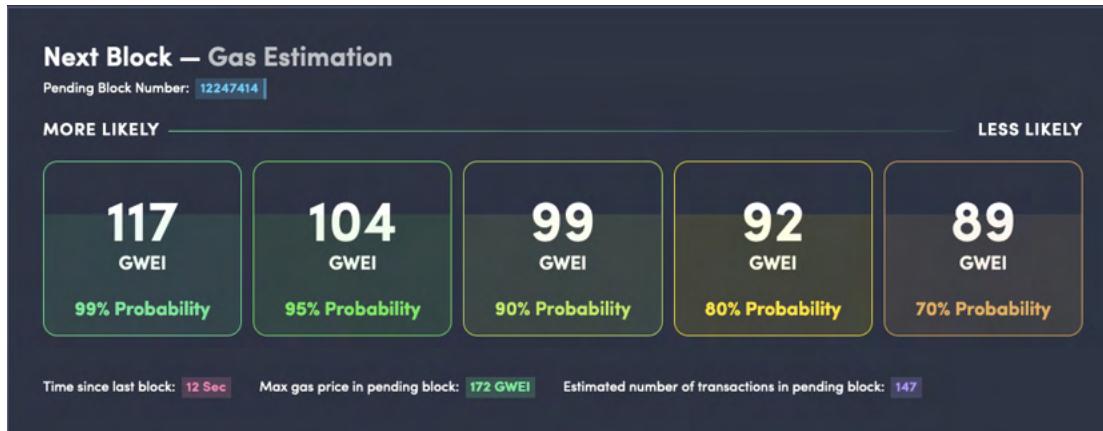
Hedera is also a relatively new network, having launched in 2019. That said, the network is well tested in production by popular applications and businesses, having already matched Ethereum and surpassed Bitcoin in total transactions. The current energy measurements are based on a 16 node network, while Ethereum and Bitcoin have thousands today. Hedera has stated that performance will scale linearly as the network grows, preserving the energy efficiencies through maturity.

Social

Sustainable Development Goals (UNSDG) define social as being accessible to all. A beauty of a public ledger is its openness. Anyone in the world is equally able to send a transaction to the network and read the information sent. This can create more fair marketplaces and other interesting opportunities that were never possible before.

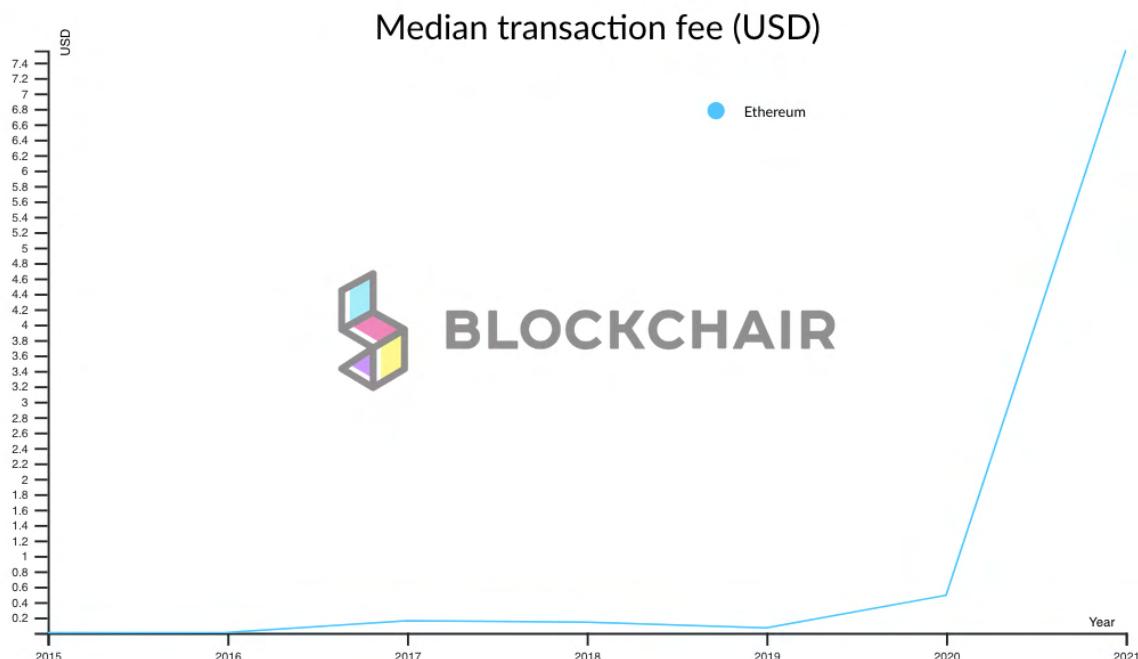
However, in order for something to be truly accessible, it must be affordable. For instance, for Power Transition we view predictable, affordable energy access as key to our mission. Energy impoverished individuals and communities must benefit from renewable energy generation even if they do not have bank accounts. Access to clean energy will pave the way for communities towards better education and commerce opportunities to create sustainable and thriving micro-economies. A sub-Saharan community should be able to trade renewable electricity within a local microgrid among themselves without worrying about expensive middlemen or price volatility.

Depending on the network you choose, prices and their design can be drastically different. On both Bitcoin and Ethereum, miners effectively force you to bid on their willingness to take a transaction. This can be more easily understood in tools like Blocknative's [Gas Estimator](#).



The more you pay, the more likely it is to be included in the next block. That doesn't seem fair and this doesn't have to be the way forward.

On Hedera, fees are fixed and based in USD. Meaning that sending a message to the network or transferring cryptocurrency to your friend will always cost you \$0.0001. This is in stark comparison to the highly variable gas fees required on Ethereum.



For something to be accessible, costs must be affordable, predictable, and fair where all stakeholders can mutually benefit and participate.

Economic

Lastly, for a network to remain sustainable, the network must choose to invest in the right, green areas. Large multinational corporations are under pressure from governments and the public to attain these SDGs within the deadlines set by the United Nations Global Compact (UNGC), a voluntary initiative based on CEO commitments to implement universal sustainability principles, during the Paris Accord in 2015.

For a decentralized network, how and who to give power to is where investment is derived. One such example of this is mining. Depending on the network, miners and cryptocurrency holders control governance using the power of their votes. Over the years, miners have consolidated mining pools in regions where electricity is cheap – with over 65% of mining power located in China⁶. These pools run predominately on coal-powered electricity generators, with over 50% of all of China's energy being coal-powered⁷. This is in comparison to the United States where coal accounts for 11% of total energy production.

Past decision making shows that a miner's primary interest is to fuel their own financial self interest. Conversely, each corporation and our individual decisions are increasingly weighed if their investments enhance their drive to sustainability. As an individual, you can make your impact heard here, as well, by choosing where you invest your time and resources.

⁶ <https://www.cnbc.com/2021/03/02/china-bitcoin-mining-hub-to-shut-down-cryptocurrency-projects.html>

⁷ <https://www.nasdaq.com/articles/chinas-coal-consumption-share-falls-to-56.8-at-end-2020-2021-02-28>

Governance

As referenced prior every decentralized network requires governance – entities or individuals which make decisions. For Bitcoin, its miners. For Hedera, it's the Hedera Governing Council. Up to 39 term-limited organizations committed to governing software changes, while bringing stability and continued decentralization to the public network. The Hedera Governing Council Members are no exception to having a desire to attain SDGs.

All members have publicly declared their ambitions to attain net-zero carbon and SDGs. Reports of their achievements are published annually in their Sustainable Development reports. The following are a few Environmental, Social, and Corporate Governance (ESG) links of notable Hedera Governing Council members: [Google](#), [IBM](#), [Boeing](#), [Tata Communications](#), [EDF](#).

A network's governance structure will make critical decisions and must hold weight when considering the right network for you. Ethereum, Bitcoin, and many other public network's governance is driven entirely by a group of developers, miners, or their communities, whether or not participants are qualified to make decisions. In many cases, users copy the decisions of those who they feel are qualified.

Understanding your network of choice's governance model is an important factor, and much more than in comparison to traditional centralized infrastructure.

Conclusion

Blockchain and the decentralized web should not be feared. While, to date, its energy consumption has been crucified -- as it should -- that does not mean that it cannot be improved. New, more efficient networks like Hedera and improvements to others, like Ethereum, promise a greener future.

As you consider where to invest your time and resources, make note of the sustainability of the network you choose. For a network to be truly sustainable, consider its economic, social, and environmental impacts and how its governance model can positively or negatively dictate its roadmap, as well.



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