

Sustainability indicators for crypto-assets

Disclosures in accordance with
Article 66 (5) MiCAR.



This report was provided by Crypto Risk Metrics.

2025-06-24

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Preamble

About Crypto Asset Service Provider (CASP)

Name of the CASP: COMMERZBANK Aktiengesellschaft
Street and number: Kaiserstraße 16
City: Frankfurt am Main
Country: Germany
LEI: 851WYGNLUQLFZBSYGB56

About this report

This disclosure serves as evidence of compliance with the regulatory requirements of MiCAR 66 (5). This requirement obliges crypto asset service providers to disclose significant adverse factors affecting the climate and the environment. In particular, this disclosure complies with the requirements of "Commission Regulation (EU) 2025/422 of December 17, 2024, supplementing Regulation (EU) 2023/1114 of the European Parliament and of the Council with regard to regulatory technical standards specifying the content, methods and presentation of information relating to sustainability indicators related to climate-related and other environmental impacts". The optional information specified in Article 6, par. 8 (a) to (d) DR 2025/422 is not included.


This report is valid until material changes occur in the data, which will result in an immediate adjustment of this report.

Overview

This is an overview of the core indicator energy consumption but does not represent the reporting according to MiCAR 66 (5). Please find the full disclosure below.

#	Crypto-Asset Name	Crypto-Asset FFG	Energy consumption (kWh per calendar year)
1	Bitcoin	V15WLZJMF	145,551,072,767.85
2	Ethereum Eth	D5RG2FHH0	2,271,380.40

Sustainability indicators

Bitcoin

Quantitative information

Field	Value	Unit
S.1 Name	COMMERZBANK Aktiengesellschaft	/
S.2 Relevant legal entity identifier	851WYGNLUQLFZBSYGB56	/
S.3 Name of the crypto-asset	Bitcoin	/
S.6 Beginning of the period to which the disclosure relates	2024-06-24	/
S.7 End of the period to which the disclosure relates	2025-06-24	/

Field	Value	Unit
S.8 Energy consumption	145551072767.85226	kWh/a
S.10 Renewable energy consumption	24.1347029759	%
S.11 Energy intensity	17.49395	kWh
S.12 Scope 1 DLT GHG emission - Controlled	0.00000	tCO ₂ e
S.13 Scope 2 DLT GHG emission - Purchased	59966468.70284	tCO ₂ e
S.14 GHG intensity	7.20744	kgCO ₂ e

Qualitative information

S.4 Consensus Mechanism

Bitcoin is present on the following networks: Bitcoin, Lightning Network.

The Bitcoin blockchain network uses a consensus mechanism called Proof of Work (PoW) to achieve distributed consensus among its nodes. Here's a detailed breakdown of how it works:

Core Concepts:

1. Nodes and Miners:

- Nodes: Nodes are computers running the Bitcoin software that participate in the network by validating transactions and blocks.
- Miners: Special nodes, called miners, perform the work of creating new blocks by solving complex cryptographic puzzles.

2. Blockchain: The blockchain is a public ledger that records all Bitcoin transactions in a series of blocks. Each block contains a list of transactions, a reference to the previous block (hash), a timestamp, and a nonce (a random number used once).

3. Hash Functions: Bitcoin uses the SHA-256 cryptographic hash function to secure the data in blocks. A hash function takes input data and produces a fixed-size string of characters, which appears random.

Consensus Process:

1. Transaction Validation: Transactions are broadcast to the network and collected by miners into a block. Each transaction must be validated by nodes to ensure it follows the network's rules, such as correct signatures and sufficient funds.

2. Mining and Block Creation:

- Nonce and Hash Puzzle: Miners compete to find a nonce that, when combined with the block's data and passed through the SHA-256 hash function, produces a hash that is less than a target value. This target value is adjusted periodically to ensure that blocks are mined approximately every 10 minutes.
- Proof of Work: The process of finding this nonce is computationally intensive and requires significant energy and resources. Once a miner finds a valid nonce, they broadcast the newly mined block to the network.

3. Block Validation and Addition: Other nodes in the network verify the new block to ensure the hash is correct and that all transactions within the block are valid. If the block is valid, nodes add it to their copy of the blockchain and the process starts again with the next block.

4. Chain Consensus: The longest chain (the chain with the most accumulated proof of work) is considered the valid chain by the network. Nodes always work to extend the longest valid chain.

In the case of multiple valid chains (forks), the network will eventually resolve the fork by continuing to mine and extending one chain until it becomes longer.

For the calculation of the corresponding indicators, the additional energy consumption and the transactions of the Lightning Network have also been taken into account, as this reflects the categorization of the Digital Token Identifier Foundation for the respective functionally fungible group ("FFG") relevant for this reporting. If one would exclude these transactions, the respective estimations regarding the "per transaction" count would be substantially higher.

S.5 Incentive Mechanisms and Applicable Fees

Bitcoin is present on the following networks: Bitcoin, Lightning Network.

The Bitcoin blockchain relies on a Proof-of-Work (PoW) consensus mechanism to ensure the security and integrity of transactions. This mechanism involves economic incentives for miners and a fee structure that supports network sustainability:

Incentive Mechanisms:

1. Block Rewards:

- Newly Minted Bitcoins: Miners are incentivized by block rewards, which consist of newly created bitcoins awarded to the miner who successfully mines a new block. Initially, the block reward was 50 BTC, but it halves every 210,000 blocks (approx. every four years) in an event known as the "halving."
- Halving and Scarcity: The halving mechanism ensures that the total supply of Bitcoin is capped at 21 million, creating scarcity and potentially increasing value over time.

2. Transaction Fees:

- User Fees: Each transaction includes a fee paid by the user to incentivize miners to include their transaction in a block. These fees are crucial, especially as the block reward diminishes over time due to halving.
- Fee Market: Transaction fees are determined by the market, where users compete to have their transactions processed quickly. Higher fees typically result in faster inclusion in a block, especially during periods of high network congestion.

For the calculation of the corresponding indicators, the additional energy consumption and the transactions of the Lightning Network have also been taken into account, as this reflects the categorization of the Digital Token Identifier Foundation for the respective functionally fungible group ("FFG") relevant for this reporting. If one would exclude these transactions, the respective estimations regarding the "per transaction" count would be substantially higher

S.9 Energy consumption sources and methodologies

The energy consumption of this asset is aggregated across multiple components:

For the calculation of energy consumptions, the so called 'top-down' approach is being used, within which an economic calculation of the miners is assumed. Miners are persons or devices that actively participate in the proof-of-work consensus mechanism. The miners are considered to be the central factor for the energy consumption of the network. Hardware is pre-selected based on the consensus mechanism's hash algorithm: SHA-256. A current profitability threshold is determined on the basis of the revenue and cost structure for mining operations. Only Hardware above the profitability threshold is considered for the network. The energy consumption of the network can be determined by taking into account the distribution for the hardware, the efficiency levels for operating the hardware and on-chain information regarding the miners' revenue opportunities. If

significant use of merge mining is known, this is taken into account. When calculating the energy consumption, we used - if available - the Functionally Fungible Group Digital Token Identifier (FFG DTI) to determine all implementations of the asset of question in scope and we update the mappings regularly, based on data of the Digital Token Identifier Foundation. The information regarding the hardware used and the number of participants in the network is based on assumptions that are verified with best effort using empirical data. In general, participants are assumed to be largely economically rational. As a precautionary principle, we make assumptions on the conservative side when in doubt, i.e. making higher estimates for the adverse impacts.

To determine the energy consumption of a token, the energy consumption of the network(s) lightning_network is calculated first. For the energy consumption of the token, a fraction of the energy consumption of the network is attributed to the token, which is determined based on the activity of the crypto-asset within the network. When calculating the energy consumption, the Functionally Fungible Group Digital Token Identifier (FFG DTI) is used - if available - to determine all implementations of the asset in scope. The mappings are updated regularly, based on data of the Digital Token Identifier Foundation. The information regarding the hardware used and the number of participants in the network is based on assumptions that are verified with best effort using empirical data. In general, participants are assumed to be largely economically rational. As a precautionary principle, we make assumptions on the conservative side when in doubt, i.e. making higher estimates for the adverse impacts.

S.15 Key energy sources and methodologies

To determine the proportion of renewable energy usage, the locations of the nodes are to be determined using public information sites, open-source crawlers and crawlers developed in-house. If no information is available on the geographic distribution of the nodes, reference networks are used which are comparable in terms of their incentivization structure and consensus mechanism. This geo-information is merged with public information from Our World in Data, see citation. The intensity is calculated as the marginal energy cost wrt. one more transaction.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. "Share of electricity generated by renewables - Ember and Energy Institute" [dataset]. Ember, "Yearly Electricity Data Europe"; Ember, "Yearly Electricity Data"; Energy Institute, "Statistical Review of World Energy" [original data]. Retrieved from <https://ourworldindata.org/grapher/share-electricity-renewables>.

S.16 Key GHG sources and methodologies

To determine the GHG Emissions, the locations of the nodes are to be determined using public information sites, open-source crawlers and crawlers developed in-house. If no information is available on the geographic distribution of the nodes, reference networks are used which are comparable in terms of their incentivization structure and consensus mechanism. This geo-information is merged with public information from Our World in Data, see citation. The intensity is calculated as the marginal emission wrt. one more transaction.

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Ethereum Eth



Quantitative information

Field	Value	Unit
S.1 Name	COMMERZBANK Aktiengesellschaft	/
S.2 Relevant legal entity identifier	851WYGNLUQLFZBSYGB56	/
S.3 Name of the crypto-asset	Ethereum Eth	/
S.6 Beginning of the period to which the disclosure relates	2024-06-24	/
S.7 End of the period to which the disclosure relates	2025-06-24	/
S.8 Energy consumption	2271380.40000	kWh/a
S.10 Renewable energy consumption	26.5386870830	%
S.11 Energy intensity	0.00009	kWh
S.12 Scope 1 DLT GHG emission - Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emission - Purchased	755.94509	tCO2e
S.14 GHG intensity	0.00003	kgCO2e

Qualitative information

S.4 Consensus Mechanism

The crypto-asset's Proof-of-Stake (PoS) consensus mechanism, introduced with The Merge in 2022, replaces mining with validator staking. Validators must stake at least 32 ETH every block a validator is randomly chosen to propose the next block. Once proposed the other validators verify the blocks integrity.

The network operates on a slot and epoch system, where a new block is proposed every 12 seconds, and finalization occurs after two epochs (~12.8 minutes) using Casper-FFG. The Beacon Chain coordinates validators, while the fork-choice rule (LMD-GHOST) ensures the chain follows the heaviest accumulated validator votes. Validators earn rewards for proposing and verifying blocks, but face slashing for malicious behavior or inactivity. PoS aims to improve energy efficiency, security, and scalability, with future upgrades like Proto-Danksharding enhancing transaction efficiency.

S.5 Incentive Mechanisms and Applicable Fees

The crypto-asset's PoS system secures transactions through validator incentives and economic penalties. Validators stake at least 32 ETH and earn rewards for proposing blocks, attesting to valid ones, and participating in sync committees. Rewards are paid in newly issued ETH and transaction fees.

Under EIP-1559, transaction fees consist of a base fee, which is burned to reduce supply, and an optional priority fee (tip) paid to validators. Validators face slashing if they act maliciously and incur penalties for inactivity.

This system aims to increase security by aligning incentives while making the crypto-asset's fee structure more predictable and deflationary during high network activity.

S.9 Energy consumption sources and methodologies

For the calculation of energy consumptions, the so called 'bottom-up' approach is being used. The nodes are considered to be the central factor for the energy consumption of the network. These assumptions are made on the basis of empirical findings through the use of public information sites, open-source crawlers and crawlers developed in-house. The main determinants for estimating the hardware used within the network are the requirements for operating the client software. The energy consumption of the hardware devices was measured in certified test laboratories. When calculating the energy consumption, we used - if available - the Functionally Fungible Group Digital Token Identifier (FFG DTI) to determine all implementations of the asset of question in scope and we update the mappings regularly, based on data of the Digital Token Identifier Foundation. The information regarding the hardware used and the number of participants in the network is based on assumptions that are verified with best effort using empirical data. In general, participants are assumed to be largely economically rational. As a precautionary principle, we make assumptions on the conservative side when in doubt, i.e. making higher estimates for the adverse impacts.

S.15 Key energy sources and methodologies

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To determine the GHG Emissions, the locations of the nodes are to be determined using public information sites, open-source crawlers and crawlers developed in-house. If no information is available on the geographic distribution of the nodes, reference networks are used which are comparable in terms of their incentivization structure and consensus mechanism. This geo-information is merged with public information from Our World in Data, see citation. The intensity is calculated as the marginal emission wrt. one more transaction.

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Crypto Risk Metrics

The IDW PS 951-certified SaaS tool “Crypto Risk Metrics” supports regulated financial institutions in the risk-based assessment of cryptocurrencies, Delta-1 Certificates (“Crypto ETPs”) and tokenized securities. ESG data, market conformity checks and KARBV-compliant price data complete the product range.

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