



#BTW2021

# DGAP MEMO

German Council on Foreign Relations

No. 08 | October 2021



## (RE)POSITIONING GERMANY IN EUROPE



# Sustainable Crypto Currencies

Mining is affecting supply chains and the environment, but Germany can help mitigate it

By Dr. Marlon Ebert, Martin Kümmel, Ulf Henning Jacobs & Dr. Matthias Hirtschulz

Crypto currencies are here to stay – and that’s a good thing. But many cryptos – like Bitcoin – use an energy-intensive proof-of-work mining process which aggravates semiconductor shortages and undermines environmental objectives. Germany has an opportunity to foster innovation to replace mining and support a more sustainable crypto ecosystem. Doing so will help free up supply of high-demand semiconductors, reduce energy consumption, and grow Germany’s innovation base while allowing Germany to benefit from the opportunities this new digital medium can bring.

Crypto currencies and, more generally, crypto assets (“cryptos”) have taken the world by storm. With an annual growth rate of 30 percent in crypto market size, development of crypto payment infrastructure and new crypto assets, cryptos are certainly here to stay.

But there are two major flaws associated with many established cryptos:

- Many cryptos require a huge amount of electricity to function. This is due to their reliance on a mechanism called “proof-of-work mining”. This mining process, first introduced with Bitcoin in 2009, has grown to consume about as much power as [all idle home appliances in the USA](#). It has subsequently been adopted by other crypto currencies.
- Crypto mining is putting additional pressure on the supply chain of computer chips, especially during the COVID-19 crisis and amidst the US-China trade conflict. The quest

## Annulized Total Bitcoin Footprints

### ANNUALIZED TOTAL BITCOIN FOOTPRINTS

**CARBON FOOTPRINT**  
71 MT CO<sub>2</sub>



Comparable to the carbon footprint of Greece

**ELECTRICAL ENERGY**  
150 TWH



Comparable to the power consumption of Malaysia

**ELECTRONIC WASTE**  
8 KT



Comparable to the e-waste generation of Luxembourg

### SINGLE BITCOIN TRANSACTION FOOTPRINTS

**CARBON FOOTPRINT**  
810 KG CO<sub>2</sub>



Equivalent to the carbon footprint of 2,000 VISA transactions or 135 hours of watching YouTube

**ELECTRICAL ENERGY**  
1,700 TWH



Equivalent to the power consumption of an average U.S. household over 58 days

**ELECTRONIC WASTE**  
86 GRAMS



Comparable to the weight of 1.3 c-size batteries or 1.9 golf balls

Source: [digiconomist.net](https://digiconomist.net)

for a reliable supply of semiconductors has become one of crucial importance for key German industries and reducing supply chain disruptions is a [high priority](#).

Crypto assets evidently need to address issues closely linked to proof-of-work mining. However, it is not clear how best to achieve this and what role policy can play. Other governments are concerned too. [Iran](#), for example, temporarily banned crypto mining after it was blamed for power outages in the country. While [China](#), where 75 per cent of all Bitcoins were mined in September 2019, banned crypto mining outright. But neither setback has had a lasting impact on the crypto market. Mining operations simply [relocated](#) to more crypto-friendly countries.

This shows the need for a balanced approach. Understanding the nuances of proof-of-work mining is essential to assess the effects policies will have, especially considering that social benefits and business opportunities of an open, transparent, and global financial infrastructure are at stake as well.

At a time when neither EU nor US regulators are paying sufficient attention to the issue, the new German govern-

ment has both an opportunity and a strong self-interest in leading international efforts, continuing and expanding its "[Blockchain-Strategie](#)", and growing Germany's innovation base.

#### DETERMINING FACTORS

##### What are crypto assets and how do they work?

If governments have not yet acted in concert, it may be because of how complex the field of crypto assets is. It is worth spelling out how this new digital medium works.

What makes crypto assets unique is that they usually employ a blockchain to create a distributed ledger. A blockchain is a growing string of data, the "chain", that uses digital signatures and other cryptographic methods to ensure its consistency and security. The data is organized in "blocks", hence the name blockchain. Overall, this results in certain beneficial properties like providing a transparent history of transactions that cannot be tampered with.

Some major crypto currencies, like Bitcoin, have a public blockchain. Unlike a regular transaction that would be verified by just your bank on the bank's centralised ledger, Bitcoin relies on

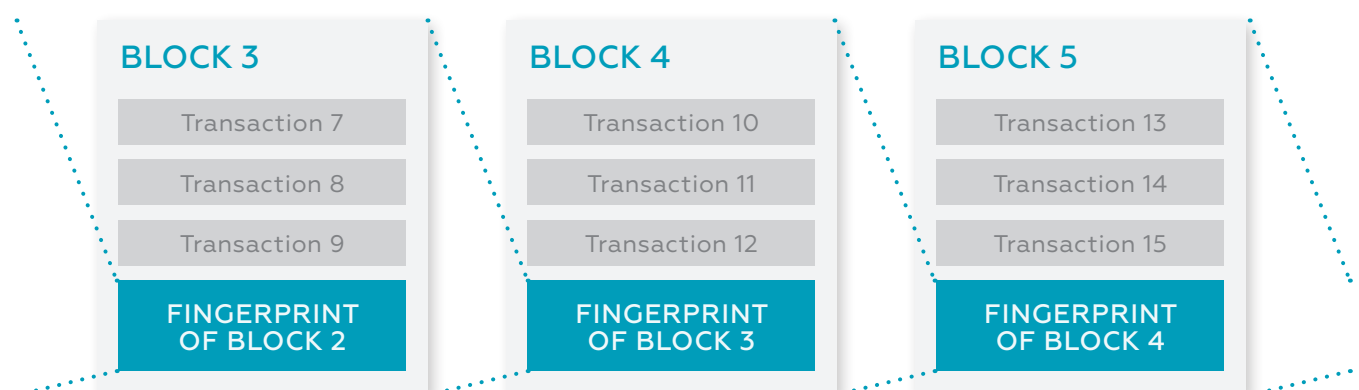
market participants to confirm blocks in the chain. With a public blockchain, it is necessary to find a way to ensure the stability and security of the network. To this end, generating incentives for market participants to validate blocks and at the same time prevent attacks on the network, is essential. Bitcoin pioneered the mechanism of proof-of-work mining to do just that. It is the mechanism that makes the crypto currency reliable. The downside is that it also requires significant energy and computing power.

##### What is proof-of-work mining and are there alternatives?

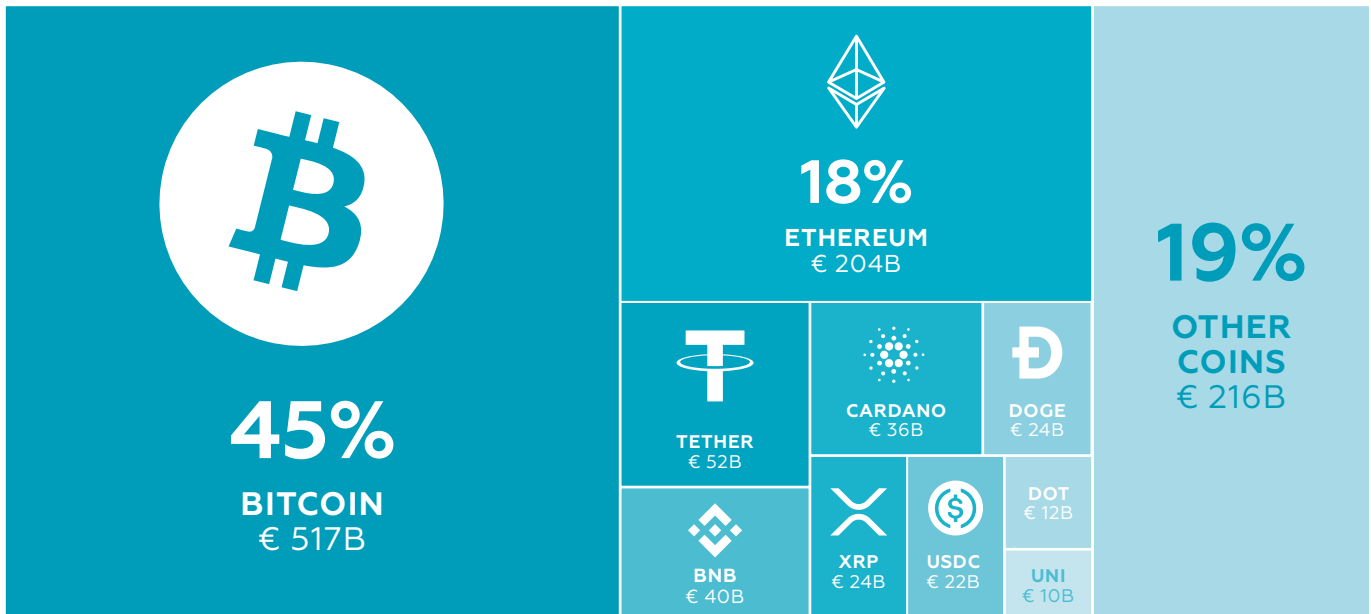
Crypto mining takes the idea of mining ore in the physical world, which can be used to mint physical coins, and adapts it to create a similar digital process – hence the name "mining".

With Bitcoin, crypto mining is used to continuously generate coins. Since anyone with the proper equipment can mine coins, coin generation is spread over time and over many market participants. To avoid Bitcoin being dominated by a single entity, mining was made intentionally hard, requiring computers to solve complicated calculations.

#### Simplified depiction of a blockchain



## Crypto market capitalisation (July 2021)

Source: Data from [coinmarketcap.com](https://coinmarketcap.com)

Having an energy-intensive mining process is not the only way to secure the public blockchain of a crypto asset. Major crypto communities are working on alternative approaches to alleviate issues related to mining.<sup>1</sup>

The most promising alternative to mining currently seems to be proof-of-stake. This alternative method to proof-of-work means that anyone who proves a stake in the crypto asset can validate transactions to regularly obtain coins – just as is the case when mining, but without the complex calculations. This solves the issues of needing lots of computational power and high energy consumption. Like buying stock to gain stockholder voting rights, having a stake in a particular crypto asset can be proven by literally staking coins to become a validator, hence the name “proof-of-stake”. The second largest crypto currency, [Ethereum](#), is in the process of transitioning from proof-of-work to proof-of-stake. Other cryptos

like Cardano already operate using a proof-of-stake model.

#### CHALLENGES

##### Barriers to a unified international approach

Industry and environmental interests are perfectly aligned on the mining issue: The supply chain impact of mining affects established industries and the use of power affects the environment. This ought to provide the perfect conditions for a transition away from proof-of-work. Despite this, lawmakers struggle to keep up with the crypto market.

It is hard to build a policy alliance around the issue of crypto mining amidst a plethora of other topics relating to cryptos that might need to be addressed as well. This issue will reach a crescendo in the next four years as the market for cryptos is expected to grow exponentially.

#### If mining generates profits, it won't stop

There is still strong demand for established cryptos that rely on mining. The rewards for Bitcoin mining are high because if the value of one Bitcoin rises, so does the overall reward – paid in Bitcoin – for mining. By the same logic, if the value of Bitcoin drops, so does the reward for mining. China and Iran failed to understand this, and their mining bans had little long-term effect on overall mining activity. Mining simply continued elsewhere. **The best way to address the issue is not to introduce new bans but to foster technological innovation, to support cryptos moving away from proof-of-work mining and towards more sustainable approaches.**

#### The crypto market is just emerging and needs to be fostered

Against this backdrop, heavy-handed regulation to rein in proof-of-work

1. For example, the so called second layer technologies for Bitcoin, which settles transaction through a highly efficient overlay over the actual Bitcoin blockchain, reducing the number of transactions that need to be written to the Bitcoin blockchain itself and enabling significantly more efficient transaction processing.

crypto currencies might be tempting. However, we do not yet know how this new digital medium will shape the world of finance and what benefits Europe and Germany might gain from fostering innovation.

Ultimately, crypto is one of the few areas of innovation where Europe is not trailing behind the US and China – even though first signs of this are already manifesting. For example, Coinbase – an American publicly-traded company with a market capitalisation over USD 50 billion – was the first to receive a German crypto custodian licence. As such, careful consideration is necessary to balance nudging markets towards alternatives to proof-of-work while encouraging growth and innovation in the European crypto ecosystem.

## RECOMMENDATIONS

### Build on existing EU initiatives

The new German government has a chance to make its economy more resilient, burnish its environmental credentials, and solve a problem that has confounded China and other powers. To solve this challenge, it is not feasible to generally discourage the use of cryptos. They are here to stay and that's a good thing. Policy makers should consider aspects like the potential benefit for society, new opportunities for businesses, and future technological advances in their decision-making.

**But reducing the impact of proof-of-work mining can be achieved by encouraging market participants to implement new technologies and transition to cryptos that use proof-of-stake or similar methods instead.** This basic principle should be at the core of German policies regarding crypto mining.

The EU already has **two major related initiatives** that Germany can use as a starting point:

- The **Markets in Crypto-Assets Regulation (MiCA)** aims to establish an EU single market for crypto assets. The goal is to boost innovation while preserving financial stability and protecting investors from risks. The new German government should take a leading role in flanking this initiative with efforts to shape a new concerted European approach to cryptos. Finding and implementing technological innovation – most importantly alternatives to proof-of-work mining – should be encouraged while fostering instead of penalising the crypto ecosystem.
- The **EU emissions trading system (EU ETS)** covers energy-intensive industries like steel works or oil refineries, which can buy emission allowances. Since mining primarily occurs outside of EU borders, proof-of-work crypto assets also need to be covered by the upcoming **carbon border adjustment mechanism (CBAM)**. Germany should ensure the EU explores feasible options to include cryptos in these mechanisms.

### Connect with crypto experts

Considering the high mobility and digital nature of crypto mining, it is not obvious how to incorporate cryptos into these mechanisms or whether this is even possible. As ever, lawmakers need the best available expertise. **A dedicated team of crypto experts is needed. These experts should be tasked with following the fast-paced developments in the crypto space and be able to quickly react to issues like crypto mining when needed.** In the case of a newly formed digital ministry or expansion of the state ministry for digital affairs in the chancellery, a department should be created to focus on cryptos. This new department should also be responsible for linking-up with stakeholders from civil society, industry, and finance.

*In this memo series, DGAP offers concise analysis of issues related to foreign and security policy that will shape the agenda of Germany's next legislative period. Each memo provides insight on how the new federal government and parliament can take advantage of opportunities and meet challenges as European and global dynamics grow increasingly complex. Topics include technology, climate, migration, the international order, security, and geo-economics.*

*These memos are an invitation to join us in an even more in-depth conversation about the German agenda.*

For more information, please visit:  
[www.dgap.org/en/dossier/btw2021](http://www.dgap.org/en/dossier/btw2021)

# DGAP

Advancing foreign policy. Since 1955.

Rauchstraße 17/18  
10787 Berlin  
[info@dgap.org](mailto:info@dgap.org)  
[www.dgap.org](http://www.dgap.org)  
@dgapev

*The German Council on Foreign Relations (DGAP) conducts research and advises on current topics of German and European foreign policy. This text reflects the opinions of the author(s), not those of DGAP. DGAP receives funding from the German Federal Foreign Office based on a resolution of the German Bundestag.*

### Publisher

Deutsche Gesellschaft für  
Auswärtige Politik e.V.

ISSN 749-5450

Editing Gareth Davies

Layout Lara Bühner

Design Concept WeDo

Photo © IMAGO / Jakub Porzycki



This work is licensed under a Creative Commons Attribution – NonCommercial – NoDerivatives 4.0 International License.