BTCDirect

Sustainability indicators for crypto-assets

Disclosures pursuant to Article 66(5) MiCA

This report was provided by:

CRYPTO RISK METRICS
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2026-09-15

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Preamble

About the Crypto-Asset Service Provider (CASP)

Name of the CASP: BTC Direct Europe B.V.
Street and number: Kerkenbos 1025
City: Nijmegen
Country: Netherlands
LEI: 724500C4D3LQAKCEZ198

About this report

This disclosure serves as evidence of compliance with the regulatory requirements of Article 66(5) MiCA. Under this provision, crypto-asset service providers are required to disclose information on the principal adverse impacts on the climate and the environment. In particular, this disclosure complies with "Commission Delegated Regulation (EU) 2025/422 of 17 December 2024 supplementing Regulation (EU) 2023/1114 of the European Parliament and of the Council with regard to regulatory technical standards specifying the content, methodologies and presentation of information in respect of sustainability indicators in relation to adverse impacts on the climate and other environment-related adverse impacts". The optional information referred to in Article 6(8), points (a) to (d), of Delegated Regulation (EU) 2025/422 is not included.

This report remains valid until material changes occur in the underlying data, in which case it will be updated promptly.

Overview

This is an overview of the core indicator "energy consumption" and does not constitute the disclosure required under Article 66(5) MiCA. The full disclosure is set out below.

#	Crypto-Asset Name	Crypto-Asset FFG	Energy consumption (kWh per calendar year)
1	Bitcoin	V15WLZJMF	173,868,617,440.54
2	Dogecoin	35PLJP6J7	5,035,345,103.49
3	Litecoin	D74JZ1VRD	805,845,510.01
4	Bitcoin Cash	919BF3W7L	428,286,092.35
5	Ethereum Classic Ether	DGMQMFZD4	371,691,548.61
6	Solana SOL	6QZ1LNC12	6,843,750.00
7	USD Tether	L09Q657BK	4,292,427.38
8	TRON TRX	HZ9HHNPLG	4,026,391.76
9	Filecoin	S6702SWRZ	2,409,025.26

#	Crypto-Asset Name	Crypto-Asset FFG	Energy consumption (kWh per calendar year)
10	Ethereum Eth	D5RG2FHH0	2,159,953.20
11	Gram	KK12JMBTX	1,419,120.00
12	NEAR Protocol	MXXM59Z0T	920,357.21
13	Avalanche AVAX	S6JCBF70N	791,269.97
14	Cardano ADA	76QS7QCXB	773,946.00
15	Polkadot DOT	SGD9NLTRG	642,546.00
16	Ripple XRP	42PHJB2BS	456,260.56
17	USDC	TJWK5QTRK	431,856.78
18	Algorand	K8S6W74KS	420,961.80
19	Sui	64RFW3D8P	394,725.60
20	Aptos Coin	C4CQCGLH2	262,800.00
21	Injective Token	92M9B0DZ7	242,392.18
22	SEI	XCDVP53WR	210,305.17
23	Cosmos ATOM	6C7F2WVZH	186,478.44
24	Canton Coin	VQ9SP7NFH	184,222.80
25	Polygon POL	GB8DQ8DWN	96,601.45
26	Binance Coin	8N2VXJKB1	90,228.00
27	Hedera HBAR	2WWB8QS47	82,125.00
28	Hyperliquid	HLTPNVXN0	67,014.00
29	Mantle	QH1GF1J5H	53,410.95
30	Monad	/	53,348.40
31	Stellar Lumen	ZCN8SR2H7	52,560.00
32	Uniswap	XMB84LZBZ	7,084.60
33	ChainLink Token	3R3J70FDR	5,595.33
34	Aave Token	H618RN577	3,624.52

#	Crypto-Asset Name	Crypto-Asset FFG	Energy consumption (kWh per calendar year)
35	Pepe	J41R6PF81	3,553.63
36	SKY Governance Token	G4GDNF84C	2,650.66
37	SHIBA INU	M4HFTFNPC	2,256.49
38	EURC	13XTMPZT3	2,136.06
39	ENA	SPRSCSVSW	1,915.87
40	Ondo	WKH09L3DV	1,699.65
41	SPX6900	V9FVRLGKC	1,531.70
42	Bonk	H6KJTT0CP	1,305.25
43	Arbitrum	44TP35HF9	954.63
44	World Liberty Financial	3XVWCVFSX	944.78
45	Lido DAO Token	8W8GLGL65	822.71
46	Quant	L8M8X31JL	693.20
47	Worldcoin	BJD0TZ8V1	542.93
48	Optimism	9NRMM2RC4	432.58
49	OFFICIAL TRUMP	LJDPGNXXK	394.88
50	Render Token	XR0JSKLNZ	358.08
51	Aster	H8BH7VR5W	120.54

Sustainability indicators

Bitcoin

BTC | V15WLZJMF

Quantitative information

Quantitative sustainability indicators for Bitcoin

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Bitcoin	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	173868617440.53641	kWh/a
S.10 Renewable energy consumption	34.4781471084	%
S.11 Energy intensity	3.78507	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	71633185.57455	tCO2e
S.14 GHG intensity	1.55943	kgCO2e

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 regulary, 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. "Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Dogecoin

DOGE | 35PLJP6J7

Quantitative information

Quantitative sustainability indicators for Dogecoin

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Dogecoin	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	5035345103.48894	kWh/a
S.10 Renewable energy consumption	34.4781471084	%
S.11 Energy intensity	0.38050	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	2074542.35008	tCO2e
S.14 GHG intensity	0.15676	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Dogecoin (DOGE) uses a Proof of Work (PoW) consensus mechanism, similar to Bitcoin, but with some key differences.

Core Concepts :

1. Nodes and Miners:
   - Nodes: Nodes in the Dogecoin network are computers running the Dogecoin software. They validate transactions, maintain the blockchain, and relay information across the network.
   - Miners: Miners are specialized nodes that solve cryptographic puzzles to create new blocks and validate transactions. This process is known as mining.
2. Blockchain: The blockchain is a public ledger that records all Dogecoin 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: Dogecoin uses the Scrypt hash function, which is different from Bitcoin's SHA-256. Scrypt is designed to be more memory-intensive, making it more resistant to ASIC (Application-Specific Integrated Circuit) mining and encouraging more widespread participation by regular users with less powerful hardware.

Consensus Process:

1. Transaction Validation: Transactions are broadcast to the network and collected by miners into a block. Each transaction is validated by nodes to ensure it adheres to 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 Scrypt hash function, produces a hash below a certain target value. This target value is adjusted periodically to maintain a consistent block creation time.
   - Proof of Work: Finding a valid nonce requires significant computational effort. Once a miner finds a valid nonce, the new block is broadcast 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 repeats for 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.

Security and Economic Incentives:

1. Incentives for Miners:
   - Block Rewards: Miners are incentivized to participate in the network by receiving block rewards. Initially, Dogecoin had a variable block reward, but now it offers a fixed reward of 10,000 DOGE per block.
   - Transaction Fees: Miners also collect transaction fees from the transactions included in the block. These fees provide an additional incentive for miners.
2. Security:
   - Hash Rate and Difficulty: The security of the Dogecoin network is directly proportional to its hash rate, the total computational power of all miners. A higher hash rate means more difficult and costly attacks.
   - 51% Attack: An attacker would need to control more than 50% of the network's hash rate to double-spend or rewrite parts of the blockchain. The cost and resource requirement for such an attack make it impractical for a sufficiently large and decentralized network like Dogecoin.
3. Merged Mining: Dogecoin supports merged mining with Litecoin (LTC). This means miners can mine both Dogecoin and Litecoin simultaneously without additional computational effort. This enhances the security of both networks by pooling their hash rates.

S.5 Incentive Mechanisms and Applicable Fees

Dogecoin uses a Proof of Work (PoW) consensus mechanism to ensure network security and integrity, relying on economic incentives for miners and transaction fees from users.

Incentive Mechanisms

1. Miners:
   - Block Rewards: Miners receive block rewards for successfully mining new blocks. Initially, Dogecoin had a variable block reward, but it now offers a fixed reward of 10,000 DOGE per

block. These rewards are a primary incentive for miners to invest in the computational power necessary to secure the network.
- Transaction Fees: In addition to block rewards, miners also earn transaction fees from the transactions they include in the blocks they mine. Although Dogecoin's transaction fees are typically low, they still provide an important supplementary income for miners.
- Merged Mining: Dogecoin supports merged mining with Litecoin, allowing miners to simultaneously mine both cryptocurrencies without additional computational effort. This process increases the hash rate and security of both networks by pooling their resources.

2. Security:
- Hash Rate and Difficulty: The security of Dogecoin's network is directly related to its hash rate, the total computational power used by all miners. A higher hash rate makes the network more resistant to attacks. The mining difficulty adjusts periodically to ensure that blocks are mined approximately every minute, maintaining network stability. 51% Attack Deterrence: Controlling more than 50% of the network's hash rate to perform a 51% attack is costly and difficult. The significant computational power and energy required make such attacks impractical for a large and decentralized network like Dogecoin.

Fees Applicable on the Dogecoin Blockchain:

1. Transaction Fees:
- Flat Fee Structure: Dogecoin uses a relatively simple fee structure. The typical transaction fee is 1 DOGE per kilobyte of transaction data. This low fee is one of Dogecoin's appeals, making it suitable for small and micro-transactions.
- Incentives for Faster Processing: Although transaction fees are generally low, users can choose to pay higher fees to incentivize miners to include their transactions in the next block, ensuring faster processing times.

2. Mining Rewards:
- Block Subsidy: The fixed block reward of 10,000 DOGE incentivizes miners to continue securing the network. This reward will persist as Dogecoin does not have a maximum supply cap, ensuring continuous incentives for miners.
- Fee Inclusion: Besides the block subsidy, the inclusion of transaction fees provides an additional, albeit smaller, incentive for miners to process transactions efficiently.

S.9 Energy consumption sources and methodologies

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: Scrypt. 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 regulary, 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.

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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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. "Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Litecoin

LTC | D74JZ1VRD

Quantitative information

Quantitative sustainability indicators for Litecoin

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Litecoin	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	805845510.01207	kWh/a
S.10 Renewable energy consumption	34.4781471084	%
S.11 Energy intensity	0.03218	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	332005.17617	tCO2e
S.14 GHG intensity	0.01326	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Litecoin, like Bitcoin, uses Proof of Work (PoW) as its consensus mechanism, but with a few key differences:

1. Scrypt Hashing Algorithm: Unlike Bitcoin's SHA-256 algorithm, Litecoin uses the Scrypt hashing algorithm, which is more memory-intensive. This makes mining Litecoin more accessible to regular users and limits the advantages of specialized hardware (like ASICs) in the early years.
2. Mining and Block Creation: Miners compete to solve cryptographic puzzles and, upon success, add new blocks to the blockchain. This process involves solving the Scrypt algorithm, which requires computational work. The first miner to solve the problem earns the block reward and transaction fees associated with the transactions in the block.
3. Block Time: Litecoin has a block time of 2.5 minutes, much faster than Bitcoin's 10 minutes. This means transactions confirm more quickly, increasing the overall network speed.

4. Block Reward Halving: Similar to Bitcoin, Litecoin has a block reward halving event approximately every four years. Initially, miners earned 50 LTC per block, but this reward decreases by half after each halving event. This process continues until the maximum supply of 84 million LTC is reached.
5. Difficulty Adjustment: Litecoin adjusts the mining difficulty approximately every 2,016 blocks (about every 3.5 days) to ensure that blocks continue to be mined at a consistent rate of 2.5 minutes per block, regardless of fluctuations in the total network hash rate.

S.5 Incentive Mechanisms and Applicable Fees

Litecoin, like Bitcoin, uses the Proof of Work (PoW) consensus mechanism to secure transactions and incentivize miners.

Incentive Mechanisms:

1. Mining Rewards:
   Block Rewards: Miners are rewarded with Litecoin (LTC) for successfully mining new blocks. Initially, miners received 50 LTC per block, but this reward halves approximately every four years. Transaction Fees: Miners also earn transaction fees from the transactions included in the blocks they mine. Users pay fees to have their transactions processed by miners, especially when they need faster confirmation times.
2. Halving:
   The halving mechanism ensures that over time, fewer Litecoins are introduced into circulation, creating a deflationary model. This makes mining more valuable as the circulating supply becomes scarcer, incentivizing miners to continue participating in the network even as block rewards decrease.
3. Economic Security:
   The cost of mining (e.g., hardware and electricity) provides a strong economic incentive for miners to act honestly. If miners attempt to cheat or attack the network, they risk losing the computational work they invested, as invalid blocks will be rejected by the network.

Fees on the Litecoin Blockchain:

- Transaction Fees: Litecoin users pay a transaction fee for each transaction, typically calculated in LTC per byte of transaction data. The fees are dynamic and vary based on network congestion.
- Low Fees: Litecoin is known for its relatively low transaction fees compared to other blockchains like Bitcoin, which makes it ideal for smaller transactions and micro-payments.
- Fee Redistribution: Collected transaction fees are distributed to miners as part of their rewards for validating transactions and securing the network.

S.9 Energy consumption sources and methodologies

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: Scrypt. 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 regulary, 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.

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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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. “Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Bitcoin Cash

BCH | 919BF3W7L

Quantitative information

Quantitative sustainability indicators for Bitcoin Cash

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Bitcoin Cash	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	428286092.35424	kWh/a
S.10 Renewable energy consumption	34.4781471084	%
S.11 Energy intensity	0.07150	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	176452.18317	tCO2e
S.14 GHG intensity	0.02946	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Bitcoin Cash is present on the following networks: Bitcoin Cash, Smart Bitcoin Cash.

The Bitcoin Cash blockchain network uses a consensus mechanism called Proof of Work (PoW) to achieve distributed consensus among its nodes. It originated from the Bitcoin blockchain, hence has the same consensus mechanisms but with a larger block size, which makes it more centralized.

Core Concepts:

1. Nodes and Miners:
   - Nodes: Nodes are computers running the Bitcoin Cash 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 Cash 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 Cash 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.

Smart Bitcoin Cash (SmartBCH) operates as a sidechain to Bitcoin Cash (BCH), leveraging a hybrid consensus mechanism combining Proof of Work (PoW) compatibility and validator-based validation.

Core Components:
- Proof of Work Compatibility: SmartBCH relies on Bitcoin Cash's PoW for settlement and security, ensuring robust integration with BCH’s main chain. SHA-256 Algorithm: Uses the same SHA-256 hashing algorithm as Bitcoin Cash, allowing compatibility with existing mining hardware and infrastructure.
- Consensus via Validators: Transactions within SmartBCH are validated by a set of validators chosen based on staking and operational efficiency. This hybrid approach combines the hash power of PoW with a validator-based model to enhance scalability and flexibility.

S.5 Incentive Mechanisms and Applicable Fees

Bitcoin Cash is present on the following networks: Bitcoin Cash, Smart Bitcoin Cash.

The Bitcoin Cash blockchain operates on a Proof-of-Work (PoW) consensus mechanism, with incentives and fee structures designed to support miners and the overall network's sustainability:

Incentive Mechanism:

1. Block Rewards:
   - Newly Minted Bitcoins: Miners receive a block reward, which consists of newly created bitcoins for successfully mining a new block. Initially, the reward was 50 BCH, but it halves approximately every four years in an event known as the "halving."
   - Halving and Scarcity: The halving ensures that the total supply of Bitcoin Cash is capped at 21 million BCH, creating scarcity that could drive up value over time.
2. Transaction Fees:
   - User Fees: Each transaction includes a fee, paid by users, that incentivizes miners to include the transaction in a new block. This fee market becomes increasingly important as block rewards decrease over time due to the halving events.
   - Fee Market: Transaction fees are market-driven, with users competing to get their transactions included quickly. Higher fees lead to faster transaction processing, especially during periods of high network congestion.

Applicable Fees:

1. Transaction Fees:
   Bitcoin Cash transactions require a small fee, paid in BCH, which is determined by the transaction's size and the network demand at the time. These fees are crucial for the continued operation of the network, particularly as block rewards decrease over time due to halvings.
2. Fee Structure During High Demand:
   In times of high congestion, users may choose to increase their transaction fees to prioritize their transactions for faster processing. The fee structure ensures that miners are incentivized to prioritize higher-fee transactions.

SmartBCH's incentive model encourages validators and network participants to secure the sidechain and process transactions efficiently.

Incentive Mechanisms:

- Validator Rewards: Validators are rewarded with a share of transaction fees for their role in validating transactions and maintaining the network.
- Economic Alignment: The system incentivizes validators to act in the network's best interest, ensuring stability and fostering adoption through economic alignment.

Applicable Fees:

Transaction Fees: Fees for transactions on SmartBCH are paid in BCH, ensuring seamless integration with the Bitcoin Cash ecosystem.

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 '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 regulary, 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.

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 regulary, 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. “Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Ethereum Classic Ether

ETC | DGMQMFZD4

Quantitative information

Quantitative sustainability indicators for Ethereum Classic Ether

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Ethereum Classic Ether	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	371691548.61266	kWh/a
S.10 Renewable energy consumption	34.4781471084	%
S.11 Energy intensity	0.10661	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	153135.45406	tCO2e
S.14 GHG intensity	0.04392	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Ethereum Classic operates on a Proof of Work (PoW) consensus mechanism with the Etchash algorithm, which is a modified version of Ethash. This PoW model requires computational work from miners to validate transactions and secure the network.

Core Components:

- Proof of Work with Etchash Mining and Security: Miners use computational resources to perform the work necessary to add blocks to the blockchain, ensuring network security and resistance to tampering.
- Code is Law Philosophy Immutable Ledger: Following the 2016 DAO hack, Ethereum Classic upheld the “Code is Law” principle by retaining the unaltered blockchain. This commitment to immutability sets Ethereum Classic apart, preserving its original ledger without reverting transactions.

S.5 Incentive Mechanisms and Applicable Fees

Ethereum Classic's incentive model combines block rewards and transaction fees, encouraging miner participation and network security.

Incentive Mechanisms:

1. Block Rewards:
   Deflationary Supply Model: Miners receive ETC through block rewards, which decrease over time, similar to Bitcoin's model. This deflationary design supports ETC's value retention and incentivizes continued mining efforts.
2. Transaction Fees:
   User-Paid Fees: Users pay fees in ETC for sending transactions, interacting with smart contracts, and utilizing dApps. These fees provide miners with additional income and help maintain network security.

Applicable Fees: Ethereum Classic's fee structure involves user-paid transaction fees to support network operations and discourage spam transactions.

1. Transaction Fees:
   - User-Paid Fees: Every transaction on Ethereum Classic incurs a fee in ETC, based on the computational effort required. These fees ensure that resources are efficiently used and contribute to miner revenue.
   - Dynamic Demand-Based Fees: Fees vary according to transaction complexity and network demand, helping maintain transaction efficiency and preventing congestion.
2. Mining Rewards:
   Block Rewards Reduction: Block rewards, which are scheduled to reduce over time, provide a primary income source for miners. This model aims to balance network security while managing ETC's supply.

S.9 Energy consumption sources and methodologies

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: Etchash. 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 regulary, 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. "Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Solana SOL

SOL | 6QZ1LNC12

Quantitative information

Quantitative sustainability indicators for Solana SOL

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Solana SOL	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	6843750.00000	kWh/a
S.10 Renewable energy consumption	38.5831139958	%
S.11 Energy intensity	0.00000	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	2319.13534	tCO2e
S.14 GHG intensity	0.00000	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.

2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.
4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.
2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

S.5 Incentive Mechanisms and Applicable Fees

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.
   - Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.
2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.
3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

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 regulary, 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. "Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

USD Tether

USDT | L09Q657BK

Quantitative information

Quantitative sustainability indicators for USD Tether

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	USD Tether	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	4292427.37563	kWh/a
S.10 Renewable energy consumption	33.8673491363	%
S.11 Energy intensity	0.00001	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	1662.14567	tCO2e
S.14 GHG intensity	0.00000	kgCO2e

Qualitative information

S.4 Consensus Mechanism

USD Tether is present on the following networks: Aptos Coin, Avalanche, Bitcoin Liquid, Celo, Ethereum, Kava, Near Protocol, Solana, Statemint, Tezos, Toncoin, Tron.

Aptos utilizes a Proof-of-Stake approach combined with a BFT consensus protocol to ensure high throughput, low latency, and secure transaction processing.

Core Components:

- Parallel Execution: Transactions are processed concurrently using Block-STM, a parallel execution engine, enabling high performance and scalability.
- Leader-Based BFT: A leader is selected among validators to propose blocks, while others validate and finalize transactions.
- Dynamic Validator Rotation: Validators are rotated regularly, enhancing decentralization and preventing collusion.
- Instant Finality: Transactions achieve finality once validated, ensuring that they are irreversible.

The Avalanche C-Chain uses the Snowman++ consensus mechanism, which is Avalanche's consensus model for linear blockchains and is implemented through the ProposerVM wrapper. Under this model, validators repeatedly query a small random subset of other validators and converge on a preferred block once the required confidence thresholds are met. Only Primary Network validators are entitled to validate the C-Chain. To participate as a validator on Avalanche mainnet, a node must stake a minimum number of token. Token holders may also participate indirectly by delegating an existing validator. Validator identity and admission to staking require the relevant staking credentials, including BLS proofs of possession under the current staking framework. For block production, Snowman++ uses stake-weighted proposer windows. Through the ProposerVM, block-building opportunities are assigned to proposers in 5-second windows, after which block production may fall back more broadly to validators if necessary. This mechanism is intended to regulate block production while preserving network liveness. Consensus voting itself remains based on repeated sub-sampled polling rather than fixed validator committees. Avalanche documentation describes the finality model as sub-second and treated by the protocol as final and irreversible once accepted, while noting that safety is probabilistic in the formal sense because the probability of conflicting acceptance can be reduced to an arbitrarily low level through the protocol parameters. The protocol does not rely on slashing of staked principal. Instead, validator reward eligibility depends on compliance with protocol conditions, including uptime requirements.

The Liquid Network is a Layer 2 solution on Bitcoin designed for fast, confidential transactions and asset issuance, secured by a federated model called Strong Federations. Instead of using Bitcoin's Proof of Work, the Liquid Network relies on trusted functionaries for consensus.

Core Components:

1. Federated Model:
   Trusted Functionaries: The Liquid Network is secured by a group of trusted entities, such as exchanges and financial institutions, called functionaries. This model provides faster transaction speeds by limiting consensus to a small, trusted group.
2. Role of Functionaries:
   - Block Signers: Functionaries are responsible for validating transactions and creating blocks. Blocks are confirmed when two-thirds of functionaries sign, ensuring secure and quick consensus.
   - Watchmen: Functionaries responsible for overseeing the peg-in and peg-out process between Bitcoin and the Liquid Network, ensuring that Liquid Bitcoin (L-BTC) is always backed by real Bitcoin.
3. Block Creation and Validation:
   - Regular Block Intervals: Blocks are produced every minute without mining, relying on multi-signature validation by block signers.
   - Multi-Signature Approval: At least two-thirds of block signers must validate and sign each block, preventing any single entity from controlling block production.
4. Peg-in and Peg-out Mechanism:
   - Peg-in Process: Users move Bitcoin onto the Liquid Network by sending it to a multi-signature address. In return, an equivalent amount of L-BTC is issued.
   - Peg-out Process: To move Bitcoin back to the Bitcoin blockchain, users initiate a peg-out, where Watchmen release the corresponding Bitcoin.
5. Confidential Transactions:
   Privacy with Confidential Transactions (CT): Liquid uses CT to hide transaction amounts, ensuring privacy while allowing functionaries to verify transaction validity. This feature is essential for financial institutions and users who require privacy.

Celo uses a Proof of Stake (PoS) consensus model, which supports a decentralized, community-driven approach to governance and network security.

Core Components of Celo's Consensus:

1. Proof of Stake (PoS):
   Validator Role: Validators are responsible for creating new blocks, validating transactions, and maintaining the security and integrity of the network. Validators are selected based on the amount of CELO tokens they hold and stake, incentivizing honest participation and network reliability.
2. Decentralized Governance:
   Community Voting: Governance on Celo is decentralized, allowing CELO token holders to vote on proposals and changes to the network. This community-driven approach ensures that token holders have a say in the network's development and strategic direction.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Kava employs the Tendermint Core consensus engine with a Proof of Stake (PoS) model, ensuring security, scalability, and decentralized decision-making.

Core Components:

- Tendermint Core (PBFT): A Practical Byzantine Fault Tolerance-based consensus engine provides fast block finality and ensures consistent transaction validation.
- Proof of Stake (PoS): Validators are selected based on the amount of KAVA tokens staked, with the top 100 nodes by bonded stake responsible for validating blocks.
- Validator Selection and Accountability: A slashing mechanism penalizes validators for malicious actions like double-signing or extended downtime, encouraging honest and reliable participation.

The NEAR Protocol uses a unique consensus mechanism combining Proof of Stake (PoS) and a novel approach called Doomslug, which enables high efficiency, fast transaction processing, and secure finality in its operations.

Core Concepts:

1. Doomslug and Proof of Stake:
   - NEAR's consensus mechanism primarily revolves around PoS, where validators stake NEAR tokens to participate in securing the network. However, NEAR's implementation is enhanced with the Doomslug protocol.

- Doomslug allows the network to achieve fast block finality by requiring blocks to be confirmed in two stages. Validators propose blocks in the first step, and finalization occurs when two-thirds of validators approve the block, ensuring rapid transaction confirmation.

2. Sharding with Nightshade:
   - NEAR uses a dynamic sharding technique called Nightshade. This method splits the network into multiple shards, enabling parallel processing of transactions across the network, thus significantly increasing throughput. Each shard processes a portion of transactions, and the outcomes are merged into a single "snapshot" block.
   - This sharding approach ensures scalability, allowing the network to grow and handle increasing demand efficiently.

Consensus Process:

1. Validator Selection:
   - Validators are selected to propose and validate blocks based on the amount of NEAR tokens staked. This selection process is designed to ensure that only validators with significant stakes and community trust participate in securing the network.
2. Transaction Finality:
   - NEAR achieves transaction finality through its PoS-based system, where validators vote on blocks. Once two-thirds of validators approve a block, it reaches finality under Doomslug, meaning that no forks can alter the confirmed state.
3. Epochs and Rotation:
   - Validators are rotated in epochs to ensure fairness and decentralization. Epochs are intervals in which validators are reshuffled, and new block proposers are selected, ensuring a balance between performance and decentralization.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.

2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.
4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.
2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

Statemint is a common-good parachain on the Polkadot and Kusama networks, designed to handle asset management and issuance efficiently while leveraging Polkadot's shared security model.

Core Components:

- Relay Chain Integration: Statemint inherits its consensus mechanism from the Polkadot Relay Chain, which operates on a Nominated Proof of Stake (NPoS) model. This model ensures robust security and decentralization by relying on validators and nominators.
- Shared Security: As a parachain, Statemint utilizes the Polkadot Relay Chain's validators for block validation, ensuring high security and interoperability without requiring independent validators.
- Collator Nodes: Statemint employs collator nodes to aggregate transactions into blocks and submit them to the Relay Chain validators for finalization. Collators do not participate in consensus directly but play a key role in transaction processing.
- Immediate Finality: The underlying Polkadot consensus mechanism ensures instant finality using the GRANDPA (GHOST-based Recursive Ancestor Deriving Prefix Agreement) protocol, which provides secure and efficient transaction confirmation.

Tezos operates on a Liquid Proof of Stake (LPoS) consensus mechanism, which combines flexibility in staking participation with an on-chain governance model.

Core Components:

Liquid Proof of Stake (LPoS) Tezos allows token holders to participate in staking by either directly staking their tokens or delegating them to a validator (known as a baker) without transferring ownership. Validators (bakers) are responsible for creating new blocks (baking) and endorsing other blocks for validation. Bakers and Endorsers Bakers are selected based on the amount of XTZ (Tezos tokens) staked or delegated to them. The more XTZ staked, the higher the probability of being chosen to bake or endorse blocks. Endorsers are randomly selected from a pool of bakers to validate and approve blocks baked by other bakers. This additional validation enhances network security. Self-Amendment and Governance Tezos's unique governance model allows token holders to propose, vote on, and implement network upgrades without requiring hard forks. This self-amendment protocol enables Tezos to evolve based on community and developer input, making it highly adaptable and flexible.

The Open Network uses a Proof-of-Stake (PoS) consensus mechanism based on the Catchain protocol. Validators stake GRAM to participate in block production, transaction validation, and network security. Catchain provides Byzantine Fault Tolerant (BFT) consensus across the network's sharded architecture, enabling multiple shardchains to process transactions in parallel while maintaining a consistent global state. Validators are selected and rotated periodically, and once consensus is reached, blocks achieve deterministic finality.

The Tron blockchain operates on a Delegated Proof of Stake (DPoS) consensus mechanism, designed to improve scalability, transaction speed, and energy efficiency.

Core Components:

1. Delegated Proof of Stake (DPoS): Tron uses DPoS, where token holders vote for a group of delegates known as Super Representatives (SRs)who are responsible for validating transactions and producing new blocks on the network. Token holders can vote for SRs based on their stake in the Tron network, and the top 27 SRs (or more, depending on the protocol version) are selected to participate in the block production process. SRs take turns producing blocks, which are added to the blockchain. This is done on a rotational basis to ensure decentralization and prevent control by a small group of validators.
2. Block Production: The Super Representatives generate new blocks and confirm transactions. The Tron blockchain achieves block finality quickly, with block production occurring every 3 seconds, making it highly efficient and capable of processing thousands of transactions per second.
3. Voting and Governance: Tron's DPoS system also allows token holders to vote on important network decisions, such as protocol upgrades and changes to the system's parameters. Voting power is proportional to the amount of TRX (Tron's native token) that a user holds and chooses to stake. This provides a governance system where the community can actively participate in decision-making.
4. Super Representatives: The Super Representatives play a crucial role in maintaining the security and stability of the Tron blockchain. They are responsible for validating transactions, proposing new blocks, and ensuring the overall functionality of the network. Super Representatives are incentivized with block rewards (newly minted TRX tokens) and transaction feesfor their work.

S.5 Incentive Mechanisms and Applicable Fees

USD Tether is present on the following networks: Aptos Coin, Avalanche, Bitcoin Liquid, Celo, Ethereum, Kava, Near Protocol, Solana, Statemint, Tezos, Toncoin, Tron.

Incentive Mechanism:

- Validator Rewards: Validators earn rewards in APT tokens for validating transactions and producing blocks. Rewards are distributed proportionally based on the stake of validators and their delegators.
- Delegator Participation: APT token holders can delegate their tokens to validators, earning a share of the staking rewards without running their own nodes.
- Slashing Mechanism: Validators face penalties, such as losing staked tokens, for malicious actions or prolonged inactivity, ensuring accountability and network security.

Applicable Fees:

- Transaction Fees: Users pay transaction fees in APT tokens for sending transactions and interacting with smart contracts.
- Dynamic Fee Adjustment: Fees are dynamically adjusted based on network activity and resource usage, ensuring cost efficiency and preventing congestion.
- Fee Distribution: Transaction fees are distributed among validators and delegators, providing an additional incentive for network participation.

The Avalanche C-Chain is secured economically through the native AVAX token. Validator incentives are based primarily on staking rewards, not on redistribution of C-Chain transaction fees. A fixed amount of 360 million AVAX was minted at genesis, while additional AVAX is minted over time as validator rewards, subject to Avalanche's capped token supply framework. Validator rewards are paid at the end of the staking period and are determined by factors such as the validator's stake and compliance with staking conditions. Unlike some proof-of-stake systems, the Avalanche Primary Network does not use slashing of bonded principal as an ordinary penalty mechanism. Instead, the main protocol-level economic consequence for underperformance is the loss of reward eligibility. Where a validator fails to satisfy the applicable uptime requirement during its staking term, that validator does not receive the corresponding staking reward. Transaction fees apply on the C-Chain for transfers and smart-contract execution. The fee model follows EIP-1559 logic, meaning that transactions are priced through a dynamic base fee mechanism. In contrast to Ethereum's validator tip model, C-Chain transaction fees are burned rather than distributed to validators. This means that C-Chain fees function as a supply-reduction mechanism and are intended in part to offset inflation arising from the minting of validator rewards. In addition to ordinary transaction and smart-contract execution fees, Avalanche documentation also recognises protocol fees in connection with other network operations on other chains of the Primary Network, such as certain import or export operations and staking-related actions. However, for the C-Chain itself, the core applicable fee category is the gas fee for transaction inclusion and contract execution, and those fees are handled through the protocol burn mechanism rather than paid to validators or a treasury.

Liquid's federated model incentivizes functionaries to maintain network security, with transaction fees as the primary source of income for network operations and validator rewards.

Incentive Mechanisms:

- Transaction Fees: User-Paid Fees: Each transaction on the Liquid Network incurs a fee paid in L-BTC. These fees are awarded to functionaries (specifically block signers), providing an incentive to validate and maintain the network

Applicable Fees:

- Transaction Fees: Minimal Transaction Costs: Fees on the Liquid Network are generally low, encouraging high-volume transactions.

- Confidential Transaction Costs: Confidential Transactions, while private, may incur slightly higher fees due to additional cryptographic processes.

Celo's incentive model rewards validators and prioritizes accessibility with minimal transaction fees, especially for cross-border payments, supporting a flexible and user-friendly ecosystem.

Incentive Mechanisms:

1. Validator Rewards:
   Transaction Fees and Newly Minted Tokens: Validators earn rewards from transaction fees as well as newly minted CELO tokens. This dual-source reward system provides a continuous financial incentive for validators to act honestly and secure the network.
2. Transaction Flexibility and Gas Price:
   - Gas Limit and Price Control: Each transaction specifies a maximum gas limit, ensuring that users are not excessively charged if a transaction fails. Users can also set a gas price to prioritize transactions, allowing faster processing for higher fees.
   - Payment Flexibility with Multiple Currencies: Unlike many blockchains, Celo allows transaction fees to be paid in various ERC-20 tokens, providing flexibility for users. This approach improves accessibility, especially for individuals with limited access to traditional banking.
3. Minimal Fee Structure for Accessibility:
   - Designed for Low-Cost Transactions: Celo's fee structure is intentionally minimal, particularly for cross-border payments, making it ideal for users who may not have traditional banking options. This focus on accessibility aligns with Celo's mission to bring blockchain technology to underserved communities.

Applicable Fees:

Transaction Fees: Fees are calculated based on gas usage, with a maximum gas limit set per transaction. This limit protects users from excessive costs, while the option to pay in multiple currencies enhances flexibility.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Kava incentivizes network security and active participation through rewards and an inflationary model, aligning stakeholders' interests.

Incentive Mechanisms:

Validator Rewards:
Validators earn rewards in KAVA tokens from block rewards and transaction fees, compensating them for securing the network and processing transactions.

Staking Rewards:
KAVA holders can delegate their tokens to validators to earn a share of rewards while participating in network governance.

Applicable Fees:

Transaction Fees:
Users pay fees in KAVA tokens for transactions, which are distributed among validators and delegators, supporting network maintenance.
Inflation Mechanism:
New KAVA tokens are minted to fund ecosystem initiatives like Kava Rise, which supports decentralization, security, and ecosystem stability.

NEAR Protocol employs several economic mechanisms to secure the network and incentivize participation.

Incentive Mechanisms to Secure Transactions:

1. Staking Rewards:
Validators and delegators secure the network by staking NEAR tokens. Validators earn around 5% annual inflation, with 90% of newly minted tokens distributed as staking rewards. Validators propose blocks, validate transactions, and receive a share of these rewards based on their staked tokens. Delegators earn rewards proportional to their delegation, encouraging broad participation.
2. Delegation:
Token holders can delegate their NEAR tokens to validators to increase the validator's stake and improve the chances of being selected to validate transactions. Delegators share in the validator's rewards based on their delegated tokens, incentivizing users to support reliable validators.
3. Slashing and Economic Penalties:
Validators face penalties for malicious behavior, such as failing to validate correctly or acting dishonestly. The slashing mechanism enforces security by deducting a portion of their staked tokens, ensuring validators follow the network's best interests.
4. Epoch Rotation and Validator Selection:
Validators are rotated regularly during epochs to ensure fairness and prevent centralization. Each epoch reshuffles validators, allowing the protocol to balance decentralization with performance.

Fees on the NEAR Blockchain:

1. Transaction Fees:
Users pay fees in NEAR tokens for transaction processing, which are burned to reduce the total circulating supply, introducing a potential deflationary effect over time. Validators also receive a portion of transaction fees as additional rewards, providing an ongoing incentive for network maintenance.
2. Storage Fees:
NEAR Protocol charges storage fees based on the amount of blockchain storage consumed by accounts, contracts, and data. This requires users to hold NEAR tokens as a deposit proportional to their storage usage, ensuring the efficient use of network resources.
3. Redistribution and Burning:
A portion of the transaction fees (burned NEAR tokens) reduces the overall supply, while the rest is distributed to validators as compensation for their work. The burning mechanism helps maintain long-term economic sustainability and potential value appreciation for NEAR holders.

4. Reserve Requirement:
   Users must maintain a minimum account balance and reserves for data storage, encouraging efficient use of resources and preventing spam attacks.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.
   - Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.
2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.
3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

Statemint is a common-good parachain on the Polkadot and Kusama networks, designed to enable efficient asset management while benefiting from Polkadot's shared security and governance model.

Incentive Mechanisms:

- Relay Chain Validators: Validators securing the Polkadot Relay Chain are indirectly incentivized through block rewards and transaction fees collected across all parachains, including Statemint. This ensures the stability and security of the network without requiring Statemint-specific rewards.
- Collator Compensation: Collator nodes aggregate transactions and produce blocks for Statemint. They may be compensated through external arrangements, such as subsidies or user-driven incentives, depending on governance decisions and usage patterns.
- Governance Participation: Polkadot (DOT) and Kusama (KSM) token holders influence Statemint's operations, such as fee adjustments and protocol upgrades, through on-chain governance mechanisms.

Applicable Fees:

- Transaction Fees: Users pay transaction fees in the native tokens of the Relay Chain, DOT for Polkadot or KSM for Kusama. These fees are distributed to Relay Chain validators to support the network's maintenance.
- Asset Creation and Transfer Fees: Fees apply for creating new assets and transferring them on the Statemint chain. These fees help prevent spam and ensure efficient use of network resources.
- Governance-Defined Fee Adjustments: The Statemint parachain's fees can be adjusted through governance proposals, enabling the community to adapt costs to network conditions.

Tezos incentivizes network participation and security through baking rewards, transaction fees, and an inflationary reward model.

Incentive Mechanisms:

Rewards for Baking and Endorsing Bakers receive XTZ rewards for baking new blocks. Endorsers, who validate and approve blocks baked by others, are also rewarded in XTZ. These rewards encourage active participation and help secure the network. Delegation Incentives XTZ holders who do not wish to bake can delegate their tokens to a baker, earning a share of the baker's rewards without directly participating. This delegation option broadens participation, making it accessible to more users, thereby enhancing overall network security. Security Deposit Requirement Bakers are required to post a bond (security deposit) in XTZ to bake blocks, which is held as collateral to prevent dishonest actions. If a baker acts maliciously, they risk forfeiting this bond, creating a disincentive for bad behavior and aligning bakers' interests with network integrity.

Applicable Fees:

Transaction Fees Users pay transaction fees in XTZ for activities such as transferring funds and interacting with smart contracts. These fees are awarded to bakers and endorsers, providing them with an additional incentive to validate and secure the network. Inflationary Reward Model Tezos has an inflationary reward system, where new XTZ tokens are periodically created and distributed as rewards to bakers and endorsers. This model encourages continuous participation but gradually increases the XTZ supply, balancing network security and token availability over time.

The Open Network incentivizes network participation through staking rewards and transaction fees. Validators receive rewards for producing blocks, validating transactions, and maintaining network security, with rewards distributed according to their participation and stake. Transaction fees are paid in GRAM and vary depending on the computational resources required by a transaction. The protocol also applies penalties to validators that fail to meet their obligations or act maliciously, encouraging reliable network operation and honest participation.

The Tron blockchain uses a Delegated Proof of Stake (DPoS) consensus mechanism to secure its network and incentivize participation.

Incentive Mechanism:

1. Super Representatives (SRs) Rewards:
   - Block Rewards: Super Representatives (SRs), who are elected by TRX holders, are rewarded for producing blocks. Each block they produce comes with a block reward in the form of TRX tokens.
   - Transaction Fees: In addition to block rewards, SRs receive transaction fees for validating transactions and including them in blocks. This ensures they are incentivized to process transactions efficiently.
2. Voting and Delegation:
   - TRX Staking: TRX holders can stake their tokens and vote for Super Representatives (SRs). When TRX holders vote, they delegate their voting power to SRs, which allows SRs to earn rewards in the form of newly minted TRX tokens.
   - Delegator Rewards: Token holders who delegate their votes to an SR can also receive a share of the rewards. This means delegators share in the block rewards and transaction fees that the SR earns.
   - Incentivizing Participation: The more tokens a user stakes, the more voting power they have, which encourages participation in governance and network security.
3. Incentive for SRs:
   SRs are also incentivized to maintain the health and performance of the network. Their reputation and continued election depend on their ability to produce blocks consistently and efficiently process transactions.

Applicable Fees:

1. Transaction Fees:
   - Fee Calculation: Users must pay transaction fees to have their transactions processed. The transaction fee varies based on the complexity of the transaction and the network's current demand. This is paid in TRX tokens. Transaction
   - Fee Distribution: Transaction fees are distributed to Super Representatives (SRs), giving them an ongoing income to maintain and support the network.
2. Storage Fees:
   Tron charges storage fees for data storage on the blockchain. This includes storing smart contracts, tokens, and other data on the network. Users are required to pay these fees in TRX tokens to store data.
3. Energy and Bandwidth:
   Energy: Tron uses a resource model that allows users to access network resources like bandwidth and energy through staking. Users who stake their TRX tokens receive \energy

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) aptos_coin, avalanche, bitcoin_liquid, celo, ethereum, kava, near_protocol, solana, statemint, tezos, toncoin, tron 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. "Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

TRON TRX

TRX | HZ9HHNPLG

Quantitative information

Quantitative sustainability indicators for TRON TRX

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	TRON TRX	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	4026391.76148	kWh/a
S.10 Renewable energy consumption	33.4000000171	%
S.11 Energy intensity	0.00002	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	1582.37196	tCO2e
S.14 GHG intensity	0.00001	kgCO2e

Qualitative information

S.4 Consensus Mechanism

TRON TRX is present on the following networks: Base, Tron.

Base does not operate its own consensus mechanism or decentralised validator set comparable to a Layer-1 blockchain. As an optimistic rollup Layer-2 network, Base relies on Ethereum's Proof-of-Stake consensus for the finality and settlement of data and state commitments posted to Ethereum Layer 1. Transaction ordering on Base is performed by a sequencer, currently operated by Coinbase. This sequencing function provides transaction ordering and execution on the Layer-2 network but does not constitute a decentralised consensus mechanism. The validity of Layer-2 state transitions is supported by an optimistic fault-proof mechanism, under which incorrect state commitments may be challenged during the applicable dispute period. Accordingly, Base's security model depends on Ethereum Layer 1 for settlement and finality, while Layer-2 transaction ordering remains dependent on the sequencer.

The Tron blockchain operates on a Delegated Proof of Stake (DPoS) consensus mechanism, designed to improve scalability, transaction speed, and energy efficiency.

Core Components:

1. Delegated Proof of Stake (DPoS): Tron uses DPoS, where token holders vote for a group of delegates known as Super Representatives (SRs)who are responsible for validating transactions and producing new blocks on the network. Token holders can vote for SRs based on their stake in the Tron network, and the top 27 SRs (or more, depending on the protocol version) are selected to participate in the block production process. SRs take turns producing blocks, which are added to the blockchain. This is done on a rotational basis to ensure decentralization and prevent control by a small group of validators.
2. Block Production: The Super Representatives generate new blocks and confirm transactions. The Tron blockchain achieves block finality quickly, with block production occurring every 3 seconds, making it highly efficient and capable of processing thousands of transactions per second.
3. Voting and Governance: Tron's DPoS system also allows token holders to vote on important network decisions, such as protocol upgrades and changes to the system's parameters. Voting power is proportional to the amount of TRX (Tron's native token) that a user holds and chooses to stake. This provides a governance system where the community can actively participate in decision-making.
4. Super Representatives: The Super Representatives play a crucial role in maintaining the security and stability of the Tron blockchain. They are responsible for validating transactions, proposing new blocks, and ensuring the overall functionality of the network. Super Representatives are incentivized with block rewards (newly minted TRX tokens) and transaction feesfor their work.

S.5 Incentive Mechanisms and Applicable Fees

TRON TRX is present on the following networks: Base, Tron.

Base does not have a native protocol token and does not operate a staking, validator reward or token issuance mechanism. Transaction fees on Base are paid in ETH. The economic incentives within the network are primarily related to transaction processing and network security. Transactions are executed on Base and periodically submitted to Ethereum Layer 1 in batches. As the cost of a Layer-1 submission is shared among multiple Layer-2 transactions, the average transaction cost per transaction may be lower than executing the same transactions directly on Ethereum Layer 1. The integrity of withdrawals from Base is supported by a fault-proof mechanism. Withdrawals are subject to a dispute period during which participants may challenge incorrect state commitments. The dispute process incorporates economic incentives intended to encourage honest behaviour and discourage invalid claims.

The Tron blockchain uses a Delegated Proof of Stake (DPoS) consensus mechanism to secure its network and incentivize participation.

Incentive Mechanism:

1. Super Representatives (SRs) Rewards:
   - Block Rewards: Super Representatives (SRs), who are elected by TRX holders, are rewarded for producing blocks. Each block they produce comes with a block reward in the form of TRX tokens.
   - Transaction Fees: In addition to block rewards, SRs receive transaction fees for validating transactions and including them in blocks. This ensures they are incentivized to process transactions efficiently.

2. Voting and Delegation:
   - TRX Staking: TRX holders can stake their tokens and vote for Super Representatives (SRs). When TRX holders vote, they delegate their voting power to SRs, which allows SRs to earn rewards in the form of newly minted TRX tokens.
   - Delegator Rewards: Token holders who delegate their votes to an SR can also receive a share of the rewards. This means delegators share in the block rewards and transaction fees that the SR earns.
   - Incentivizing Participation: The more tokens a user stakes, the more voting power they have, which encourages participation in governance and network security.
3. Incentive for SRs:
   SRs are also incentivized to maintain the health and performance of the network. Their reputation and continued election depend on their ability to produce blocks consistently and efficiently process transactions.

Applicable Fees:

1. Transaction Fees:
   - Fee Calculation: Users must pay transaction fees to have their transactions processed. The transaction fee varies based on the complexity of the transaction and the network's current demand. This is paid in TRX tokens. Transaction
   - Fee Distribution: Transaction fees are distributed to Super Representatives (SRs), giving them an ongoing income to maintain and support the network.
2. Storage Fees:
   Tron charges storage fees for data storage on the blockchain. This includes storing smart contracts, tokens, and other data on the network. Users are required to pay these fees in TRX tokens to store data.
3. Energy and Bandwidth:
   Energy: Tron uses a resource model that allows users to access network resources like bandwidth and energy through staking. Users who stake their TRX tokens receive \energy

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 '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 regulary, 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) base, tron 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. “Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Filecoin

FIL | S6702SWRZ

Quantitative information

Quantitative sustainability indicators for Filecoin

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Filecoin	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	2409025.26020	kWh/a
S.10 Renewable energy consumption	37.9124155904	%
S.11 Energy intensity	0.00175	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	801.75581	tCO2e
S.14 GHG intensity	0.00058	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Filecoin is present on the following networks: Binance Smart Chain, Filecoin, Huobi.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated

periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

Filecoin's consensus mechanism, Expected Consensus (EC), is designed to reward data storage providers based on the amount of storage they contribute.

Core Components of Expected Consensus (EC):

1. Storage Power-Based Block Production:
   Probabilistic Block Selection: Block producers (miners) are chosen probabilistically based on their storage power, meaning providers with more storage capacity have higher chances of being selected to produce new blocks.
2. Proof of Replication (PoRep):
   Initial Data Verification: Miners provide cryptographic Proof of Replication to verify they are uniquely storing clients' data at the start of each storage contract.
3. Proof of Spacetime (PoSt):
   Ongoing Verification: Miners periodically submit Proof of Spacetime to confirm they continue to store data over the contract's duration, maintaining data availability and integrity.
4. Chain Quality and Fork Choice:
   Chain Quality Rule: In cases of chain splits, the network follows the chain with the highest cumulative storage power, ensuring security by selecting the most robust chain.

The Huobi Eco Chain (HECO) blockchain employs a Hybrid-Proof-of-Stake (HPoS) consensus mechanism, combining elements of Proof-of-Stake (PoS) to enhance transaction efficiency and scalability.

Key Features of HECO's Consensus Mechanism:

1. Validator Selection: HECO supports up to 21 validators, selected based on their stake in the network.
2. Transaction Processing: Validators are responsible for processing transactions and adding blocks to the blockchain.
3. Transaction Finality: The consensus mechanism ensures quick finality, allowing for rapid confirmation of transactions.
4. Energy Efficiency: By utilizing PoS elements, HECO reduces energy consumption compared to traditional Proof-of-Work systems.

S.5 Incentive Mechanisms and Applicable Fees

Filecoin is present on the following networks: Binance Smart Chain, Filecoin, Huobi.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are

updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

Filecoin incentivizes storage providers (miners) to maintain data integrity and make decentralized storage available through block rewards and storage fees.

Incentive Mechanisms:

1. Block Rewards:
   - Storage-Based Block Rewards: Block rewards in FIL (Filecoin's native token) are given to storage providers selected to add new blocks, proportional to their storage power. These rewards incentivize providers to contribute more storage to the network, enhancing security and decentralized data availability.
   - Reward Distribution: Providers with higher storage capacity receive rewards more frequently, creating a direct economic incentive to offer larger storage volumes.
2. Storage Fees:
   - Client Payments: Clients pay storage providers (miners) in FIL tokens to store data, incentivizing providers to offer reliable storage.
   - Market Pricing: Storage costs are determined by supply and demand, allowing competitive, flexible pricing based on network conditions.
3. Data Retrieval Payments:
   In addition to storage fees, miners can earn retrieval fees for providing data access to clients. These fees incentivize storage providers to make stored data readily accessible, enabling Filecoin to support efficient, decentralized data retrieval services.
4. Slashing and Penalties:
   - If a miner fails to provide Proof of Spacetime, they may face slashing penalties, losing a portion of their FIL collateral. This mechanism disincentivizes data tampering or deletion by holding providers accountable to their storage commitments.
   - Client Refunds: In cases of missed proofs, clients may receive refunds or compensations, ensuring that the network maintains a high standard of data reliability and provider accountability.

Applicable Fees:

1. Transaction Fees:
   Filecoin charges transaction fees for standard network operations, paid in FIL. These fees help maintain network functionality and discourage spam by aligning costs with network resource usage.

2. Gas Fees:
   Miners pay gas fees based on the computational resources required to submit PoRep and PoSt proofs. These fees are integral to the network's operation, ensuring that participants contribute fairly to Filecoin's resource demands.
3. Storage and Retrieval Fees:
   Clients pay miners for data storage on a contract basis, and retrieval fees are paid when miners deliver data on request. These fees are tailored to the type and duration of storage services, providing flexibility in data pricing and availability.

The Huobi Eco Chain (HECO) blockchain employs a Hybrid-Proof-of-Stake (HPoS) consensus mechanism, combining elements of Proof-of-Stake (PoS) to enhance transaction efficiency and scalability.

Incentive Mechanism:

1. Validator Rewards:
   Validators are selected based on their stake in the network. They process transactions and add blocks to the blockchain. Validators receive rewards in the form of transaction fees for their role in maintaining the blockchain's integrity.
2. Staking Participation:
   Users can stake Huobi Token (HT) to become validators or delegate their tokens to existing validators. Staking helps secure the network and, in return, participants receive a portion of the transaction fees as rewards.

Applicable Fees:

1. Transaction Fees (Gas Fees):
   Users pay gas fees in HT tokens to execute transactions and interact with smart contracts on the HECO network. These fees compensate validators for processing and validating transactions.
2. Smart Contract Execution Fees:
   Deploying and interacting with smart contracts incur additional fees, which are also paid in HT tokens. These fees cover the computational resources required to execute contract code.

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 '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 regulary, 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) binance_smart_chain, huobi 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.

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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

ETH | D5RG2FHH0

Quantitative information

Quantitative sustainability indicators for Ethereum Eth

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Ethereum Eth	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	2159953.20000	kWh/a
S.10 Renewable energy consumption	37.9124101186	%
S.11 Energy intensity	0.00006	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	718.86066	tCO2e
S.14 GHG intensity	0.00002	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

S.5 Incentive Mechanisms and Applicable Fees

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

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 regulary, 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.

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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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. “Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Gram

GRAM | KK12JMBTX

Quantitative information

Quantitative sustainability indicators for Gram

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Gram	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	1419120.00000	kWh/a
S.10 Renewable energy consumption	37.9124101186	%
S.11 Energy intensity	0.00003	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	472.30168	tCO2e
S.14 GHG intensity	0.00001	kgCO2e

Qualitative information

S.4 Consensus Mechanism

The Open Network uses a Proof-of-Stake (PoS) consensus mechanism based on the Catchain protocol. Validators stake GRAM to participate in block production, transaction validation, and network security. Catchain provides Byzantine Fault Tolerant (BFT) consensus across the network's sharded architecture, enabling multiple shardchains to process transactions in parallel while maintaining a consistent global state. Validators are selected and rotated periodically, and once consensus is reached, blocks achieve deterministic finality.

S.5 Incentive Mechanisms and Applicable Fees

The Open Network incentivizes network participation through staking rewards and transaction fees. Validators receive rewards for producing blocks, validating transactions, and maintaining network security, with rewards distributed according to their participation and stake. Transaction fees are paid in GRAM and vary depending on the computational resources required by a transaction. The

protocol also applies penalties to validators that fail to meet their obligations or act maliciously, encouraging reliable network operation and honest participation.

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 regulary, 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. “Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

NEAR Protocol

NEAR | MXXM59Z0T

Quantitative information

Quantitative sustainability indicators for NEAR Protocol

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	NEAR Protocol	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	920357.21443	kWh/a
S.10 Renewable energy consumption	37.4190659546	%
S.11 Energy intensity	0.00007	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	309.93708	tCO2e
S.14 GHG intensity	0.00002	kgCO2e

Qualitative information

S.4 Consensus Mechanism

NEAR Protocol is present on the following networks: Binance Smart Chain, Ethereum, Near Protocol.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated

periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

The NEAR Protocol uses a unique consensus mechanism combining Proof of Stake (PoS) and a novel approach called Doomslug, which enables high efficiency, fast transaction processing, and secure finality in its operations.

Core Concepts:

1. Doomslug and Proof of Stake:
   - NEAR's consensus mechanism primarily revolves around PoS, where validators stake NEAR tokens to participate in securing the network. However, NEAR's implementation is enhanced with the Doomslug protocol.
   - Doomslug allows the network to achieve fast block finality by requiring blocks to be confirmed in two stages. Validators propose blocks in the first step, and finalization occurs when two-thirds of validators approve the block, ensuring rapid transaction confirmation.
2. Sharding with Nightshade:
   - NEAR uses a dynamic sharding technique called Nightshade. This method splits the network into multiple shards, enabling parallel processing of transactions across the network, thus significantly increasing throughput. Each shard processes a portion of transactions, and the outcomes are merged into a single "snapshot" block.
   - This sharding approach ensures scalability, allowing the network to grow and handle increasing demand efficiently.

Consensus Process:

1. Validator Selection:
   - Validators are selected to propose and validate blocks based on the amount of NEAR tokens staked. This selection process is designed to ensure that only validators with significant stakes and community trust participate in securing the network.
2. Transaction Finality:
   - NEAR achieves transaction finality through its PoS-based system, where validators vote on blocks. Once two-thirds of validators approve a block, it reaches finality under Doomslug, meaning that no forks can alter the confirmed state.
3. Epochs and Rotation:
   - Validators are rotated in epochs to ensure fairness and decentralization. Epochs are intervals in which validators are reshuffled, and new block proposers are selected, ensuring a balance between performance and decentralization.

S.5 Incentive Mechanisms and Applicable Fees

NEAR Protocol is present on the following networks: Binance Smart Chain, Ethereum, Near Protocol.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

NEAR Protocol employs several economic mechanisms to secure the network and incentivize participation.

Incentive Mechanisms to Secure Transactions:

1. Staking Rewards:
   Validators and delegators secure the network by staking NEAR tokens. Validators earn around 5% annual inflation, with 90% of newly minted tokens distributed as staking rewards. Validators propose blocks, validate transactions, and receive a share of these rewards based on their staked tokens. Delegators earn rewards proportional to their delegation, encouraging broad participation.
2. Delegation:
   Token holders can delegate their NEAR tokens to validators to increase the validator's stake and improve the chances of being selected to validate transactions. Delegators share in the validator's rewards based on their delegated tokens, incentivizing users to support reliable validators.
3. Slashing and Economic Penalties:
   Validators face penalties for malicious behavior, such as failing to validate correctly or acting dishonestly. The slashing mechanism enforces security by deducting a portion of their staked tokens, ensuring validators follow the network's best interests.
4. Epoch Rotation and Validator Selection:
   Validators are rotated regularly during epochs to ensure fairness and prevent centralization. Each epoch reshuffles validators, allowing the protocol to balance decentralization with performance.

Fees on the NEAR Blockchain:

1. Transaction Fees:
   Users pay fees in NEAR tokens for transaction processing, which are burned to reduce the total circulating supply, introducing a potential deflationary effect over time. Validators also receive a portion of transaction fees as additional rewards, providing an ongoing incentive for network maintenance.
2. Storage Fees:
   NEAR Protocol charges storage fees based on the amount of blockchain storage consumed by accounts, contracts, and data. This requires users to hold NEAR tokens as a deposit proportional to their storage usage, ensuring the efficient use of network resources.
3. Redistribution and Burning:
   A portion of the transaction fees (burned NEAR tokens) reduces the overall supply, while the rest is distributed to validators as compensation for their work. The burning mechanism helps maintain long-term economic sustainability and potential value appreciation for NEAR holders.
4. Reserve Requirement:
   Users must maintain a minimum account balance and reserves for data storage, encouraging efficient use of resources and preventing spam attacks.

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 '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 regulary, 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) binance_smart_chain, ethereum 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. “Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Avalanche AVAX

AVAX | S6JCBF70N

Quantitative information

Quantitative sustainability indicators for Avalanche AVAX

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Avalanche AVAX	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	791269.96946	kWh/a
S.10 Renewable energy consumption	36.3152910542	%
S.11 Energy intensity	0.00016	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	297.09481	tCO2e
S.14 GHG intensity	0.00006	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Avalanche AVAX is present on the following networks: Avalanche, Avalanche X Chain.

The Avalanche C-Chain uses the Snowman++ consensus mechanism, which is Avalanche's consensus model for linear blockchains and is implemented through the ProposerVM wrapper. Under this model, validators repeatedly query a small random subset of other validators and converge on a preferred block once the required confidence thresholds are met. Only Primary Network validators are entitled to validate the C-Chain. To participate as a validator on Avalanche mainnet, a node must stake a minimum number of token. Token holders may also participate indirectly by delegating an existing validator. Validator identity and admission to staking require the relevant staking credentials, including BLS proofs of possession under the current staking framework. For block production, Snowman++ uses stake-weighted proposer windows. Through the ProposerVM, block-building opportunities are assigned to proposers in 5-second windows, after which block production may fall back more broadly to validators if necessary. This mechanism is intended to regulate block production while preserving network liveness. Consensus voting itself remains based on repeated

sub-sampled polling rather than fixed validator committees. Avalanche documentation describes the finality model as sub-second and treated by the protocol as final and irreversible once accepted, while noting that safety is probabilistic in the formal sense because the probability of conflicting acceptance can be reduced to an arbitrarily low level through the protocol parameters. The protocol does not rely on slashing of staked principal. Instead, validator reward eligibility depends on compliance with protocol conditions, including uptime requirements.

The Avalanche X-Chain uses the Avalanche consensus protocol, which relies on repeated subsampling of validators to reach agreement on transactions.

S.5 Incentive Mechanisms and Applicable Fees

Avalanche AVAX is present on the following networks: Avalanche, Avalanche X Chain.

The Avalanche C-Chain is secured economically through the native AVAX token. Validator incentives are based primarily on staking rewards, not on redistribution of C-Chain transaction fees. A fixed amount of 360 million AVAX was minted at genesis, while additional AVAX is minted over time as validator rewards, subject to Avalanche's capped token supply framework. Validator rewards are paid at the end of the staking period and are determined by factors such as the validator's stake and compliance with staking conditions. Unlike some proof-of-stake systems, the Avalanche Primary Network does not use slashing of bonded principal as an ordinary penalty mechanism. Instead, the main protocol-level economic consequence for underperformance is the loss of reward eligibility. Where a validator fails to satisfy the applicable uptime requirement during its staking term, that validator does not receive the corresponding staking reward. Transaction fees apply on the C-Chain for transfers and smart-contract execution. The fee model follows EIP-1559 logic, meaning that transactions are priced through a dynamic base fee mechanism. In contrast to Ethereum's validator tip model, C-Chain transaction fees are burned rather than distributed to validators. This means that C-Chain fees function as a supply-reduction mechanism and are intended in part to offset inflation arising from the minting of validator rewards. In addition to ordinary transaction and smart-contract execution fees, Avalanche documentation also recognises protocol fees in connection with other network operations on other chains of the Primary Network, such as certain import or export operations and staking-related actions. However, for the C-Chain itself, the core applicable fee category is the gas fee for transaction inclusion and contract execution, and those fees are handled through the protocol burn mechanism rather than paid to validators or a treasury.

Validator incentives on the X-Chain are indirect and come from network-wide AVAX issuance. Transaction fees are fixed and burned to prevent spam and reduce the total supply of AVAX over time

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 '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 regulary, 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) avalanche, avalanche_x_chain 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. “Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Cardano ADA

ADA | 76QS7QCXB

Quantitative information

Quantitative sustainability indicators for Cardano ADA

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Cardano ADA	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	773946.00000	kWh/a
S.10 Renewable energy consumption	37.4187578605	%
S.11 Energy intensity	0.00109	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	260.63169	tCO2e
S.14 GHG intensity	0.00037	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Core Components: Cardano uses the Ouroboros consensus mechanism, a Proof of Stake (PoS) protocol designed for scalability, security, and energy efficiency.

Core Concepts:

1. Proof of Stake (PoS): Validators (called slot leaders) are selected based on the amount of ADA they have staked, rather than solving complex computational puzzles. Validators propose and validate blocks, which are added to the blockchain.
2. Epochs and Slot Leaders: Cardano divides time into epochs (fixed time periods), each of which is subdivided into slots. Slot leaders are selected for each slot to validate and propose blocks. Slot leaders are chosen randomly based on the amount of ADA staked. More stake increases the probability of being selected. Validators are responsible for confirming transactions during their slot and passing the block to the next slot leader.

3. Delegation and Staking Pools: ADA holders can delegate their tokens to staking pools, which increases the pool's chances of being selected to validate a block. The pool operator and delegators share the rewards based on their stakes. This system ensures that participants who do not want to operate a full validator node can still earn rewards and contribute to network security by supporting trusted staking pools.
4. Security and Adversary Resistance: Ouroboros ensures security even in the presence of potential attacks. It assumes that adversaries may attempt to propagate alternative chains or send arbitrary messages. The protocol is secure as long as more than 51% of the staked ADA is controlled by honest participants. Settlement Delay: To protect against adversarial attacks, the new slot leader must consider the last few blocks as transient. Only the blocks preceding these are treated as finalized, ensuring that chain finality is secure against manipulation attempts. This mechanism also allows participants to temporarily go offline and resynchronize as long as they are not disconnected for more than the settlement delay period.
5. Chain Selection: Cardano's nodes adopt the longest valid chain rule: each node stores a local copy of the blockchain and replaces it with any discovered valid, longer chain. This ensures that all nodes eventually converge on a single version of the blockchain, maintaining network consistency.

S.5 Incentive Mechanisms and Applicable Fees

Cardano uses incentive mechanisms to ensure network security and decentralization through staking rewards, slashing mechanisms, and transaction fees.

Incentive Mechanisms to Secure Transactions:

1. Staking Rewards:
   - Validators, known as slot leaders, secure the network by validating transactions and creating new blocks. To participate, validators must stake ADA, and those with larger stakes are more likely to be selected as slot leaders.
   - Validators are rewarded with newly minted ADA and transaction fees for successfully producing blocks and validating transactions.
   - Delegators, who may not wish to run a validator node, can delegate their ADA to staking pools. By doing so, they contribute to the network's security and earn a share of the rewards earned by the pool. The rewards are distributed proportionally based on the amount of ADA delegated.
2. Slashing Mechanism:
   - To prevent malicious behavior, Cardano employs a slashing mechanism. Validators who act dishonestly, fail to validate transactions properly, or produce incorrect blocks face penalties that involve the slashing of a portion of their staked ADA.
   - This provides strong economic incentives for validators to act honestly and ensures the network's integrity and security.
3. Delegation and Pool Operation:
   - Staking pools can charge operation fees (a margin on rewards) to maintain their infrastructure. This includes fixed costs set by pool operators. Delegators earn rewards after pool fees are deducted, providing a balanced incentive for both operators and delegators to participate actively.
   - Rewards are distributed at the end of each epoch, where staking pool performance and participation determine the distribution of ADA rewards to all stakeholders.

Applicable Fees:

1. Transaction Fees:
   - Transaction fees on Cardano are paid in ADA and are generally low. They are calculated based on the size of the transaction and the network's current demand. These fees are paid to validators for including transactions in new blocks.
   - The fee formula is: a + b × size, where a is a constant (typically 0.155381 ADA), b is a coefficient related to the transaction size (0.000043946 ADA/byte), and size refers to the transaction size in bytes. This ensures that the fee adapts based on network load and the size of each transaction.
2. Staking Pool Fees:
   - Staking pool operators charge operational costs and a margin fee, which covers the cost of running and maintaining the staking pool. These fees vary between pools but ensure that operators can continue to provide their services while offering rewards to delegators.
   - After the operator's fee, the remaining rewards are distributed among the delegators based on the size of their stake.

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 regulary, 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.

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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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. “Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Polkadot DOT

DOT | SGD9NLTRG

Quantitative information

Quantitative sustainability indicators for Polkadot DOT

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Polkadot DOT	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	642546.00000	kWh/a
S.10 Renewable energy consumption	39.0062350679	%
S.11 Energy intensity	0.00004	kWh
S.12 Scope 1 DLT GHG emissions – Controlled	0.00000	tCO2e
S.13 Scope 2 DLT GHG emissions – Purchased	190.07953	tCO2e
S.14 GHG intensity	0.00001	kgCO2e

Qualitative information

S.4 Consensus Mechanism

Polkadot DOT is present on the following networks: Astar, Polkadot, Statemint.

Astar uses a hybrid consensus mechanism that combines Proof of Stake (PoS) and Delegated Proof of Stake (DPoS), with the added feature of Sharded Multichain capabilities. The primary goal is to provide a scalable, interoperable, and decentralized platform for building decentralized applications (dApps), which can run on multiple blockchains in parallel.

Key Features of Astar's Consensus Mechanism:

1. Proof of Stake (PoS): In Astar, validators participate by staking ASTR tokens, the native currency of the network. The more tokens staked, the higher the chances of being selected as a validator. Validators are responsible for validating transactions and securing the network. Validators receive block rewards for their efforts, which are paid in ASTR tokens.
2. Delegated Proof of Stake (DPoS): Astar incorporates DPoS to allow ASTR token holders to vote for validators. Token holders delegate their voting power to trusted validators, who then produce

blocks and validate transactions. This ensures greater decentralization by allowing the community to have a direct say in who validates the network. Delegators receive a share of the block rewards earned by their selected validators.
3. Sharded Multichain: Astar's consensus mechanism allows for multichain execution via Parachains in the Polkadot ecosystem, enabling Astar to process multiple parallel chains and increase scalability. This sharding mechanism ensures that Astar can scale effectively, maintaining high throughput while decentralizing the network.
4. Finality: Astar leverages Polkadot's GRANDPA (GHOST-based Recursive Ancestor Deriving Prefix Agreement) finality gadget for fast and deterministic finality. Once a block is finalized, it is irreversible, ensuring the integrity and security of transactions.

Polkadot, a heterogeneous multi-chain framework designed to enable different blockchains to interoperate, uses a sophisticated consensus mechanism known as Nominated Proof-of-Stake (NPoS). This mechanism combines elements of Proof-of-Stake (PoS) and a layered consensus model involving multiple roles and stages.

Core Components:

1. Validators: Validators are responsible for producing new blocks and finalizing the relay chain, Polkadot's main chain. They stake DOT tokens and validate transactions, ensuring the security and integrity of the network.
2. Nominators: Nominators delegate their stake to trusted validators, choosing which validators they believe will act honestly and effectively. They share in the rewards and penalties of the validators they nominate.
3. Collators: Collators maintain parachains (individual blockchains that connect to the Polkadot relay chain) by collecting transactions from users and producing state transition proofs for validators.
4. Fishermen: Fishermen monitor the network for malicious activity. They report bad behavior to the validators to help maintain network security.

Consensus Process: Polkadot's consensus mechanism operates through a combination of two key protocols: GRANDPA (GHOST-based Recursive Ancestor Deriving Prefix Agreement) and BABE (Blind Assignment for Blockchain Extension).

1. BABE (Block Production): BABE is the block production mechanism. It operates similarly to a lottery, where validators are pseudo-randomly assigned slots to produce blocks based on their stake. Each validator signs the blocks they produce, which are then propagated through the network.
2. GRANDPA (Finality): GRANDPA is the finality gadget that provides a higher level of security by finalizing blocks after they are produced. Unlike traditional blockchains where blocks are considered final after a number of confirmations, GRANDPA allows for asynchronous finality. Validators vote on chains, and once a supermajority agrees, the chain is finalized instantly.

Detailed Steps:

1. Block Production (BABE):
   - Slot Allocation: Validators are selected to produce blocks in specific time slots.
   - Block Proposal: The selected validator for a slot proposes a block, including new transactions and state changes.
2. Block Propagation and Preliminary Consensus: Proposed blocks are propagated across the network, where other validators verify the correctness of the transactions and state transitions.
3. Finalization (GRANDPA):
   - Voting on Blocks: Validators vote on the chains they believe to be the correct history.

- Supermajority Agreement: Once more than two-thirds of validators agree on a block, it is finalized.
- Instant Finality: This finality process ensures that once a block is finalized, it is irreversible and becomes part of the canonical chain.

4. Rewards and Penalties: Validators and nominators earn rewards for participating in the consensus process and maintaining network security. Misbehavior, such as producing invalid blocks or being offline, results in penalties, including slashing of staked tokens.

Statemint is a common-good parachain on the Polkadot and Kusama networks, designed to handle asset management and issuance efficiently while leveraging Polkadot's shared security model.

Core Components:

- Relay Chain Integration: Statemint inherits its consensus mechanism from the Polkadot Relay Chain, which operates on a Nominated Proof of Stake (NPoS) model. This model ensures robust security and decentralization by relying on validators and nominators.
- Shared Security: As a parachain, Statemint utilizes the Polkadot Relay Chain's validators for block validation, ensuring high security and interoperability without requiring independent validators.
- Collator Nodes: Statemint employs collator nodes to aggregate transactions into blocks and submit them to the Relay Chain validators for finalization. Collators do not participate in consensus directly but play a key role in transaction processing.
- Immediate Finality: The underlying Polkadot consensus mechanism ensures instant finality using the GRANDPA (GHOST-based Recursive Ancestor Deriving Prefix Agreement) protocol, which provides secure and efficient transaction confirmation.

S.5 Incentive Mechanisms and Applicable Fees

Polkadot DOT is present on the following networks: Astar, Polkadot, Statemint.

Astar incentivizes network participation through block rewards, transaction fees, and staking rewards while encouraging governance via delegated voting.

Incentive Mechanism:

1. Staking Rewards: Validators earn ASTR tokens for validating transactions and securing the network. The more tokens staked, the higher the chances of validating blocks.
2. Delegated Proof of Stake (DPoS): ASTR token holders can delegate their tokens to validators, sharing in the rewards based on the performance of their chosen validators.
3. Cross-Chain dApp Rewards: Developers deploying dApps on Astar earn rewards for using the network's multichain capabilities.
4. Governance Participation: ASTR token holders participate in on-chain governance to vote on proposals and protocol changes.

Applicable Fees:

1. Transaction Fees: Users pay fees in ASTR tokens for transactions. These are collected by validators who process the transactions.
2. dApp Execution Fees: Developers pay for smart contract execution based on resource demands.
3. Cross-Chain Fees: Additional fees apply for asset transfers and interactions between different blockchain networks.
4. Parachain Slot Fees: Astar incurs fees for its parachain slot on the Polkadot network to ensure interoperability.

Polkadot uses a consensus mechanism called Nominated Proof-of-Stake (NPoS), which involves a combination of validators, nominators, and a unique layered consensus process to secure the network:

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are responsible for producing new blocks and finalizing the relay chain. They are incentivized with staking rewards, which are distributed in proportion to their stake and their performance in the consensus process. Validators earn these rewards for maintaining uptime and correctly validating transactions.
   - Commission: Validators can set a commission rate that they charge on the rewards earned by their nominators. This incentivizes them to perform well to attract more nominators.
2. Nominators:
   - Delegation: Nominators stake their tokens by delegating them to trusted validators. They share in the rewards earned by the validators they support. This mechanism incentivizes nominators to carefully choose reliable validators.
   - Rewards Distribution: The rewards are distributed among validators and their nominators based on the amount of stake contributed by each party. This ensures that both parties are incentivized to maintain the network's security.
3. Collators:
   Parachain Maintenance: Collators maintain parachains by collecting transactions and producing state transition proofs for validators. They are incentivized through rewards for their role in keeping the parachain operational and secure.
4. Fishermen:
   Monitoring: Fishermen are responsible for monitoring the network for malicious activities. They are rewarded for identifying and reporting malicious behavior, which helps maintain the network's security.
5. Economic Penalties:
   - Slashing: Validators and nominators face penalties in the form of slashing if they engage in malicious activities such as double-signing or being offline for extended periods. Slashing results in the loss of a portion of their staked tokens, which serves as a strong deterrent against bad behavior.
   - Unbonding Period: To withdraw staked tokens, participants must go through an unbonding period during which their tokens are still at risk of being slashed. This ensures continued network security even when validators or nominators decide to exit.

Fees on the Polkadot Blockchain:

1. Transaction Fees:
   - Dynamic Fees: Transaction fees on Polkadot are dynamic, adjusting based on network demand and the complexity of the transaction. This model ensures that fees remain fair and proportional to the network's usage.
   - Fee Burn: A portion of the transaction fees is burned (permanently removed from circulation), which helps to control inflation and can potentially increase the value of the remaining tokens.
2. Smart Contract Fees:
   Execution Costs: Fees for deploying and interacting with smart contracts on Polkadot are based on the computational resources required. This encourages efficient use of network resources.
3. Parachain Slot Auction Fees:
   Bidding for Slots: Projects that want to secure a parachain slot must participate in a slot auction. They bid DOT tokens, and the highest bidders win the right to operate a parachain for a

specified period. This process ensures that only serious projects with significant backing can secure parachain slots, contributing to the network's overall quality and security.

Statemint is a common-good parachain on the Polkadot and Kusama networks, designed to enable efficient asset management while benefiting from Polkadot's shared security and governance model.

Incentive Mechanisms:

- Relay Chain Validators: Validators securing the Polkadot Relay Chain are indirectly incentivized through block rewards and transaction fees collected across all parachains, including Statemint. This ensures the stability and security of the network without requiring Statemint-specific rewards.
- Collator Compensation: Collator nodes aggregate transactions and produce blocks for Statemint. They may be compensated through external arrangements, such as subsidies or user-driven incentives, depending on governance decisions and usage patterns.
- Governance Participation: Polkadot (DOT) and Kusama (KSM) token holders influence Statemint's operations, such as fee adjustments and protocol upgrades, through on-chain governance mechanisms.

Applicable Fees:

- Transaction Fees: Users pay transaction fees in the native tokens of the Relay Chain, DOT for Polkadot or KSM for Kusama. These fees are distributed to Relay Chain validators to support the network's maintenance.
- Asset Creation and Transfer Fees: Fees apply for creating new assets and transferring them on the Statemint chain. These fees help prevent spam and ensure efficient use of network resources.
- Governance-Defined Fee Adjustments: The Statemint parachain's fees can be adjusted through governance proposals, enabling the community to adapt costs to network conditions.

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 '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 regulary, 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.

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To determine the energy consumption of a token, the energy consumption of the network(s) astar 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.

Ember (2025); Energy Institute - Statistical Review of World Energy (2024) - with major processing by Our World in Data. “Carbon intensity of electricity generation - 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/carbon-intensity-electricity Licenced under CC BY 4.0.

Ripple XRP

XRP | 42PHJB2BS

Quantitative information

Quantitative sustainability indicators for Ripple XRP

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Ripple XRP	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	456260.56124	kWh/a

Qualitative information

S.4 Consensus Mechanism

Ripple XRP is present on the following networks: Binance Smart Chain, Klaytn, Ripple.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

Klaytn employs a modified Istanbul Byzantine Fault Tolerance (IBFT) consensus algorithm, a variant of Proof of Authority (PoA), enabling high performance and immediate transaction finality.

Core Components of Klaytn's Consensus:

1. Modified IBFT Algorithm:
   Immediate Transaction Finality: Klaytn's IBFT algorithm ensures that once a block is validated, it is immediately final and cannot be reversed. This guarantees that transactions are quickly settled, providing a secure and efficient user experience.
2. Klaytn Governance Council:
   - Council-Driven Governance: The Klaytn network is governed by the Klaytn Governance Council, a consortium of global organizations responsible for selecting and maintaining Consensus Nodes (CNs). This council-based governance model balances decentralization with performance and ensures transparency in decision-making.
   - Two-Thirds Majority for Finalization: For a block to be finalized, it must receive signatures from more than two-thirds of the council members, ensuring broad consensus and network security.
3. Three-Tiered Node Architecture:
   - Consensus Nodes (CNs): The selected validators responsible for producing and validating blocks. CNs are at the core of the network's security and stability.
   - Proxy Nodes (PNs): Act as intermediaries, relaying data between CNs and the broader network, which helps distribute network traffic and improve accessibility.
   - Endpoint Nodes (ENs): Interface directly with end-users, facilitating transactions, executing smart contracts, and serving as user access points to the Klaytn network.

The Ripple blockchain, specifically the XRP Ledger (XRPL), uses a consensus mechanism known as the Ripple Protocol Consensus Algorithm (RPCA). It differs from Proof of Work (PoW) and Proof of Stake (PoS) as it doesn't rely on mining or staking but instead leverages trusted validators in a Federated Byzantine Agreement (FBA) model.

Core Concepts:

1. Validators and Unique Node Lists (UNL): Validators are trusted nodes in the network that validate transactions and propose new ledger updates. Each node maintains a list of trusted validators known as its Unique Node List (UNL). Consensus is achieved when 80% of the validators in a node's UNL agree on the validity of a transaction or block. This ensures high levels of security and decentralization.
2. Transaction Ordering and Validation: Transactions are broadcast to validators, and once 80% of the validators agree, the transaction is considered confirmed. Each ledger in the XRPL contains transaction data, and validators ensure the validity and proper ordering of these transactions.

Consensus Process:

1. Proposal Phase: Validators propose new transactions to be added to the ledger.
2. Validation Phase: Validators vote on proposed transactions by comparing them to their UNL. Consensus is achieved when 80% of validators agree.
3. Finalization: Once consensus is reached, the transactions are written into the new ledger, making them irreversible and final.

S.5 Incentive Mechanisms and Applicable Fees

Ripple XRP is present on the following networks: Binance Smart Chain, Klaytn, Ripple.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that

proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

Klaytn's incentive structure includes block rewards and transaction fees distributed to Consensus Nodes (CNs) and various network funds, fostering network security, sustainability, and community development.

Incentive Mechanisms:

1. Rewards for Consensus Nodes (CNs):
   - Fixed Block Rewards: CNs earn fixed rewards in KLAY tokens for validating and producing blocks. This predictable income incentivizes CNs to maintain active participation and secure the network.
   - Transaction Fees: Users pay transaction fees in KLAY tokens, which are collected by the network and distributed among the CNs as additional rewards, further supporting network security and stability.
2. Block Reward Distribution: Governance Council (GC) Reward:
   - GC Block Proposer Reward: 10% of the block reward goes to the specific CN that proposed the block, incentivizing continuous active participation.
   - GC Staking Award: 40% of the block reward is distributed among all Governance Council members who stake KLAY, promoting network security by rewarding staked tokens.
   - Klaytn Community Fund (KCF): 30% of each block reward is allocated to the KCF to support community development, dApp creation, and overall ecosystem growth.
   - Klaytn Foundation Fund (KFF): 20% of the block reward goes to the KFF, providing resources for long-term network sustainability and future development initiatives.
3. Transaction Fees:
   - User Fees for Network Interaction: Users pay fees in KLAY based on gas usage and gas price for transactions. These fees are then distributed to CNs, incentivizing efficient transaction processing and active participation.

Applicable Fees:

Transaction Fees: Transaction fees on Klaytn are paid in KLAY and calculated based on gas consumption. These fees support network maintenance by compensating validators and fostering economic sustainability.

The Ripple XRP blockchain uses a unique incentive structure that differs from traditional Proof of Work (PoW) or Proof of Stake (PoS) systems, focusing on its Ripple Protocol Consensus Algorithm (RPCA).

Incentive Mechanisms to Secure Transactions:

1. Validators: Validators on the Ripple network are not directly compensated with rewards like in PoW/PoS models. Instead, they are incentivized by the utility and stability of the network, particularly financial institutions that benefit from Ripple's efficiency in cross-border payments.
2. No Mining: Since Ripple does not use mining, it eliminates the need for energy-intensive computations, contributing to fast transaction speeds and scalability.

Fees on the Ripple XRP Blockchain:

1. Transaction Fees: Ripple charges minimal transaction fees (typically fractions of an XRP, known as \drops") for each transaction. The purpose of these fees is to prevent network spam and overload.
2. Burn Mechanism: A portion of each transaction fee is burned, meaning it's permanently removed from circulation. This reduces the overall supply of XRP over time, contributing to potential long-term value stability.

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 '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 regulary, 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) binance_smart_chain, klaytn 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.

USDC

USDC | TJWK5QTRK

Quantitative information

Quantitative sustainability indicators for USDC

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	USDC	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	431856.77714	kWh/a

Qualitative information

S.4 Consensus Mechanism

USDC is present on the following networks: Algorand, Aptos Coin, Arbitrum, Avalanche, Base, Celo, Ethereum, Flow, Hedera Hbar, Hyperliquid, Injective, Linea, Near Protocol, Optimism, Plume, Polygon, Ripple, Sei, Solana, Sonic, Starknet, Statemint, Stellar, Sui, Tron, Xdc Network, Zksync.

The Algorand blockchain utilizes a consensus mechanism termed Pure Proof-of-Stake (PPoS). Consensus, in this context, describes the method by which blocks are selected and appended to the blockchain. Algorand employs a verifiable random function (VRF) to select leaders who propose blocks for each round.

Upon block proposal, a pseudorandomly selected committee of voters is chosen to evaluate the proposal. If a supermajority of these votes are from honest participants, the block is certified. What makes this algorithm a Pure Proof of Stake is that users are chosen for committees based on the number of algos in their accounts. This system leverages random committee selection to maintain high performance and inclusivity within the network.

The consensus process involves three stages:

1. Propose: A leader proposes a new block.
2. Soft Vote: A committee of voters assesses the proposed block.
3. Certify Vote: Another committee certifies the block if it meets the required honesty threshold.

Aptos utilizes a Proof-of-Stake approach combined with a BFT consensus protocol to ensure high throughput, low latency, and secure transaction processing.

Core Components:

- Parallel Execution: Transactions are processed concurrently using Block-STM, a parallel execution engine, enabling high performance and scalability.
- Leader-Based BFT: A leader is selected among validators to propose blocks, while others validate and finalize transactions.
- Dynamic Validator Rotation: Validators are rotated regularly, enhancing decentralization and preventing collusion.
- Instant Finality: Transactions achieve finality once validated, ensuring that they are irreversible.

Arbitrum is an optimistic rollup that processes transactions on a Layer 2 network and relies on Ethereum for data availability and settlement. A sequencer orders incoming transactions, executes them and publishes compressed transaction batches to Ethereum. Arbitrum nodes can independently reconstruct and verify the resulting Layer 2 state using the transaction data published on the parent chain. Validators submit assertions representing the state of the network. Under the BoLD dispute protocol, conflicting or incorrect assertions may be challenged and resolved through an interactive fraud-proof process on Ethereum. Once an assertion has been confirmed and the applicable challenge process has been completed, the corresponding Layer 2 state is accepted for settlement purposes.

The Avalanche C-Chain uses the Snowman++ consensus mechanism, which is Avalanche's consensus model for linear blockchains and is implemented through the ProposerVM wrapper. Under this model, validators repeatedly query a small random subset of other validators and converge on a preferred block once the required confidence thresholds are met. Only Primary Network validators are entitled to validate the C-Chain. To participate as a validator on Avalanche mainnet, a node must stake a minimum number of token. Token holders may also participate indirectly by delegating an existing validator. Validator identity and admission to staking require the relevant staking credentials, including BLS proofs of possession under the current staking framework. For block production, Snowman++ uses stake-weighted proposer windows. Through the ProposerVM, block-building opportunities are assigned to proposers in 5-second windows, after which block production may fall back more broadly to validators if necessary. This mechanism is intended to regulate block production while preserving network liveness. Consensus voting itself remains based on repeated sub-sampled polling rather than fixed validator committees. Avalanche documentation describes the finality model as sub-second and treated by the protocol as final and irreversible once accepted, while noting that safety is probabilistic in the formal sense because the probability of conflicting acceptance can be reduced to an arbitrarily low level through the protocol parameters. The protocol does not rely on slashing of staked principal. Instead, validator reward eligibility depends on compliance with protocol conditions, including uptime requirements.

Base does not operate its own consensus mechanism or decentralised validator set comparable to a Layer-1 blockchain. As an optimistic rollup Layer-2 network, Base relies on Ethereum's Proof-of-Stake consensus for the finality and settlement of data and state commitments posted to Ethereum Layer 1. Transaction ordering on Base is performed by a sequencer, currently operated by Coinbase. This sequencing function provides transaction ordering and execution on the Layer-2 network but does not constitute a decentralised consensus mechanism. The validity of Layer-2 state transitions is supported by an optimistic fault-proof mechanism, under which incorrect state commitments may be challenged during the applicable dispute period. Accordingly, Base's security model depends on Ethereum Layer 1 for settlement and finality, while Layer-2 transaction ordering remains dependent on the sequencer.

Celo uses a Proof of Stake (PoS) consensus model, which supports a decentralized, community-driven approach to governance and network security.

Core Components of Celo's Consensus:

1. Proof of Stake (PoS):
   Validator Role: Validators are responsible for creating new blocks, validating transactions, and maintaining the security and integrity of the network. Validators are selected based on the amount of CELO tokens they hold and stake, incentivizing honest participation and network reliability.
2. Decentralized Governance:
   Community Voting: Governance on Celo is decentralized, allowing CELO token holders to vote on proposals and changes to the network. This community-driven approach ensures that token holders have a say in the network's development and strategic direction.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Flow employs a Proof of Stake (PoS) model with a multi-role node architecture and the HotStuff Byzantine Fault Tolerant (BFT) protocol to achieve high throughput, scalability, and fast finality.

Core Components of Flow's Consensus:

1. Proof of Stake with Multi-Role Architecture:
   Specialized Node Roles: Flow's PoS model features a multi-node architecture where node roles are divided among different types of specialized nodes, each responsible for specific tasks. This separation enhances scalability by allowing nodes to focus on particular operations, leading to efficient transaction processing and high throughput.
2. HotStuff Consensus Algorithm:
   - Optimized for High Throughput and Fast Finality: Flow utilizes an optimized version of the HotStuff consensus protocol, which is designed to support high-speed, low-latency transactions essential for Flow's performance-oriented blockchain.
   - BFT Compliance: HotStuff is a BFT protocol, allowing it to tolerate up to one-third of nodes acting maliciously without compromising the network's security. This resilience ensures the network remains secure and functional, even with potential faults or dishonest nodes.
3. Leader-Based Block Proposal:
   - Leader and Replica Nodes: HotStuff operates with a leader-based approach where a designated leader node proposes new blocks, and other nodes (replicas) validate these blocks. This method simplifies the consensus process, reducing complexity and improving efficiency.
   - Leader Rotation Mechanism: To prevent centralization and enhance fault tolerance, HotStuff incorporates a leader rotation system, replacing the leader if it becomes unresponsive or acts maliciously. This rotation ensures continuous network reliability and minimizes downtime.

Hedera Hashgraph operates on a unique Hashgraph consensus algorithm, a directed acyclic graph (DAG) system that diverges from traditional blockchain technology. It uses Asynchronous Byzantine Fault Tolerance (aBFT) to secure the network.

Core Components:

1. Hashgraph Consensus and aBFT:
   Hedera Hashgraph's consensus mechanism achieves aBFT, which allows the network to tolerate malicious nodes without compromising security, ensuring high levels of fault tolerance and stability.
2. Gossip about Gossip Protocol:
   The network employs a "Gossip about Gossip" protocol, where nodes share transaction information along with details of previous gossip events. This process allows each node to rapidly learn the entire network state, enhancing communication efficiency and minimizing latency.
3. Virtual Voting:
   Hedera does not rely on traditional miners or stakers. Instead, it uses virtual voting, where nodes reach consensus by analyzing the gossip history and simulating votes based on the order and frequency of transactions received. Virtual voting eliminates the need for actual voting messages, reducing network congestion and speeding up consensus.
4. Deterministic Finality:
   Once consensus is reached, transactions achieve deterministic finality instantly, making them irreversible and confirmed within seconds. This attribute is ideal for applications needing quick and irreversible transaction confirmations.
5. Staking for Network Security:
   Hedera incorporates staking to bolster network security. HBAR holders can stake their tokens to support validator nodes, contributing to the network's resilience and encouraging long-term engagement in consensus operations.

Hyperliquid is a decentralized perpetual exchange (DEX) built on its proprietary Layer 1 blockchain, Hyperliquid L1. At the core of its architecture is the HyperBFT consensus mechanism, inspired by the Hotstuff protocol, designed to meet the demands of high-frequency trading while maintaining security and consistency across the ecosystem.

Injective operates on a Tendermint-based Proof of Stake (PoS) consensus model, ensuring high throughput and immediate transaction finality.

Core Components:

- Tendermint-based Proof of Stake (PoS):
  Ensures instant transaction finality and supports efficient block production for high-speed transactions.
- Validator Selection:
  Validators are chosen based on the amount of INJ tokens staked, considering both self-staked and delegated tokens, to maintain a decentralized network.
- Delegation:
  INJ holders can delegate their tokens to validators, earning a share of staking rewards while participating in network governance.
- Instant Finality:
  The Tendermint consensus mechanism provides immediate finality, ensuring transactions cannot be reversed once validated.

The Linea Network uses a Zero-Knowledge Rollup (ZK-Rollup) architecture with a zkEVM for Ethereum compatibility, and its consensus is derived from Ethereum's own proof-of-stake security. While the Network has components like a sequencer for ordering transactions and a coordinator for network management, its consensus mechanism is fundamentally linked to the proof and verification process of zero-knowledge proofs and the security of the Ethereum mainnet. Instead of a typical decentralized consensus on a separate blockchain, the Network inherits its security and state finality from Ethereum.

The NEAR Protocol uses a unique consensus mechanism combining Proof of Stake (PoS) and a novel approach called Doomslug, which enables high efficiency, fast transaction processing, and secure finality in its operations.

Core Concepts:

1. Doomslug and Proof of Stake:
   - NEAR's consensus mechanism primarily revolves around PoS, where validators stake NEAR tokens to participate in securing the network. However, NEAR's implementation is enhanced with the Doomslug protocol.
   - Doomslug allows the network to achieve fast block finality by requiring blocks to be confirmed in two stages. Validators propose blocks in the first step, and finalization occurs when two-thirds of validators approve the block, ensuring rapid transaction confirmation.
2. Sharding with Nightshade:
   - NEAR uses a dynamic sharding technique called Nightshade. This method splits the network into multiple shards, enabling parallel processing of transactions across the network, thus significantly increasing throughput. Each shard processes a portion of transactions, and the outcomes are merged into a single "snapshot" block.
   - This sharding approach ensures scalability, allowing the network to grow and handle increasing demand efficiently.

Consensus Process:

1. Validator Selection:
   - Validators are selected to propose and validate blocks based on the amount of NEAR tokens staked. This selection process is designed to ensure that only validators with significant stakes and community trust participate in securing the network.
2. Transaction Finality:
   - NEAR achieves transaction finality through its PoS-based system, where validators vote on blocks. Once two-thirds of validators approve a block, it reaches finality under Doomslug, meaning that no forks can alter the confirmed state.
3. Epochs and Rotation:
   - Validators are rotated in epochs to ensure fairness and decentralization. Epochs are intervals in which validators are reshuffled, and new block proposers are selected, ensuring a balance between performance and decentralization.

Since Optimism is based on Ethereum, it ultimately inherits its security via the Ethereum blockchain and the proof-of-stake consensus. Within the rollup system, Optimism relies on a “fault proof” procedure. By default, transactions are assumed to be correct (“optimistic”). Only in the event of suspected faults is a fault proof initiated, in which incorrect transactions can be challenged by challengers. This model allows for high efficiency while ensuring correctness.

Plume is described as relying on an architecture aligned with optimistic rollup technology within the Arbitrum Orbit framework. Under this design, transaction ordering is typically performed by a sequencer, while settlement and finality are achieved via anchoring to Ethereum. Economic

incentives and protocol rules are generally designed to encourage timely submission of fraud proofs (where applicable) within predefined challenge windows. The precise security guarantees and finality characteristics depend on the rollup configuration, the sequencer setup, and Ethereum's underlying security assumptions.

Polygon PoS is an EVM-compatible sidechain that operates with a Proof-of-Stake consensus mechanism and periodically submits checkpoints to the Ethereum mainnet. The network maintains its own validator set and processes transactions independently from Ethereum, while using Ethereum smart contracts for staking-related functions and checkpoint verification. Polygon PoS therefore uses Ethereum as a staking and checkpointing layer, but does not rely on Ethereum for full transaction execution or transaction data availability. The Polygon-side architecture consists of two primary node layers. The Bor layer is responsible for transaction execution and block production. The Heimdall layer is responsible for validator coordination, staking-related monitoring, consensus, and checkpoint finalisation. Heimdall is based on Cosmos SDK and CometBFT and aggregates blocks produced by Bor into periodic Merkle-root checkpoints that are submitted to smart contracts on the Ethereum mainnet. Validators participate in the network by staking POL tokens. Token holders may delegate POL tokens to validators, contributing to the validator's effective stake and participating indirectly in network validation. Following the Rio upgrade, Polygon PoS uses a Validator-Elected Block Producer model. Under this model, validators elect the block producer or block producers for a span, rather than relying on the previous stake-weighted selection model for multiple block producers over shorter intervals. Block production and transaction execution are performed on the Bor layer, while Heimdall validators coordinate consensus and checkpoint finalisation. At regular intervals, Heimdall validators aggregate blocks into a Merkle root and submit the resulting checkpoint to Ethereum smart contracts. These checkpoints provide an additional verification layer and support cross-chain verification, including in the context of asset transfers between Polygon PoS and Ethereum. This design enables higher transaction throughput and lower transaction costs than the Ethereum mainnet, while maintaining a technical connection to Ethereum through staking contracts and periodic checkpointing. Polygon PoS should therefore be understood as an independent sidechain or commit-chain architecture, rather than a rollup that inherits full execution and data availability security from Ethereum.

The Ripple blockchain, specifically the XRP Ledger (XRPL), uses a consensus mechanism known as the Ripple Protocol Consensus Algorithm (RPCA). It differs from Proof of Work (PoW) and Proof of Stake (PoS) as it doesn't rely on mining or staking but instead leverages trusted validators in a Federated Byzantine Agreement (FBA) model.

Core Concepts:

1. Validators and Unique Node Lists (UNL): Validators are trusted nodes in the network that validate transactions and propose new ledger updates. Each node maintains a list of trusted validators known as its Unique Node List (UNL). Consensus is achieved when 80% of the validators in a node's UNL agree on the validity of a transaction or block. This ensures high levels of security and decentralization.
2. Transaction Ordering and Validation: Transactions are broadcast to validators, and once 80% of the validators agree, the transaction is considered confirmed. Each ledger in the XRPL contains transaction data, and validators ensure the validity and proper ordering of these transactions.

Consensus Process:

1. Proposal Phase: Validators propose new transactions to be added to the ledger.
2. Validation Phase: Validators vote on proposed transactions by comparing them to their UNL. Consensus is achieved when 80% of validators agree.

3. Finalization: Once consensus is reached, the transactions are written into the new ledger, making them irreversible and final.

Sei leverages its Twin-Turbo consensus mechanism, integrating advanced transaction processing techniques with the reliability of Tendermint Core, to achieve high performance and security.

Core Components:

- Twin-Turbo Consensus:
  - Optimistic Block Processing: Validators process transactions optimistically, assuming their validity, reducing latency and increasing throughput.
  - Intelligent Block Propagation: Compressed block proposals containing transaction hashes enable validators to reconstruct blocks locally, expediting consensus.
  - Single Slot Finality: Ensures immediate block finality upon addition, eliminating the need for confirmations and minimizing the risk of chain reorganizations.
- Tendermint Core Integration:
  Incorporates Byzantine Fault Tolerance (BFT) to maintain security and resilience, safeguarding the network against malicious actors.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.

4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.
2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

Sonic utilizes a Proof-of-Stake (PoS) consensus mechanism integrated with a Directed Acyclic Graph (DAG) architecture to enhance scalability and efficiency. Validators are required to stake the network's native $S tokens, with a minimum of 500,000 $S tokens needed to operate a validator node. This substantial staking requirement ensures that validators have a significant investment in the network's integrity.

Starknet employs zero-knowledge rollups (ZK-Rollups) for transaction aggregation and scalability, ensuring efficiency and security through succinct proof submissions to Ethereum.

Core Components:

- Zero-Knowledge Rollups (ZK-Rollups):
  Aggregates multiple off-chain transactions into a single proof, which is submitted to Ethereum's mainnet, reducing computational load and gas costs.
- Sequencer and Prover Roles:
  - Sequencers: Order and batch transactions for efficient processing.
  - Provers: Generate validity proofs ensuring the correctness of processed batches.
- Instant Finality:
  Transactions are final once a proof is verified and accepted on Ethereum, minimizing the risk of chain reorganizations and enhancing reliability.

Statemint is a common-good parachain on the Polkadot and Kusama networks, designed to handle asset management and issuance efficiently while leveraging Polkadot's shared security model.

Core Components:

- Relay Chain Integration: Statemint inherits its consensus mechanism from the Polkadot Relay Chain, which operates on a Nominated Proof of Stake (NPoS) model. This model ensures robust security and decentralization by relying on validators and nominators.
- Shared Security: As a parachain, Statemint utilizes the Polkadot Relay Chain's validators for block validation, ensuring high security and interoperability without requiring independent validators.
- Collator Nodes: Statemint employs collator nodes to aggregate transactions into blocks and submit them to the Relay Chain validators for finalization. Collators do not participate in consensus directly but play a key role in transaction processing.
- Immediate Finality: The underlying Polkadot consensus mechanism ensures instant finality using the GRANDPA (GHOST-based Recursive Ancestor Deriving Prefix Agreement) protocol, which provides secure and efficient transaction confirmation.

Consensus is reached through the Stellar Consensus Protocol (SCP), which is based on federated Byzantine agreement. This mechanism allows fast finality without mining or staking, but it depends on validators choosing other validators which they trust to reach agreement, called a quorum set. As a result, validator diversity and governance choices play a critical role in security, and concentration of influence among large operators may increase systemic risks.

The Sui blockchain utilizes a Byzantine Fault Tolerant (BFT) consensus mechanism optimized for high throughput and low latency.

Core Components:

1. Mysten Consensus Protocol:
   - The Sui consensus is based on Mysten Labs' Byzantine Fault Tolerance (BFT) protocol, which builds on principles of Practical Byzantine Fault Tolerance (pBFT) but introduces key optimizations for performance.
   - Leaderless Design: Unlike traditional BFT models, Sui does not rely on a single leader to propose blocks. Validators can propose blocks simultaneously, increasing efficiency and reducing the risks associated with leader failure or attacks.
   - Parallel Processing: Transactions can be processed in parallel, maximizing network throughput by utilizing multiple cores and threads. This allows for faster confirmation of transactions and high scalability.
2. Transaction Validation:
   Validators are responsible for receiving transaction requests from clients and processing them. Each transaction includes digital signatures and must meet the network's rules to be considered valid. Validators can propose transactions simultaneously, unlike many other networks that require a sequential, leader-driven process.
3. Optimistic Execution:
   Optimistic Consensus: Sui allows validators to process certain non-contentious, independent transactions without waiting for full consensus. This is known as optimistic execution and helps reduce transaction latency for many use cases, allowing for fast finality in most cases.
4. Finality and Latency:
   The system only requires three rounds of communication between validators to finalize a transaction. This results in low-latency consensus and rapid transaction confirmation times, achieving scalability while maintaining security.
5. Fault Tolerance:
   The system can tolerate up to one-third of validators being faulty or malicious without compromising the integrity of the consensus process.

The Tron blockchain operates on a Delegated Proof of Stake (DPoS) consensus mechanism, designed to improve scalability, transaction speed, and energy efficiency.

Core Components:

1. Delegated Proof of Stake (DPoS): Tron uses DPoS, where token holders vote for a group of delegates known as Super Representatives (SRs)who are responsible for validating transactions and producing new blocks on the network. Token holders can vote for SRs based on their stake in the Tron network, and the top 27 SRs (or more, depending on the protocol version) are selected to participate in the block production process. SRs take turns producing blocks, which are added to the blockchain. This is done on a rotational basis to ensure decentralization and prevent control by a small group of validators.
2. Block Production: The Super Representatives generate new blocks and confirm transactions. The Tron blockchain achieves block finality quickly, with block production occurring every 3 seconds, making it highly efficient and capable of processing thousands of transactions per second.
3. Voting and Governance: Tron's DPoS system also allows token holders to vote on important network decisions, such as protocol upgrades and changes to the system's parameters. Voting power is proportional to the amount of TRX (Tron's native token) that a user holds and chooses to stake. This provides a governance system where the community can actively participate in decision-making.
4. Super Representatives: The Super Representatives play a crucial role in maintaining the security and stability of the Tron blockchain. They are responsible for validating transactions, proposing new blocks, and ensuring the overall functionality of the network. Super Representatives are incentivized with block rewards (newly minted TRX tokens) and transaction feesfor their work.

XinFin Network operates on a modified Delegated Proof of Stake (XDPoS) model, XDPoS 2.0, which ensures scalability, security, and efficiency suitable for enterprise applications.

Core Components:

1. XDPoS 2.0 (Delegated Proof of Stake):
   Masternode System: Validators, known as masternodes, are required to stake XDC tokens to participate in transaction validation and block production. Validators are selected based on both stake size and community votes, ensuring only reliable nodes secure the network.
2. Double Validation Feature:
   - Enhanced Security: Each transaction is validated by two independent validators before it's finalized, reducing the risk of double-spending or malicious behavior and increasing network reliability.
   - Randomized Validator Rotation: Validators are selected in a rotating and randomized manner, preventing any single validator from consistently producing blocks, which enhances decentralization and security.

zkSync operates as a Layer 2 scaling solution for Ethereum, leveraging zero-knowledge rollups (ZK-Rollups) to enable fast, cost-effective, and secure transactions. This consensus mechanism allows zkSync to offload transaction computation from Ethereum's Layer 1, ensuring scalability while maintaining Ethereum's base-layer security.

Core Components:

- Zero-Knowledge Rollups (ZK-Rollups):
  zkSync aggregates multiple transactions off-chain and processes them in batches. A cryptographic proof, called a validity proof, is generated for each batch and submitted to the Ethereum

mainnet. This ensures that all transactions are valid and compliant with Ethereum's rules without processing them individually on Layer 1.

- Validity Proofs:
  zkSync uses zk-SNARKs (Succinct Non-Interactive Arguments of Knowledge) for its validity proofs. These proofs provide mathematical guarantees that transactions within a batch are valid, eliminating the need for Ethereum nodes to re-execute off-chain transactions.
- Sequencers:
  Transactions on zkSync are ordered and processed by sequencers, which bundle transactions into batches. Sequencers maintain network efficiency and provide fast confirmations.
- Fraud Resistance:
  Unlike Optimistic Rollups, zkSync relies on validity proofs rather than fraud proofs, meaning that transactions are final and secure as soon as the validity proof is accepted by Ethereum.
- Data Availability:
  All transaction data is stored on-chain, ensuring that the network remains decentralized and users can reconstruct the state of zkSync at any time.

S.5 Incentive Mechanisms and Applicable Fees

USDC is present on the following networks: Algorand, Aptos Coin, Arbitrum, Avalanche, Base, Celo, Ethereum, Flow, Hedera Hbar, Hyperliquid, Injective, Linea, Near Protocol, Optimism, Plume, Polygon, Ripple, Sei, Solana, Sonic, Starknet, Statemint, Stellar, Sui, Tron, Xdc Network, Zksync.

Algorand's consensus mechanism, Pure Proof-of-Stake (PPoS), relies on the participation of token holders (stakers) to ensure the network's security and integrity:

1. Participation Rewards:
   - Staking Rewards: Users who participate in the consensus protocol by staking their ALGO tokens earn rewards. These rewards are distributed periodically and are proportional to the amount of ALGO staked. This incentivizes users to hold and stake their tokens, contributing to network security and stability.
   - Node Participation Rewards: Validators, also known as participation nodes, are responsible for proposing and voting on blocks. These nodes receive additional rewards for their active role in maintaining the network.
2. Transaction Fees:
   - Flat Fee Model: Algorand employs a flat fee model for transactions, which ensures predictability and simplicity. The standard transaction fee on Algorand is very low (around 0.001 ALGO per transaction). These fees are paid by users to have their transactions processed and included in a block.
   - Fee Redistribution: Collected transaction fees are redistributed to participants in the network. This includes stakers and validators, further incentivizing their participation and ensuring continuous network operation.
3. Economic Security:
   Token Locking: To participate in the consensus mechanism, users must lock up their ALGO tokens. This economic stake acts as a security deposit that can be slashed (forfeited) if the participant acts maliciously. The potential loss of staked tokens discourages dishonest behavior and helps maintain network integrity.

Fees on the Algorand Blockchain

1. Transaction Fees:
   Algorand uses a flat transaction fee model. The current standard fee is 0.001 ALGO per transaction. This fee is minimal compared to other blockchain networks, ensuring affordability and accessibility.
2. Smart Contract Execution Fees:
   Fees for executing smart contracts on Algorand are also designed to be low. These fees are based on the computational resources required to execute the contract, ensuring that users are only charged for the actual resources they consume.
3. Asset Creation Fees:
   Creating new assets (tokens) on the Algorand blockchain involves a small fee. This fee is necessary to prevent spam and ensure that only genuine assets are created and maintained on the network.

Incentive Mechanism:

- Validator Rewards: Validators earn rewards in APT tokens for validating transactions and producing blocks. Rewards are distributed proportionally based on the stake of validators and their delegators.
- Delegator Participation: APT token holders can delegate their tokens to validators, earning a share of the staking rewards without running their own nodes.
- Slashing Mechanism: Validators face penalties, such as losing staked tokens, for malicious actions or prolonged inactivity, ensuring accountability and network security.

Applicable Fees:

- Transaction Fees: Users pay transaction fees in APT tokens for sending transactions and interacting with smart contracts.
- Dynamic Fee Adjustment: Fees are dynamically adjusted based on network activity and resource usage, ensuring cost efficiency and preventing congestion.
- Fee Distribution: Transaction fees are distributed among validators and delegators, providing an additional incentive for network participation.

Transactions on Arbitrum are subject to fees paid in ETH. The total fee generally consists of a Layer 2 execution component, which covers the computational resources required to process the transaction, and a parent-chain data component, which reflects the cost of publishing compressed transaction data to Ethereum. The amount payable therefore depends on the computational complexity of the transaction, the volume and compressibility of its data and the prevailing cost of data publication on Ethereum. Participants that submit or challenge state assertions under the dispute protocol must provide economic bonds. These bonds are intended to discourage incorrect assertions and compensate successful participants in the dispute process. Withdrawals through the canonical bridge become executable after the relevant Layer 2 state has been confirmed and the applicable challenge period has elapsed.

The Avalanche C-Chain is secured economically through the native AVAX token. Validator incentives are based primarily on staking rewards, not on redistribution of C-Chain transaction fees. A fixed amount of 360 million AVAX was minted at genesis, while additional AVAX is minted over time as validator rewards, subject to Avalanche's capped token supply framework. Validator rewards are paid at the end of the staking period and are determined by factors such as the validator's stake and compliance with staking conditions. Unlike some proof-of-stake systems, the Avalanche Primary Network does not use slashing of bonded principal as an ordinary penalty mechanism. Instead, the main protocol-level economic consequence for underperformance is the loss of reward eligibility.

Where a validator fails to satisfy the applicable uptime requirement during its staking term, that validator does not receive the corresponding staking reward. Transaction fees apply on the C-Chain for transfers and smart-contract execution. The fee model follows EIP-1559 logic, meaning that transactions are priced through a dynamic base fee mechanism. In contrast to Ethereum's validator tip model, C-Chain transaction fees are burned rather than distributed to validators. This means that C-Chain fees function as a supply-reduction mechanism and are intended in part to offset inflation arising from the minting of validator rewards. In addition to ordinary transaction and smart-contract execution fees, Avalanche documentation also recognises protocol fees in connection with other network operations on other chains of the Primary Network, such as certain import or export operations and staking-related actions. However, for the C-Chain itself, the core applicable fee category is the gas fee for transaction inclusion and contract execution, and those fees are handled through the protocol burn mechanism rather than paid to validators or a treasury.

Base does not have a native protocol token and does not operate a staking, validator reward or token issuance mechanism. Transaction fees on Base are paid in ETH. The economic incentives within the network are primarily related to transaction processing and network security. Transactions are executed on Base and periodically submitted to Ethereum Layer 1 in batches. As the cost of a Layer-1 submission is shared among multiple Layer-2 transactions, the average transaction cost per transaction may be lower than executing the same transactions directly on Ethereum Layer 1. The integrity of withdrawals from Base is supported by a fault-proof mechanism. Withdrawals are subject to a dispute period during which participants may challenge incorrect state commitments. The dispute process incorporates economic incentives intended to encourage honest behaviour and discourage invalid claims.

Celo's incentive model rewards validators and prioritizes accessibility with minimal transaction fees, especially for cross-border payments, supporting a flexible and user-friendly ecosystem.

Incentive Mechanisms:

1. Validator Rewards:
   Transaction Fees and Newly Minted Tokens: Validators earn rewards from transaction fees as well as newly minted CELO tokens. This dual-source reward system provides a continuous financial incentive for validators to act honestly and secure the network.
2. Transaction Flexibility and Gas Price:
   - Gas Limit and Price Control: Each transaction specifies a maximum gas limit, ensuring that users are not excessively charged if a transaction fails. Users can also set a gas price to prioritize transactions, allowing faster processing for higher fees.
   - Payment Flexibility with Multiple Currencies: Unlike many blockchains, Celo allows transaction fees to be paid in various ERC-20 tokens, providing flexibility for users. This approach improves accessibility, especially for individuals with limited access to traditional banking.
3. Minimal Fee Structure for Accessibility:
   - Designed for Low-Cost Transactions: Celo's fee structure is intentionally minimal, particularly for cross-border payments, making it ideal for users who may not have traditional banking options. This focus on accessibility aligns with Celo's mission to bring blockchain technology to underserved communities.

Applicable Fees:

Transaction Fees: Fees are calculated based on gas usage, with a maximum gas limit set per transaction. This limit protects users from excessive costs, while the option to pay in multiple currencies enhances flexibility.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Flow's incentive model rewards validator nodes, supports ecosystem growth, and maintains affordable fees for developers and users.

Incentive Mechanisms:

1. Staking Rewards for Specialized Nodes:
   Role-Based Rewards: Validators earn Flow tokens according to their specific roles and contributions within the multi-node architecture, aligning rewards with each node's responsibilities to encourage balanced and effective network participation.
2. Transaction Fees:
   Stable and Consumer-Friendly Fees: Flow's fee structure is designed for predictability, keeping transaction costs stable for both developers and users. Fees are based on transaction complexity and provide an ongoing income stream for validators.
3. Misbehavior Penalties:
   Penalties for Downtime or Malicious Behavior: To maintain network stability, Flow imposes penalties on validators for misbehavior or downtime. This incentivizes high-quality validator participation and ensures consistent performance.
4. Ecosystem and Developer Support:
   Dedicated Portion of Fees and Rewards: A portion of Flow's transaction fees and rewards is allocated to developer initiatives, ecosystem growth, and community engagement. This investment fosters innovation, supports long-term network health, and aligns incentives for ecosystem development.

Hedera Hashgraph incentivizes network participation through transaction fees and staking rewards, with a structured and predictable fee model designed for enterprise use.

Incentive Mechanisms:

1. Staking Rewards for Nodes:
   - HBAR Rewards for Node Operators: Node operators earn HBAR rewards for providing network security and processing transactions, incentivizing them to act honestly and support network stability.
   - User Staking: HBAR holders can stake their tokens to support nodes. Staking rewards offer an additional incentive for token holders to engage in network operations, although the structure may evolve with network growth.
2. Service-Based Node Rewards:
   Nodes receive rewards based on specific services they provide to the network, such as:
   - Consensus Services: Reaching consensus and maintaining transaction order.
   - File Storage: Storing data on the Hedera network.

- Smart Contract Processing: Supporting contract executions for decentralized applications.

Applicable Fees:

1. Predictable Transaction Fees: Hedera's fee structure is fixed and predictable, ensuring transparent costs for users and appealing to enterprise-grade applications. Transaction fees are paid in HBAR and are designed to be stable, making it easier for businesses to plan for usage costs.
2. Fee Allocation: All transaction fees collected in HBAR are distributed to network nodes as rewards, reinforcing their role in maintaining network integrity and processing transactions efficiently.

Hyperliquid incentivizes participants through its native token, HYPE. Validators and delegators earn rewards in HYPE for securing the network and participating in governance. Users can also earn HYPE by staking, providing liquidity, and engaging in other ecosystem activities. This dual-token system encourages active participation and supports the network's growth and stability.

Hyperliquid employs a dynamic fee model where transaction fees are based on network activity and the complexity of the transactions. These fees are paid by users conducting transactions on the network and are designed to cover the costs of processing transactions while incentivizing validators.

Injective incentivizes network participation through staking rewards and a unique transaction fee model that supports long-term value for INJ tokens.

Incentive Mechanisms:

Staking Rewards:
INJ holders earn rewards for staking their tokens, encouraging active participation in securing the network.
Validator Rewards:
Validators receive staking rewards and transaction fees for processing transactions and maintaining network security.

Applicable Fees:

Transaction Fees:
Users pay fees in INJ tokens for network transactions, including smart contract execution and trading.
Fee Structure:
A portion of transaction fees is burned via a weekly on-chain auction, reducing the overall supply of INJ tokens and supporting a deflationary tokenomics model.

Like Ethereum, the Network uses a gas system, where gas is the unit of computational effort required to process a transaction. All gas fees on the Network are paid in Ether (ETH). The Network has a base fee that is designed to stabilize at 7 wei. The base fee still decreases or increases based on network traffic, similar to Ethereum, but it does not go below 7 wei. The Network does not require token staking for transaction validation purposes and thus provides no staking rewards. It does not offer incentives for running a full network node. It does charge fees collected by the sequencer for transaction processing. Those fees are paid in ETH, 20% of which are immediately burned while the remaining 80% are converted to Tokens and then burned.

NEAR Protocol employs several economic mechanisms to secure the network and incentivize participation.

Incentive Mechanisms to Secure Transactions:

1. Staking Rewards:
   Validators and delegators secure the network by staking NEAR tokens. Validators earn around 5% annual inflation, with 90% of newly minted tokens distributed as staking rewards. Validators propose blocks, validate transactions, and receive a share of these rewards based on their staked tokens. Delegators earn rewards proportional to their delegation, encouraging broad participation.
2. Delegation:
   Token holders can delegate their NEAR tokens to validators to increase the validator's stake and improve the chances of being selected to validate transactions. Delegators share in the validator's rewards based on their delegated tokens, incentivizing users to support reliable validators.
3. Slashing and Economic Penalties:
   Validators face penalties for malicious behavior, such as failing to validate correctly or acting dishonestly. The slashing mechanism enforces security by deducting a portion of their staked tokens, ensuring validators follow the network's best interests.
4. Epoch Rotation and Validator Selection:
   Validators are rotated regularly during epochs to ensure fairness and prevent centralization. Each epoch reshuffles validators, allowing the protocol to balance decentralization with performance.

Fees on the NEAR Blockchain:

1. Transaction Fees:
   Users pay fees in NEAR tokens for transaction processing, which are burned to reduce the total circulating supply, introducing a potential deflationary effect over time. Validators also receive a portion of transaction fees as additional rewards, providing an ongoing incentive for network maintenance.
2. Storage Fees:
   NEAR Protocol charges storage fees based on the amount of blockchain storage consumed by accounts, contracts, and data. This requires users to hold NEAR tokens as a deposit proportional to their storage usage, ensuring the efficient use of network resources.
3. Redistribution and Burning:
   A portion of the transaction fees (burned NEAR tokens) reduces the overall supply, while the rest is distributed to validators as compensation for their work. The burning mechanism helps maintain long-term economic sustainability and potential value appreciation for NEAR holders.
4. Reserve Requirement:
   Users must maintain a minimum account balance and reserves for data storage, encouraging efficient use of resources and preventing spam attacks.

Optimism charges lower transaction fees than Ethereum Layer 1, as transactions are bundled in the rollup and written to the Ethereum main chain in compressed form. Gas fees on Optimism continue to be paid in ETH. The incentive model is based on increased efficiency for users (lower fees, faster confirmation) and on the role of sequencers. Sequencers are central actors who collect, organize, and include transactions in the rollup. Their revenue comes from the gas fees they charge.

The network is described as applying transaction fees as a core economic mechanism to support network operation and security. Fee flows may be used to remunerate relevant network roles (for example, sequencer- or validator-related functions, if and to the extent such roles exist in the deployed architecture). In addition, PLUME is described as being used in connection with incentive and participation mechanisms, including potential staking-related arrangements and interaction with DeFi applications. Any yields, rewards, or other economic benefits are contingent on protocol

parameters, market conditions, and user behaviour, and may be changed by governance or technical updates, or may not materialise as expected.

Polygon PoS uses economic incentives to support validator participation, transaction processing, and network operation. Validators stake POL tokens and participate in block production, validation, voting, and checkpoint finalisation. Validators may receive rewards connected to their participation in the network, including rewards linked to validation activities and transaction-fee allocation, depending on the applicable protocol rules. Token holders who do not operate validator infrastructure may delegate POL tokens to validators. Delegators may receive a share of rewards attributable to the validator to whom they delegate, subject to the validator's commission and applicable protocol rules. Delegation increases the validator's effective stake and may affect its role in the validator set and related network processes. Following the Rio upgrade, Polygon PoS introduced a Validator-Elected Block Producer model, under which validators elect the block producer or block producers for a span. Publicly described protocol changes associated with this model also provide for redistribution of fees, including maximum extractable value-related fees where applicable, to non-producing validators under the relevant protocol design. This changes the incentive structure from the previous model in which block production selection was more directly described by reference to stake-weighted producer selection. Polygon PoS includes protocol specifications for validator penalties, including slashing-related concepts. Transactions on Polygon PoS require payment of network fees in POL. Fees apply to ordinary token transfers, smart contract deployment, and smart contract interaction. The amount of fees may vary depending on network demand, transaction complexity, and computational resources required. Because Polygon PoS processes transactions independently from Ethereum, transaction fees are generally designed to be lower than equivalent activity on the Ethereum mainnet, although actual fees may change according to network conditions and protocol parameters.

The Ripple XRP blockchain uses a unique incentive structure that differs from traditional Proof of Work (PoW) or Proof of Stake (PoS) systems, focusing on its Ripple Protocol Consensus Algorithm (RPCA).

Incentive Mechanisms to Secure Transactions:

1. Validators: Validators on the Ripple network are not directly compensated with rewards like in PoW/PoS models. Instead, they are incentivized by the utility and stability of the network, particularly financial institutions that benefit from Ripple's efficiency in cross-border payments.
2. No Mining: Since Ripple does not use mining, it eliminates the need for energy-intensive computations, contributing to fast transaction speeds and scalability.

Fees on the Ripple XRP Blockchain:

1. Transaction Fees: Ripple charges minimal transaction fees (typically fractions of an XRP, known as \drops") for each transaction. The purpose of these fees is to prevent network spam and overload.
2. Burn Mechanism: A portion of each transaction fee is burned, meaning it's permanently removed from circulation. This reduces the overall supply of XRP over time, contributing to potential long-term value stability.

The Sei Network incentivizes participation through staking rewards and a transparent fee structure, supporting its decentralized ecosystem.

Incentive Mechanisms:

- Staking Rewards: Validators and delegators earn SEI tokens as rewards for securing the network through staking, promoting active engagement and long-term commitment.

- Governance Participation: SEI token holders can participate in network governance decisions, influencing protocol upgrades and key changes.

Applicable Fees:

Transaction Fees: Users pay fees in SEI tokens for network transactions. These fees are distributed to validators and delegators as rewards, supporting network operations and security.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.
   - Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.
2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.
3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

Sonic's economic model is designed to incentivize active participation from both validators and developers. Validators earn rewards through a combination of block rewards and transaction fees. The block reward system employs a dynamic Annual Percentage Rate (APR) mechanism.

Starknet's incentive model combines transaction fees and plans for future staking rewards to support network operations and security.

Incentive Mechanisms:

- Transaction Fees: Users pay fees in Ether (ETH) to compensate sequencers and cover the cost of proof submission and storage on Ethereum.
- Dynamic Fee Model: Fees adjust based on transaction complexity and resource requirements, ensuring fair cost distribution and efficient network usage.
- Future Staking Rewards: Planned staking mechanisms will incentivize participants to lock their STARK tokens, enhancing network security and governance.

Statemint is a common-good parachain on the Polkadot and Kusama networks, designed to enable efficient asset management while benefiting from Polkadot's shared security and governance model.

Incentive Mechanisms:

- Relay Chain Validators: Validators securing the Polkadot Relay Chain are indirectly incentivized through block rewards and transaction fees collected across all parachains, including Statemint. This ensures the stability and security of the network without requiring Statemint-specific rewards.
- Collator Compensation: Collator nodes aggregate transactions and produce blocks for Statemint. They may be compensated through external arrangements, such as subsidies or user-driven incentives, depending on governance decisions and usage patterns.
- Governance Participation: Polkadot (DOT) and Kusama (KSM) token holders influence Statemint's operations, such as fee adjustments and protocol upgrades, through on-chain governance mechanisms.

Applicable Fees:

- Transaction Fees: Users pay transaction fees in the native tokens of the Relay Chain, DOT for Polkadot or KSM for Kusama. These fees are distributed to Relay Chain validators to support the network's maintenance.
- Asset Creation and Transfer Fees: Fees apply for creating new assets and transferring them on the Statemint chain. These fees help prevent spam and ensure efficient use of network resources.
- Governance-Defined Fee Adjustments: The Statemint parachain's fees can be adjusted through governance proposals, enabling the community to adapt costs to network conditions.

Stellar does not use block rewards or mining. Instead, validators operate without direct protocol-level rewards. While this design keeps costs low, it may reduce incentives for validator participation compared to staking-based models. The sustainability of validator engagement depends largely on external factors such as institutional involvement and ecosystem adoption.

Security and Economic Incentives:

1. Validators:
   Validators stake SUI tokens to participate in the consensus process. They earn rewards for validating transactions and securing the network.

2. Slashing:
   Validators can be penalized (slashed) for malicious behavior, such as double-signing or failing to properly validate transactions. This helps maintain network security and incentivizes honest behavior.
3. Delegation:
   Token holders can delegate their SUI tokens to trusted validators. In return, they share in the rewards earned by validators. This encourages widespread participation in securing the network.

Fees on the SUI Blockchain:

1. Transaction Fees:
   Users pay transaction fees to validators for processing and confirming transactions. These fees are calculated based on the computational resources required to process the transaction. Fees are paid in SUI tokens, which is the native cryptocurrency of the Sui blockchain.
2. Dynamic Fee Model:
   The transaction fees on Sui are dynamic, meaning they adjust based on network demand and the complexity of the transactions being processed.

The Tron blockchain uses a Delegated Proof of Stake (DPoS) consensus mechanism to secure its network and incentivize participation.

Incentive Mechanism:

1. Super Representatives (SRs) Rewards:
   - Block Rewards: Super Representatives (SRs), who are elected by TRX holders, are rewarded for producing blocks. Each block they produce comes with a block reward in the form of TRX tokens.
   - Transaction Fees: In addition to block rewards, SRs receive transaction fees for validating transactions and including them in blocks. This ensures they are incentivized to process transactions efficiently.
2. Voting and Delegation:
   - TRX Staking: TRX holders can stake their tokens and vote for Super Representatives (SRs). When TRX holders vote, they delegate their voting power to SRs, which allows SRs to earn rewards in the form of newly minted TRX tokens.
   - Delegator Rewards: Token holders who delegate their votes to an SR can also receive a share of the rewards. This means delegators share in the block rewards and transaction fees that the SR earns.
   - Incentivizing Participation: The more tokens a user stakes, the more voting power they have, which encourages participation in governance and network security.
3. Incentive for SRs:
   SRs are also incentivized to maintain the health and performance of the network. Their reputation and continued election depend on their ability to produce blocks consistently and efficiently process transactions.

Applicable Fees:

1. Transaction Fees:
   - Fee Calculation: Users must pay transaction fees to have their transactions processed. The transaction fee varies based on the complexity of the transaction and the network's current demand. This is paid in TRX tokens. Transaction
   - Fee Distribution: Transaction fees are distributed to Super Representatives (SRs), giving them an ongoing income to maintain and support the network.

2. Storage Fees:
   Tron charges storage fees for data storage on the blockchain. This includes storing smart contracts, tokens, and other data on the network. Users are required to pay these fees in TRX tokens to store data.
3. Energy and Bandwidth:
   Energy: Tron uses a resource model that allows users to access network resources like bandwidth and energy through staking. Users who stake their TRX tokens receive \energy

XinFin incentivizes both validators and token holders to actively participate in network security and stability through staking and fee distribution mechanisms.

Incentive Mechanisms:

1. Staking Rewards:
   - Validator Rewards: Validators earn XDC token rewards for validating transactions and maintaining network security.
   - Delegator Rewards: XDC holders who delegate their tokens to validators receive a share of staking rewards, promoting community participation without requiring users to operate nodes.
2. Delegation Model:
   Passive Income: XDC holders can delegate tokens to validators, enabling them to earn rewards passively and boosting network security through broader staking participation.

Applicable Fees:

- Fee Distribution: All transactions incur XDC fees, which are distributed to validators as additional rewards for their role in securing the network.
- Predictable Fees for Enterprises: Transaction fees are kept low and predictable, supporting XinFin's focus on enterprise use cases in finance, trade, and cross-border payments.

zkSync incentivizes network participants through a streamlined fee structure and role-based rewards, designed to ensure security, scalability, and usability for both users and validators.

Incentive Mechanism:

- Validator Rewards: Validators, who generate validity proofs and secure the network, are compensated through transaction fees paid by users. Their role ensures that batches of transactions are processed efficiently and accurately.
- Sequencer Incentives: Sequencers are responsible for bundling and ordering transactions off-chain. They earn a share of the transaction fees for maintaining network performance and fast processing times.
- Ecosystem Growth Rewards: zkSync allocates resources to incentivize developers and projects building on its platform, fostering a robust ecosystem of dApps, DeFi protocols, and NFT marketplaces.

Applicable Fees:

- Transaction Fees: Users pay fees in Ether (ETH) for transactions on zkSync. These fees are significantly lower than Ethereum Layer 1 fees, as zkSync processes transactions off-chain and submits only aggregated proofs to the Ethereum mainnet.
- Fee Model: Fees are dynamically calculated based on the complexity of transactions (e.g., token transfers, smart contract interactions) and the cost of submitting validity proofs to Ethereum.
- Scalability Benefits: zkSync's efficient rollup architecture reduces gas fees for users while ensuring that validators and sequencers are appropriately compensated for their roles.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) algorand, aptos_coin, arbitrum, avalanche, base, celo, ethereum, flow, hedera_hbar, hyperliquid, injective, linea, near_protocol, optimism, plume, polygon, ripple, sei, solana, sonic, starknet, statemint, stellar, sui, tron, xdc_network, zksync 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.

Algorand

ALGO | K8S6W74KS

Quantitative information

Quantitative sustainability indicators for Algorand

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Algorand	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	420961.80000	kWh/a

Qualitative information

S.4 Consensus Mechanism

The Algorand blockchain utilizes a consensus mechanism termed Pure Proof-of-Stake (PPoS). Consensus, in this context, describes the method by which blocks are selected and appended to the blockchain. Algorand employs a verifiable random function (VRF) to select leaders who propose blocks for each round.

Upon block proposal, a pseudorandomly selected committee of voters is chosen to evaluate the proposal. If a supermajority of these votes are from honest participants, the block is certified. What makes this algorithm a Pure Proof of Stake is that users are chosen for committees based on the number of algos in their accounts. This system leverages random committee selection to maintain high performance and inclusivity within the network.

The consensus process involves three stages:

1. Propose: A leader proposes a new block.
2. Soft Vote: A committee of voters assesses the proposed block.
3. Certify Vote: Another committee certifies the block if it meets the required honesty threshold.

S.5 Incentive Mechanisms and Applicable Fees

Algorand's consensus mechanism, Pure Proof-of-Stake (PPoS), relies on the participation of token holders (stakers) to ensure the network's security and integrity:

1. Participation Rewards:
   - Staking Rewards: Users who participate in the consensus protocol by staking their ALGO tokens earn rewards. These rewards are distributed periodically and are proportional to the amount of ALGO staked. This incentivizes users to hold and stake their tokens, contributing to network security and stability.
   - Node Participation Rewards: Validators, also known as participation nodes, are responsible for proposing and voting on blocks. These nodes receive additional rewards for their active role in maintaining the network.
2. Transaction Fees:
   - Flat Fee Model: Algorand employs a flat fee model for transactions, which ensures predictability and simplicity. The standard transaction fee on Algorand is very low (around 0.001 ALGO per transaction). These fees are paid by users to have their transactions processed and included in a block.
   - Fee Redistribution: Collected transaction fees are redistributed to participants in the network. This includes stakers and validators, further incentivizing their participation and ensuring continuous network operation.
3. Economic Security:
   Token Locking: To participate in the consensus mechanism, users must lock up their ALGO tokens. This economic stake acts as a security deposit that can be slashed (forfeited) if the participant acts maliciously. The potential loss of staked tokens discourages dishonest behavior and helps maintain network integrity.

Fees on the Algorand Blockchain

1. Transaction Fees:
   Algorand uses a flat transaction fee model. The current standard fee is 0.001 ALGO per transaction. This fee is minimal compared to other blockchain networks, ensuring affordability and accessibility.
2. Smart Contract Execution Fees:
   Fees for executing smart contracts on Algorand are also designed to be low. These fees are based on the computational resources required to execute the contract, ensuring that users are only charged for the actual resources they consume.
3. Asset Creation Fees:
   Creating new assets (tokens) on the Algorand blockchain involves a small fee. This fee is necessary to prevent spam and ensure that only genuine assets are created and maintained on the network.

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 regulary, 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.

Sui

SUI | 64RFW3D8P

Quantitative information

Quantitative sustainability indicators for Sui

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Sui	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	394725.60000	kWh/a

Qualitative information

S.4 Consensus Mechanism

The Sui blockchain utilizes a Byzantine Fault Tolerant (BFT) consensus mechanism optimized for high throughput and low latency.

Core Components:

1. Mysten Consensus Protocol:
   - The Sui consensus is based on Mysten Labs' Byzantine Fault Tolerance (BFT) protocol, which builds on principles of Practical Byzantine Fault Tolerance (pBFT) but introduces key optimizations for performance.
   - Leaderless Design: Unlike traditional BFT models, Sui does not rely on a single leader to propose blocks. Validators can propose blocks simultaneously, increasing efficiency and reducing the risks associated with leader failure or attacks.
   - Parallel Processing: Transactions can be processed in parallel, maximizing network throughput by utilizing multiple cores and threads. This allows for faster confirmation of transactions and high scalability.
2. Transaction Validation:
   Validators are responsible for receiving transaction requests from clients and processing them. Each transaction includes digital signatures and must meet the network's rules to be considered valid. Validators can propose transactions simultaneously, unlike many other networks that require a sequential, leader-driven process.

3. Optimistic Execution:
   Optimistic Consensus: Sui allows validators to process certain non-contentious, independent transactions without waiting for full consensus. This is known as optimistic execution and helps reduce transaction latency for many use cases, allowing for fast finality in most cases.
4. Finality and Latency:
   The system only requires three rounds of communication between validators to finalize a transaction. This results in low-latency consensus and rapid transaction confirmation times, achieving scalability while maintaining security.
5.Fault Tolerance:
   The system can tolerate up to one-third of validators being faulty or malicious without compromising the integrity of the consensus process.

S.5 Incentive Mechanisms and Applicable Fees

Security and Economic Incentives:

1. Validators:
   Validators stake SUI tokens to participate in the consensus process. They earn rewards for validating transactions and securing the network.
2. Slashing:
   Validators can be penalized (slashed) for malicious behavior, such as double-signing or failing to properly validate transactions. This helps maintain network security and incentivizes honest behavior.
3. Delegation:
   Token holders can delegate their SUI tokens to trusted validators. In return, they share in the rewards earned by validators. This encourages widespread participation in securing the network.

Fees on the SUI Blockchain:

1. Transaction Fees:
   Users pay transaction fees to validators for processing and confirming transactions. These fees are calculated based on the computational resources required to process the transaction. Fees are paid in SUI tokens, which is the native cryptocurrency of the Sui blockchain.
2. Dynamic Fee Model:
   The transaction fees on Sui are dynamic, meaning they adjust based on network demand and the complexity of the transactions being processed.

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 '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 regulary, 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) sui 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.

Aptos Coin

APT | C4CQCGLH2

Quantitative information

Quantitative sustainability indicators for Aptos Coin

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Aptos Coin	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	262800.00000	kWh/a

Qualitative information

S.4 Consensus Mechanism

Aptos utilizes a Proof-of-Stake approach combined with a BFT consensus protocol to ensure high throughput, low latency, and secure transaction processing.

Core Components:

- Parallel Execution: Transactions are processed concurrently using Block-STM, a parallel execution engine, enabling high performance and scalability.
- Leader-Based BFT: A leader is selected among validators to propose blocks, while others validate and finalize transactions.
- Dynamic Validator Rotation: Validators are rotated regularly, enhancing decentralization and preventing collusion.
- Instant Finality: Transactions achieve finality once validated, ensuring that they are irreversible.

S.5 Incentive Mechanisms and Applicable Fees

Incentive Mechanism:

- Validator Rewards: Validators earn rewards in APT tokens for validating transactions and producing blocks. Rewards are distributed proportionally based on the stake of validators and their delegators.
- Delegator Participation: APT token holders can delegate their tokens to validators, earning a share of the staking rewards without running their own nodes.

- Slashing Mechanism: Validators face penalties, such as losing staked tokens, for malicious actions or prolonged inactivity, ensuring accountability and network security.

Applicable Fees:

- Transaction Fees: Users pay transaction fees in APT tokens for sending transactions and interacting with smart contracts.
- Dynamic Fee Adjustment: Fees are dynamically adjusted based on network activity and resource usage, ensuring cost efficiency and preventing congestion.
- Fee Distribution: Transaction fees are distributed among validators and delegators, providing an additional incentive for network participation.

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 '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 regulary, 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) aptos_coin 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.

Injective Token

INJ | 92M9B0DZ7

Quantitative information

Quantitative sustainability indicators for Injective Token

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Injective Token	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	242392.18261	kWh/a

Qualitative information

S.4 Consensus Mechanism

Injective Token is present on the following networks: Binance Smart Chain, Cosmos, Ethereum, Injective, Osmosis.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

The Cosmos network uses the Cosmos SDK, a modular framework that enables developers to build custom, application-specific blockchains. Cosmos SDK chains rely on Tendermint Core, a Byzantine Fault Tolerant (BFT) Proof of Stake (PoS) consensus engine that supports interoperability and fast transaction finality.

Core Components:

1. Tendermint BFT Consensus with Proof of Stake:
   - Validator Selection: Cosmos validators are selected based on the amount of ATOM they stake or receive from delegators. These validators participate in block proposal and validation through a two-thirds majority voting system.
   - Security Threshold: Tendermint BFT ensures network security as long as fewer than one-third of validators act maliciously.
2. Modular Cosmos SDK Framework:
   - Inter-Blockchain Communication (IBC): The Cosmos SDK supports IBC, allowing seamless interoperability between Cosmos-based blockchains.
   - Application Blockchain Interface (ABCI): This interface separates the consensus layer from the application layer, enabling developers to implement custom logic without modifying the consensus engine.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Injective operates on a Tendermint-based Proof of Stake (PoS) consensus model, ensuring high throughput and immediate transaction finality.

Core Components:

- Tendermint-based Proof of Stake (PoS):
  Ensures instant transaction finality and supports efficient block production for high-speed transactions.
- Validator Selection:
  Validators are chosen based on the amount of INJ tokens staked, considering both self-staked and delegated tokens, to maintain a decentralized network.
- Delegation:
  INJ holders can delegate their tokens to validators, earning a share of staking rewards while participating in network governance.
- Instant Finality:
  The Tendermint consensus mechanism provides immediate finality, ensuring transactions cannot be reversed once validated.

Osmosis operates on a Proof of Stake (PoS) consensus mechanism, leveraging the Cosmos SDK and Tendermint Core to provide secure, decentralized, and scalable transaction processing.

Core Components:

- Proof of Stake (PoS): Validators are chosen based on the amount of OSMO tokens they stake or are delegated by other token holders. Validators are responsible for validating transactions, producing blocks, and maintaining network security.
- Cosmos SDK and Tendermint Core: Osmosis uses Tendermint Core for Byzantine Fault Tolerant (BFT) consensus, ensuring fast finality and resistance to attacks as long as less than one-third of validators are malicious.
- Decentralized Governance: OSMO token holders can participate in governance by voting on protocol upgrades and network parameters, fostering a community-driven approach to network development.

S.5 Incentive Mechanisms and Applicable Fees

Injective Token is present on the following networks: Binance Smart Chain, Cosmos, Ethereum, Injective, Osmosis.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

The Cosmos network incentivizes both validators and delegators to secure the network through staking rewards, funded by transaction fees and newly minted ATOM.

Incentive Mechanisms:

1. Staking Rewards for Validators and Delegators:
   ATOM Rewards: Validators earn staking rewards in ATOM tokens for participating in consensus, with rewards shared with delegators who stake ATOM through delegation.
2. Slashing for Accountability:
   Penalties for Misconduct: Validators who act maliciously, such as double-signing or staying offline, face slashing penalties, which remove a portion of their staked ATOM. Delegators may also experience slashing if their chosen validator is penalized, encouraging careful selection of trustworthy validators.

Applicable Fees:

1. Transaction Fees:
   User-Paid Fees in ATOM: All transactions on the Cosmos Hub incur fees paid in ATOM, compensating validators for transaction processing and helping to prevent network spam.
2. Customizable Fee Model:
   Custom Token Fees: Cosmos SDK allows individual chains to define their own transaction fees in tokens other than ATOM, supporting varied application requirements within the ecosystem.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Injective incentivizes network participation through staking rewards and a unique transaction fee model that supports long-term value for INJ tokens.

Incentive Mechanisms:

Staking Rewards:
   INJ holders earn rewards for staking their tokens, encouraging active participation in securing the network.
Validator Rewards:
   Validators receive staking rewards and transaction fees for processing transactions and maintaining network security.

Applicable Fees:

Transaction Fees:
   Users pay fees in INJ tokens for network transactions, including smart contract execution and trading.

Fee Structure:

A portion of transaction fees is burned via a weekly on-chain auction, reducing the overall supply of INJ tokens and supporting a deflationary tokenomics model.

Osmosis incentivizes validators, delegators, and liquidity providers through a combination of staking rewards, transaction fees, and liquidity incentives.

Incentive Mechanisms:

- Validator Rewards: Validators earn rewards from transaction fees and block rewards, distributed in OSMO tokens, for their role in securing the network and processing transactions. Delegators who stake their OSMO tokens with validators receive a share of these rewards.
- Liquidity Provider Rewards: Users providing liquidity to Osmosis pools earn swap fees and may receive additional incentives in the form of OSMO tokens to encourage liquidity provision.
- Superfluid Staking: Liquidity providers can participate in superfluid staking, staking a portion of their OSMO tokens within liquidity pools. This mechanism allows users to earn staking rewards while maintaining liquidity in the pools

Applicable Fees:

Transaction Fees: Users pay transaction fees in OSMO tokens for network activities, including swaps, staking, and governance participation. These fees are distributed to validators and delegators, incentivizing their continued participation and support for network security.

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 '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. Due to the structure of this network, it is not only the mainnet that is responsible for energy consumption. In order to calculate the structure adequately, a proportion of the energy consumption of the connected network, cosmos, must also be taken into account, because the connected network is also responsible for security. This proportion is determined on the basis of gas consumption. 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 regulary, 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) binance_smart_chain, cosmos, ethereum, osmosis 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.

SEI

SEI | XCDVP53WR

Quantitative information

Quantitative sustainability indicators for SEI

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	SEI	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	210305.17440	kWh/a

Qualitative information

S.4 Consensus Mechanism

SEI is present on the following networks: Osmosis, Sei.

Osmosis operates on a Proof of Stake (PoS) consensus mechanism, leveraging the Cosmos SDK and Tendermint Core to provide secure, decentralized, and scalable transaction processing.

Core Components:

- Proof of Stake (PoS): Validators are chosen based on the amount of OSMO tokens they stake or are delegated by other token holders. Validators are responsible for validating transactions, producing blocks, and maintaining network security.
- Cosmos SDK and Tendermint Core: Osmosis uses Tendermint Core for Byzantine Fault Tolerant (BFT) consensus, ensuring fast finality and resistance to attacks as long as less than one-third of validators are malicious.
- Decentralized Governance: OSMO token holders can participate in governance by voting on protocol upgrades and network parameters, fostering a community-driven approach to network development.

Sei leverages its Twin-Turbo consensus mechanism, integrating advanced transaction processing techniques with the reliability of Tendermint Core, to achieve high performance and security.

Core Components:

- Twin-Turbo Consensus:
  - Optimistic Block Processing: Validators process transactions optimistically, assuming their validity, reducing latency and increasing throughput.
  - Intelligent Block Propagation: Compressed block proposals containing transaction hashes enable validators to reconstruct blocks locally, expediting consensus.
  - Single Slot Finality: Ensures immediate block finality upon addition, eliminating the need for confirmations and minimizing the risk of chain reorganizations.
- Tendermint Core Integration:
  Incorporates Byzantine Fault Tolerance (BFT) to maintain security and resilience, safeguarding the network against malicious actors.

S.5 Incentive Mechanisms and Applicable Fees

SEI is present on the following networks: Osmosis, Sei.

Osmosis incentivizes validators, delegators, and liquidity providers through a combination of staking rewards, transaction fees, and liquidity incentives.

Incentive Mechanisms:

- Validator Rewards: Validators earn rewards from transaction fees and block rewards, distributed in OSMO tokens, for their role in securing the network and processing transactions. Delegators who stake their OSMO tokens with validators receive a share of these rewards.
- Liquidity Provider Rewards: Users providing liquidity to Osmosis pools earn swap fees and may receive additional incentives in the form of OSMO tokens to encourage liquidity provision.
- Superfluid Staking: Liquidity providers can participate in superfluid staking, staking a portion of their OSMO tokens within liquidity pools. This mechanism allows users to earn staking rewards while maintaining liquidity in the pools

Applicable Fees:

Transaction Fees: Users pay transaction fees in OSMO tokens for network activities, including swaps, staking, and governance participation. These fees are distributed to validators and delegators, incentivizing their continued participation and support for network security.

The Sei Network incentivizes participation through staking rewards and a transparent fee structure, supporting its decentralized ecosystem.

Incentive Mechanisms:

- Staking Rewards: Validators and delegators earn SEI tokens as rewards for securing the network through staking, promoting active engagement and long-term commitment.
- Governance Participation: SEI token holders can participate in network governance decisions, influencing protocol upgrades and key changes.

Applicable Fees:

Transaction Fees: Users pay fees in SEI tokens for network transactions. These fees are distributed to validators and delegators as rewards, supporting network operations and security.

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 '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 regulary, 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) osmosis 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.

Cosmos ATOM

ATOM | 6C7F2WVZH

Quantitative information

Quantitative sustainability indicators for Cosmos ATOM

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Cosmos ATOM	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	186478.44130	kWh/a

Qualitative information

S.4 Consensus Mechanism

Cosmos ATOM is present on the following networks: Binance Smart Chain, Bitsong, Cosmos, Cronos, Ethereum, Injective, Osmosis.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

BitSong operates on a Delegated Proof-of-Stake (DPoS) consensus mechanism. In this model, BTSG token holders delegate their tokens to validators, who are responsible for producing and validating new blocks. The selection of validators is based on the amount of BTSG tokens staked and the duration of staking, which determines their voting power in the network's governance processes.

The Cosmos network uses the Cosmos SDK, a modular framework that enables developers to build custom, application-specific blockchains. Cosmos SDK chains rely on Tendermint Core, a Byzantine Fault Tolerant (BFT) Proof of Stake (PoS) consensus engine that supports interoperability and fast transaction finality.

Core Components:

1. Tendermint BFT Consensus with Proof of Stake:
   - Validator Selection: Cosmos validators are selected based on the amount of ATOM they stake or receive from delegators. These validators participate in block proposal and validation through a two-thirds majority voting system.
   - Security Threshold: Tendermint BFT ensures network security as long as fewer than one-third of validators act maliciously.
2. Modular Cosmos SDK Framework:
   - Inter-Blockchain Communication (IBC): The Cosmos SDK supports IBC, allowing seamless interoperability between Cosmos-based blockchains.
   - Application Blockchain Interface (ABCI): This interface separates the consensus layer from the application layer, enabling developers to implement custom logic without modifying the consensus engine.

Cronos operates on a Proof of Stake (PoS) model integrated with Tendermint's Byzantine Fault Tolerant (BFT) consensus, designed for decentralization, security, and interoperability. This model enables validators to be selected based on staking power, rewarding them for securing and validating the network.

Core Components:

- Proof of Stake (PoS) with Tendermint BFT Validator Selection: Validators are chosen based on the amount of CRO tokens staked, securing the network and producing blocks.
- Delegation Model: Token holders can delegate their CRO to validators, enabling participation in network security without needing to run a validator node.
- Cosmos SDK and Inter-Blockchain Communication (IBC) Cross-Chain Connectivity: Built on the Cosmos SDK, Cronos enables cross-chain communication, connecting to other Cosmos blockchains and ecosystems such as Ethereum and Binance Smart Chain.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Injective operates on a Tendermint-based Proof of Stake (PoS) consensus model, ensuring high throughput and immediate transaction finality.

Core Components:

- Tendermint-based Proof of Stake (PoS):
  Ensures instant transaction finality and supports efficient block production for high-speed transactions.
- Validator Selection:
  Validators are chosen based on the amount of INJ tokens staked, considering both self-staked and delegated tokens, to maintain a decentralized network.
- Delegation:
  INJ holders can delegate their tokens to validators, earning a share of staking rewards while participating in network governance.
- Instant Finality:
  The Tendermint consensus mechanism provides immediate finality, ensuring transactions cannot be reversed once validated.

Osmosis operates on a Proof of Stake (PoS) consensus mechanism, leveraging the Cosmos SDK and Tendermint Core to provide secure, decentralized, and scalable transaction processing.

Core Components:

- Proof of Stake (PoS): Validators are chosen based on the amount of OSMO tokens they stake or are delegated by other token holders. Validators are responsible for validating transactions, producing blocks, and maintaining network security.
- Cosmos SDK and Tendermint Core: Osmosis uses Tendermint Core for Byzantine Fault Tolerant (BFT) consensus, ensuring fast finality and resistance to attacks as long as less than one-third of validators are malicious.
- Decentralized Governance: OSMO token holders can participate in governance by voting on protocol upgrades and network parameters, fostering a community-driven approach to network development.

S.5 Incentive Mechanisms and Applicable Fees

Cosmos ATOM is present on the following networks: Binance Smart Chain, Bitsong, Cosmos, Cronos, Ethereum, Injective, Osmosis.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support

reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

The native token, BTSG, serves multiple roles within the BitSong ecosystem, including transaction fee payments, staking, and governance participation. Validators earn rewards from transaction fees and block rewards, with a portion of these rewards distributed to delegators after deducting the validator's commission.

The Cosmos network incentivizes both validators and delegators to secure the network through staking rewards, funded by transaction fees and newly minted ATOM.

Incentive Mechanisms:

1. Staking Rewards for Validators and Delegators:
   ATOM Rewards: Validators earn staking rewards in ATOM tokens for participating in consensus, with rewards shared with delegators who stake ATOM through delegation.
2. Slashing for Accountability:
   Penalties for Misconduct: Validators who act maliciously, such as double-signing or staying offline, face slashing penalties, which remove a portion of their staked ATOM. Delegators may also experience slashing if their chosen validator is penalized, encouraging careful selection of trustworthy validators.

Applicable Fees:

1. Transaction Fees:
   User-Paid Fees in ATOM: All transactions on the Cosmos Hub incur fees paid in ATOM, compensating validators for transaction processing and helping to prevent network spam.
2. Customizable Fee Model:
   Custom Token Fees: Cosmos SDK allows individual chains to define their own transaction fees in tokens other than ATOM, supporting varied application requirements within the ecosystem.

Cronos incentivizes validators and delegators with staking rewards and transaction fees, aligning economic incentives with network security and growth.

Incentive Mechanisms:

- Staking Rewards Validators and Delegators: Both groups earn CRO rewards for supporting network security. Delegators earn a portion of the validator rewards, promoting broader network participation.
- Deflationary Mechanism Token Burning: A portion of transaction fees and staking rewards may be periodically burned, reducing CRO supply over time and potentially increasing token value.

Applicable Fees:

- Transaction and Smart Contract Fees Standard Transactions: Users pay CRO for network transactions and dApp interactions, providing a steady income for validators.

- Ethereum-Compatible Gas Fees: Executing Ethereum-compatible smart contracts incurs gas fees, similar to Ethereum, payable in CRO.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Injective incentivizes network participation through staking rewards and a unique transaction fee model that supports long-term value for INJ tokens.

Incentive Mechanisms:

Staking Rewards:
INJ holders earn rewards for staking their tokens, encouraging active participation in securing the network.
Validator Rewards:
Validators receive staking rewards and transaction fees for processing transactions and maintaining network security.

Applicable Fees:

Transaction Fees:
Users pay fees in INJ tokens for network transactions, including smart contract execution and trading.
Fee Structure:
A portion of transaction fees is burned via a weekly on-chain auction, reducing the overall supply of INJ tokens and supporting a deflationary tokenomics model.

Osmosis incentivizes validators, delegators, and liquidity providers through a combination of staking rewards, transaction fees, and liquidity incentives.

Incentive Mechanisms:

- Validator Rewards: Validators earn rewards from transaction fees and block rewards, distributed in OSMO tokens, for their role in securing the network and processing transactions. Delegators who stake their OSMO tokens with validators receive a share of these rewards.
- Liquidity Provider Rewards: Users providing liquidity to Osmosis pools earn swap fees and may receive additional incentives in the form of OSMO tokens to encourage liquidity provision.
- Superfluid Staking: Liquidity providers can participate in superfluid staking, staking a portion of their OSMO tokens within liquidity pools. This mechanism allows users to earn staking rewards while maintaining liquidity in the pools

Applicable Fees:

Transaction Fees: Users pay transaction fees in OSMO tokens for network activities, including swaps, staking, and governance participation. These fees are distributed to validators and delegators, incentivizing their continued participation and support for network security.

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 '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 regulary, 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) binance_smart_chain, bitsong, cosmos, cronos, ethereum, injective, osmosis 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.

Canton Coin

CC | VQ9SP7NFH

Quantitative information

Quantitative sustainability indicators for Canton Coin

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Canton Coin	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	184222.80000	kWh/a

Qualitative information

S.4 Consensus Mechanism

The Canton Network uses a “proof-of-stakeholder” consensus model. Participants who are stakeholders in a given transaction validate that transaction, while a separate synchronization domain (sync domain) sequences transactions and ensures ordering through a Byzantine Fault Tolerant protocol in its decentralized mode.

S.5 Incentive Mechanisms and Applicable Fees

Fees paid in the network’s native token are burned, while new tokens are minted as rewards based on participants’ contribution to network utility. Rewards are allocated across infrastructure providers, application builders, and users in line with their roles and the value they bring to the network.

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 regulary, 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.

Polygon POL

MATIC | GB8DQ8DWN

Quantitative information

Quantitative sustainability indicators for Polygon POL

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Polygon POL	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	96601.44772	kWh/a

Qualitative information

S.4 Consensus Mechanism

Polygon POL is present on the following networks: Ethereum, Polygon.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Polygon PoS is an EVM-compatible sidechain that operates with a Proof-of-Stake consensus mechanism and periodically submits checkpoints to the Ethereum mainnet. The network maintains its own validator set and processes transactions independently from Ethereum, while using Ethereum smart contracts for staking-related functions and checkpoint verification. Polygon PoS therefore uses Ethereum as a staking and checkpointing layer, but does not rely on Ethereum for full transaction execution or transaction data availability. The Polygon-side architecture consists of two primary node layers. The Bor layer is responsible for transaction execution and block production.

The Heimdall layer is responsible for validator coordination, staking-related monitoring, consensus, and checkpoint finalisation. Heimdall is based on Cosmos SDK and CometBFT and aggregates blocks produced by Bor into periodic Merkle-root checkpoints that are submitted to smart contracts on the Ethereum mainnet. Validators participate in the network by staking POL tokens. Token holders may delegate POL tokens to validators, contributing to the validator's effective stake and participating indirectly in network validation. Following the Rio upgrade, Polygon PoS uses a Validator-Elected Block Producer model. Under this model, validators elect the block producer or block producers for a span, rather than relying on the previous stake-weighted selection model for multiple block producers over shorter intervals. Block production and transaction execution are performed on the Bor layer, while Heimdall validators coordinate consensus and checkpoint finalisation. At regular intervals, Heimdall validators aggregate blocks into a Merkle root and submit the resulting checkpoint to Ethereum smart contracts. These checkpoints provide an additional verification layer and support cross-chain verification, including in the context of asset transfers between Polygon PoS and Ethereum. This design enables higher transaction throughput and lower transaction costs than the Ethereum mainnet, while maintaining a technical connection to Ethereum through staking contracts and periodic checkpointing. Polygon PoS should therefore be understood as an independent sidechain or commit-chain architecture, rather than a rollup that inherits full execution and data availability security from Ethereum.

S.5 Incentive Mechanisms and Applicable Fees

Polygon POL is present on the following networks: Ethereum, Polygon.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Polygon PoS uses economic incentives to support validator participation, transaction processing, and network operation. Validators stake POL tokens and participate in block production, validation, voting, and checkpoint finalisation. Validators may receive rewards connected to their participation in the network, including rewards linked to validation activities and transaction-fee allocation, depending on the applicable protocol rules. Token holders who do not operate validator infrastructure may delegate POL tokens to validators. Delegators may receive a share of rewards attributable to the validator to whom they delegate, subject to the validator's commission and applicable protocol rules. Delegation increases the validator's effective stake and may affect its role in the validator set and related network processes. Following the Rio upgrade, Polygon PoS introduced a Validator-Elected Block Producer model, under which validators elect the block producer or block producers for a span. Publicly described protocol changes associated with this model also provide for redistribution of fees, including maximum extractable value-related fees where applicable, to non-producing validators under the relevant protocol design. This changes the incentive structure from the previous model in which block production selection was more directly described by reference to stake-weighted producer selection. Polygon PoS includes protocol specifications for

validator penalties, including slashing-related concepts. Transactions on Polygon PoS require payment of network fees in POL. Fees apply to ordinary token transfers, smart contract deployment, and smart contract interaction. The amount of fees may vary depending on network demand, transaction complexity, and computational resources required. Because Polygon PoS processes transactions independently from Ethereum, transaction fees are generally designed to be lower than equivalent activity on the Ethereum mainnet, although actual fees may change according to network conditions and protocol parameters.

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 '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. Due to the structure of this network, it is not only the mainnet that is responsible for energy consumption. In order to calculate the structure adequately, a proportion of the energy consumption of the connected network, ethereum, must also be taken into account, because the connected network is also responsible for security. This proportion is determined on the basis of gas consumption. 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 regulary, 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) ethereum 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.

Binance Coin

BNB | 8N2VXJKB1

Quantitative information

Quantitative sustainability indicators for Binance Coin

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Binance Coin	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	90228.00000	kWh/a

Qualitative information

S.4 Consensus Mechanism

Binance Coin is present on the following networks: Binance Smart Chain, Opbnb.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

S.5 Incentive Mechanisms and Applicable Fees

Binance Coin is present on the following networks: Binance Smart Chain, Opbnb.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block

production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

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 '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 regulary, 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.

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 regulary, 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.

Hedera HBAR

HBAR | 2WWB8QS47

Quantitative information

Quantitative sustainability indicators for Hedera HBAR

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Hedera HBAR	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	82125.00000	kWh/a

Qualitative information

S.4 Consensus Mechanism

Hedera Hashgraph operates on a unique Hashgraph consensus algorithm, a directed acyclic graph (DAG) system that diverges from traditional blockchain technology. It uses Asynchronous Byzantine Fault Tolerance (aBFT) to secure the network.

Core Components:

1. Hashgraph Consensus and aBFT:
   Hedera Hashgraph's consensus mechanism achieves aBFT, which allows the network to tolerate malicious nodes without compromising security, ensuring high levels of fault tolerance and stability.
2. Gossip about Gossip Protocol:
   The network employs a "Gossip about Gossip" protocol, where nodes share transaction information along with details of previous gossip events. This process allows each node to rapidly learn the entire network state, enhancing communication efficiency and minimizing latency.
3. Virtual Voting:
   Hedera does not rely on traditional miners or stakers. Instead, it uses virtual voting, where nodes reach consensus by analyzing the gossip history and simulating votes based on the order and frequency of transactions received. Virtual voting eliminates the need for actual voting messages, reducing network congestion and speeding up consensus.

4. Deterministic Finality:
   Once consensus is reached, transactions achieve deterministic finality instantly, making them irreversible and confirmed within seconds. This attribute is ideal for applications needing quick and irreversible transaction confirmations.
5. Staking for Network Security:
   Hedera incorporates staking to bolster network security. HBAR holders can stake their tokens to support validator nodes, contributing to the network's resilience and encouraging long-term engagement in consensus operations.

S.5 Incentive Mechanisms and Applicable Fees

Hedera Hashgraph incentivizes network participation through transaction fees and staking rewards, with a structured and predictable fee model designed for enterprise use.

Incentive Mechanisms:

1. Staking Rewards for Nodes:
   - HBAR Rewards for Node Operators: Node operators earn HBAR rewards for providing network security and processing transactions, incentivizing them to act honestly and support network stability.
   - User Staking: HBAR holders can stake their tokens to support nodes. Staking rewards offer an additional incentive for token holders to engage in network operations, although the structure may evolve with network growth.
2. Service-Based Node Rewards:
   Nodes receive rewards based on specific services they provide to the network, such as:
   - Consensus Services: Reaching consensus and maintaining transaction order.
   - File Storage: Storing data on the Hedera network.
   - Smart Contract Processing: Supporting contract executions for decentralized applications.

Applicable Fees:

1. Predictable Transaction Fees: Hedera's fee structure is fixed and predictable, ensuring transparent costs for users and appealing to enterprise-grade applications. Transaction fees are paid in HBAR and are designed to be stable, making it easier for businesses to plan for usage costs.
2. Fee Allocation: All transaction fees collected in HBAR are distributed to network nodes as rewards, reinforcing their role in maintaining network integrity and processing transactions efficiently.

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 regulary, 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.

Hyperliquid

HYPE | HLTPNVXN0

Quantitative information

Quantitative sustainability indicators for Hyperliquid

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Hyperliquid	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	67014.00000	kWh/a

Qualitative information

S.4 Consensus Mechanism

Hyperliquid is a decentralized perpetual exchange (DEX) built on its proprietary Layer 1 blockchain, Hyperliquid L1. At the core of its architecture is the HyperBFT consensus mechanism, inspired by the Hotstuff protocol, designed to meet the demands of high-frequency trading while maintaining security and consistency across the ecosystem.

S.5 Incentive Mechanisms and Applicable Fees

Hyperliquid incentivizes participants through its native token, HYPE. Validators and delegators earn rewards in HYPE for securing the network and participating in governance. Users can also earn HYPE by staking, providing liquidity, and engaging in other ecosystem activities. This dual-token system encourages active participation and supports the network's growth and stability.

Hyperliquid employs a dynamic fee model where transaction fees are based on network activity and the complexity of the transactions. These fees are paid by users conducting transactions on the network and are designed to cover the costs of processing transactions while incentivizing validators.

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 regulary, 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.

Mantle

MNT | QH1GF1J5H

Quantitative information

Quantitative sustainability indicators for Mantle

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Mantle	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	53410.94662	kWh/a

Qualitative information

S.4 Consensus Mechanism

Mantle is present on the following networks: Ethereum, Mantle.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Mantle is a Layer-2 rollup built on top of Ethereum, designed to leverage Ethereum's security and Proof-of-Stake (PoS) consensus without an independent consensus layer.

Core Components of Mantle's Consensus:

1. Ethereum PoS Inheritance:
   Layer-2 Rollup Model: Mantle does not operate its own consensus mechanism; instead, it relies on Ethereum's PoS for transaction finalization and network security. As a rollup on Ethereum, Mantle inherits the security guarantees of Ethereum's established PoS model.
2. Rollup Type Options:
   Optimistic Rollups or Zero-Knowledge Rollups: Depending on its configuration, Mantle may use either Optimistic Rollups or Zero-Knowledge Rollups (zk-Rollups) to batch transactions. These rollup methods allow Mantle to achieve efficient off-chain processing and on-chain finality by periodically committing transaction data to Ethereum's mainnet.

S.5 Incentive Mechanisms and Applicable Fees

Mantle is present on the following networks: Ethereum, Mantle.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Mantle aims to reduce transaction fees for users by utilizing Ethereum compatibility, rollup technology, and transaction bundling, offering a cost-effective Layer-2 solution.

Incentive Mechanisms:

1. Gas Fee Model:
   Ethereum Compatibility: Mantle is EVM-compatible, meaning it shares Ethereum's gas fee model. Transactions require users to pay fees in units of gas, with costs varying based on transaction complexity and computational demand.
2. Lower Transaction Costs:
   - Off-Chain Processing with Bundling: By processing transactions off-chain and settling data on Ethereum only periodically, Mantle reduces individual transaction costs. This method results in significantly lower fees compared to the Ethereum mainnet.
   - Economies of Scale: Through transaction bundling, Mantle can spread the cost of Ethereum's on-chain settlement across multiple transactions, allowing users to pay only a fraction of the gas fees they would incur directly on Ethereum.

Applicable Fees:

Layer-2 Gas Fees: While Mantle's gas fees are lower than those on Ethereum, they are still measured in units of gas and depend on transaction complexity. The fees reflect the cost of executing transactions in Mantle's Layer-2 environment while benefiting from reduced overall gas consumption due to batching.

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 '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. Due to the structure of this network, it is not only the mainnet that is responsible for energy consumption. In order to calculate the structure adequately, a proportion of the energy consumption of the connected network, ethereum, must also be taken into account, because the connected network is also responsible for security. This proportion is determined on the basis of gas consumption. 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 regulary, 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) ethereum 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.

Monad

MON | /

Quantitative information

Quantitative sustainability indicators for Monad

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Monad	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	53348.40000	kWh/a

Qualitative information

S.4 Consensus Mechanism

Monad uses a custom Byzantine Fault Tolerant protocol called MonadBFT to achieve network-wide agreement on transaction ordering and block proposals. Consensus proceeds with asynchronous coordination across validators, decoupling transaction execution from block ordering to increase throughput.

S.5 Incentive Mechanisms and Applicable Fees

The native token MON is used to pay network transaction (gas) fees, which compensate validators for including and processing transactions.

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 regulary, 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.

Stellar Lumen

XLM | ZCN8SR2H7

Quantitative information

Quantitative sustainability indicators for Stellar Lumen

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Stellar Lumen	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	52560.00000	kWh/a

Qualitative information

S.4 Consensus Mechanism

Consensus is reached through the Stellar Consensus Protocol (SCP), which is based on federated Byzantine agreement. This mechanism allows fast finality without mining or staking, but it depends on validators choosing other validators which they trust to reach agreement, called a quorum set. As a result, validator diversity and governance choices play a critical role in security, and concentration of influence among large operators may increase systemic risks.

S.5 Incentive Mechanisms and Applicable Fees

Stellar does not use block rewards or mining. Instead, validators operate without direct protocol-level rewards. While this design keeps costs low, it may reduce incentives for validator participation compared to staking-based models. The sustainability of validator engagement depends largely on external factors such as institutional involvement and ecosystem adoption.

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 regulary, 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.

Uniswap

UNI | XMB84LZBZ

Quantitative information

Quantitative sustainability indicators for Uniswap

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Uniswap	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	7084.60355	kWh/a

Qualitative information

S.4 Consensus Mechanism

Uniswap is present on the following networks: Arbitrum, Binance Smart Chain, Ethereum, Polygon.

Arbitrum is an optimistic rollup that processes transactions on a Layer 2 network and relies on Ethereum for data availability and settlement. A sequencer orders incoming transactions, executes them and publishes compressed transaction batches to Ethereum. Arbitrum nodes can independently reconstruct and verify the resulting Layer 2 state using the transaction data published on the parent chain. Validators submit assertions representing the state of the network. Under the BoLD dispute protocol, conflicting or incorrect assertions may be challenged and resolved through an interactive fraud-proof process on Ethereum. Once an assertion has been confirmed and the applicable challenge process has been completed, the corresponding Layer 2 state is accepted for settlement purposes.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower

probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Polygon PoS is an EVM-compatible sidechain that operates with a Proof-of-Stake consensus mechanism and periodically submits checkpoints to the Ethereum mainnet. The network maintains its own validator set and processes transactions independently from Ethereum, while using Ethereum smart contracts for staking-related functions and checkpoint verification. Polygon PoS therefore uses Ethereum as a staking and checkpointing layer, but does not rely on Ethereum for full transaction execution or transaction data availability. The Polygon-side architecture consists of two primary node layers. The Bor layer is responsible for transaction execution and block production. The Heimdall layer is responsible for validator coordination, staking-related monitoring, consensus, and checkpoint finalisation. Heimdall is based on Cosmos SDK and CometBFT and aggregates blocks produced by Bor into periodic Merkle-root checkpoints that are submitted to smart contracts on the Ethereum mainnet. Validators participate in the network by staking POL tokens. Token holders may delegate POL tokens to validators, contributing to the validator's effective stake and participating indirectly in network validation. Following the Rio upgrade, Polygon PoS uses a Validator-Elected Block Producer model. Under this model, validators elect the block producer or block producers for a span, rather than relying on the previous stake-weighted selection model for multiple block producers over shorter intervals. Block production and transaction execution are performed on the Bor layer, while Heimdall validators coordinate consensus and checkpoint finalisation. At regular intervals, Heimdall validators aggregate blocks into a Merkle root and submit the resulting checkpoint to Ethereum smart contracts. These checkpoints provide an additional verification layer and support cross-chain verification, including in the context of asset transfers between Polygon PoS and Ethereum. This design enables higher transaction throughput and lower transaction costs than the Ethereum mainnet, while maintaining a technical connection to Ethereum through staking contracts and periodic checkpointing. Polygon PoS should therefore be understood as an independent sidechain or commit-chain architecture, rather than a rollup that inherits full execution and data availability security from Ethereum.

S.5 Incentive Mechanisms and Applicable Fees

Uniswap is present on the following networks: Arbitrum, Binance Smart Chain, Ethereum, Polygon.

Transactions on Arbitrum are subject to fees paid in ETH. The total fee generally consists of a Layer 2 execution component, which covers the computational resources required to process the transaction, and a parent-chain data component, which reflects the cost of publishing compressed transaction data to Ethereum. The amount payable therefore depends on the computational

complexity of the transaction, the volume and compressibility of its data and the prevailing cost of data publication on Ethereum. Participants that submit or challenge state assertions under the dispute protocol must provide economic bonds. These bonds are intended to discourage incorrect assertions and compensate successful participants in the dispute process. Withdrawals through the canonical bridge become executable after the relevant Layer 2 state has been confirmed and the applicable challenge period has elapsed.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Polygon PoS uses economic incentives to support validator participation, transaction processing, and network operation. Validators stake POL tokens and participate in block production, validation, voting, and checkpoint finalisation. Validators may receive rewards connected to their participation in

the network, including rewards linked to validation activities and transaction-fee allocation, depending on the applicable protocol rules. Token holders who do not operate validator infrastructure may delegate POL tokens to validators. Delegators may receive a share of rewards attributable to the validator to whom they delegate, subject to the validator's commission and applicable protocol rules. Delegation increases the validator's effective stake and may affect its role in the validator set and related network processes. Following the Rio upgrade, Polygon PoS introduced a Validator-Elected Block Producer model, under which validators elect the block producer or block producers for a span. Publicly described protocol changes associated with this model also provide for redistribution of fees, including maximum extractable value-related fees where applicable, to non-producing validators under the relevant protocol design. This changes the incentive structure from the previous model in which block production selection was more directly described by reference to stake-weighted producer selection. Polygon PoS includes protocol specifications for validator penalties, including slashing-related concepts. Transactions on Polygon PoS require payment of network fees in POL. Fees apply to ordinary token transfers, smart contract deployment, and smart contract interaction. The amount of fees may vary depending on network demand, transaction complexity, and computational resources required. Because Polygon PoS processes transactions independently from Ethereum, transaction fees are generally designed to be lower than equivalent activity on the Ethereum mainnet, although actual fees may change according to network conditions and protocol parameters.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) arbitrum, binance_smart_chain, ethereum, polygon 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.

ChainLink Token

LINK | 3R3J70FDR

Quantitative information

Quantitative sustainability indicators for ChainLink Token

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	ChainLink Token	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	5595.32731	kWh/a

Qualitative information

S.4 Consensus Mechanism

ChainLink Token is present on the following networks: Arbitrum, Avalanche, Binance Smart Chain, Ethereum, Fantom, Gnosis Chain, Optimism, Polygon, Solana.

Arbitrum is an optimistic rollup that processes transactions on a Layer 2 network and relies on Ethereum for data availability and settlement. A sequencer orders incoming transactions, executes them and publishes compressed transaction batches to Ethereum. Arbitrum nodes can independently reconstruct and verify the resulting Layer 2 state using the transaction data published on the parent chain. Validators submit assertions representing the state of the network. Under the BoLD dispute protocol, conflicting or incorrect assertions may be challenged and resolved through an interactive fraud-proof process on Ethereum. Once an assertion has been confirmed and the applicable challenge process has been completed, the corresponding Layer 2 state is accepted for settlement purposes.

The Avalanche C-Chain uses the Snowman++ consensus mechanism, which is Avalanche's consensus model for linear blockchains and is implemented through the ProposerVM wrapper. Under this model, validators repeatedly query a small random subset of other validators and converge on a preferred block once the required confidence thresholds are met. Only Primary Network validators are entitled to validate the C-Chain. To participate as a validator on Avalanche mainnet, a node must stake a minimum number of token. Token holders may also participate indirectly by delegating an existing validator. Validator identity and admission to staking require the relevant staking credentials, including BLS proofs of possession under the current staking framework. For block production, Snowman++ uses stake-weighted proposer windows. Through the ProposerVM, block-building opportunities are assigned to proposers in 5-second windows, after which block production may fall

back more broadly to validators if necessary. This mechanism is intended to regulate block production while preserving network liveness. Consensus voting itself remains based on repeated sub-sampled polling rather than fixed validator committees. Avalanche documentation describes the finality model as sub-second and treated by the protocol as final and irreversible once accepted, while noting that safety is probabilistic in the formal sense because the probability of conflicting acceptance can be reduced to an arbitrarily low level through the protocol parameters. The protocol does not rely on slashing of staked principal. Instead, validator reward eligibility depends on compliance with protocol conditions, including uptime requirements.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum’s consensus mechanism and Layer 2 functionality.

Fantom operates on the Lachesis Protocol, an Asynchronous Byzantine Fault Tolerant (aBFT) consensus mechanism designed for fast, secure, and scalable transactions.

Core Components of Fantom’s Consensus:

1. Lachesis Protocol (aBFT):
   - Asynchronous and Leaderless: Lachesis allows nodes to reach consensus independently without relying on a central leader, enhancing decentralization and speed.
   - DAG Structure: Instead of a linear blockchain, Lachesis uses a Directed Acyclic Graph (DAG) structure, allowing multiple transactions to be processed in parallel across nodes. This structure supports high throughput, making the network suitable for applications requiring rapid transaction processing.

2. Event Blocks and Instant Finality:
   - Event Blocks: Transactions are grouped into event blocks, which are validated asynchronously by multiple validators. When enough validators confirm an event block, it becomes part of the Fantom network's history.
   - Instant Finality: Transactions on Fantom achieve immediate finality, meaning they are confirmed and cannot be reversed. This property is ideal for applications requiring fast and irreversible transactions.

Gnosis Chain – Consensus Mechanism Gnosis Chain employs a dual-layer structure to balance scalability and security, using Proof of Stake (PoS) for its core consensus and transaction finality.

Core Components:

- Two-Layer Structure Layer 1: Gnosis Beacon Chain The Gnosis Beacon Chain operates on a Proof of Stake (PoS) mechanism, acting as the security and consensus backbone. Validators stake GNO tokens on the Beacon Chain and validate transactions, ensuring network security and finality.
- Layer 2: Gnosis xDai Chain processes transactions and dApp interactions, providing high-speed, low-cost transactions. Layer 2 transaction data is finalized on the Gnosis Beacon Chain, creating an integrated framework where Layer 1 ensures security and finality, and Layer 2 enhances scalability. Validator Role and Staking Validators on the Gnosis Beacon Chain stake GNO tokens and participate in consensus by validating blocks. This setup ensures that validators have an economic interest in maintaining the security and integrity of both the Beacon Chain (Layer 1) and the xDai Chain (Layer 2). Cross-Layer Security Transactions on Layer 2 are ultimately finalized on Layer 1, providing security and finality to all activities on the Gnosis Chain. This architecture allows Gnosis Chain to combine the speed and cost efficiency of Layer 2 with the security guarantees of a PoS-secured Layer 1, making it suitable for both high-frequency applications and secure asset management.

Since Optimism is based on Ethereum, it ultimately inherits its security via the Ethereum blockchain and the proof-of-stake consensus. Within the rollup system, Optimism relies on a "fault proof" procedure. By default, transactions are assumed to be correct ("optimistic"). Only in the event of suspected faults is a fault proof initiated, in which incorrect transactions can be challenged by challengers. This model allows for high efficiency while ensuring correctness.

Polygon PoS is an EVM-compatible sidechain that operates with a Proof-of-Stake consensus mechanism and periodically submits checkpoints to the Ethereum mainnet. The network maintains its own validator set and processes transactions independently from Ethereum, while using Ethereum smart contracts for staking-related functions and checkpoint verification. Polygon PoS therefore uses Ethereum as a staking and checkpointing layer, but does not rely on Ethereum for full transaction execution or transaction data availability. The Polygon-side architecture consists of two primary node layers. The Bor layer is responsible for transaction execution and block production. The Heimdall layer is responsible for validator coordination, staking-related monitoring, consensus, and checkpoint finalisation. Heimdall is based on Cosmos SDK and CometBFT and aggregates blocks produced by Bor into periodic Merkle-root checkpoints that are submitted to smart contracts on the Ethereum mainnet. Validators participate in the network by staking POL tokens. Token holders may delegate POL tokens to validators, contributing to the validator's effective stake and participating indirectly in network validation. Following the Rio upgrade, Polygon PoS uses a Validator-Elected Block Producer model. Under this model, validators elect the block producer or block producers for a span, rather than relying on the previous stake-weighted selection model for multiple block producers over shorter intervals. Block production and transaction execution are performed on the Bor layer, while Heimdall validators coordinate consensus and checkpoint finalisation. At regular intervals, Heimdall validators aggregate blocks into a Merkle root and submit the resulting checkpoint

to Ethereum smart contracts. These checkpoints provide an additional verification layer and support cross-chain verification, including in the context of asset transfers between Polygon PoS and Ethereum. This design enables higher transaction throughput and lower transaction costs than the Ethereum mainnet, while maintaining a technical connection to Ethereum through staking contracts and periodic checkpointing. Polygon PoS should therefore be understood as an independent sidechain or commit-chain architecture, rather than a rollup that inherits full execution and data availability security from Ethereum.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.
4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.

- Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.

2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

S.5 Incentive Mechanisms and Applicable Fees

ChainLink Token is present on the following networks: Arbitrum, Avalanche, Binance Smart Chain, Ethereum, Fantom, Gnosis Chain, Optimism, Polygon, Solana.

Transactions on Arbitrum are subject to fees paid in ETH. The total fee generally consists of a Layer 2 execution component, which covers the computational resources required to process the transaction, and a parent-chain data component, which reflects the cost of publishing compressed transaction data to Ethereum. The amount payable therefore depends on the computational complexity of the transaction, the volume and compressibility of its data and the prevailing cost of data publication on Ethereum. Participants that submit or challenge state assertions under the dispute protocol must provide economic bonds. These bonds are intended to discourage incorrect assertions and compensate successful participants in the dispute process. Withdrawals through the canonical bridge become executable after the relevant Layer 2 state has been confirmed and the applicable challenge period has elapsed.

The Avalanche C-Chain is secured economically through the native AVAX token. Validator incentives are based primarily on staking rewards, not on redistribution of C-Chain transaction fees. A fixed amount of 360 million AVAX was minted at genesis, while additional AVAX is minted over time as validator rewards, subject to Avalanche's capped token supply framework. Validator rewards are paid at the end of the staking period and are determined by factors such as the validator's stake and compliance with staking conditions. Unlike some proof-of-stake systems, the Avalanche Primary Network does not use slashing of bonded principal as an ordinary penalty mechanism. Instead, the main protocol-level economic consequence for underperformance is the loss of reward eligibility. Where a validator fails to satisfy the applicable uptime requirement during its staking term, that validator does not receive the corresponding staking reward. Transaction fees apply on the C-Chain for transfers and smart-contract execution. The fee model follows EIP-1559 logic, meaning that transactions are priced through a dynamic base fee mechanism. In contrast to Ethereum's validator tip model, C-Chain transaction fees are burned rather than distributed to validators. This means that C-Chain fees function as a supply-reduction mechanism and are intended in part to offset inflation arising from the minting of validator rewards. In addition to ordinary transaction and smart-contract execution fees, Avalanche documentation also recognises protocol fees in connection with other network operations on other chains of the Primary Network, such as certain import or export operations and staking-related actions. However, for the C-Chain itself, the core applicable fee category is the gas fee for transaction inclusion and contract execution, and those fees are handled through the protocol burn mechanism rather than paid to validators or a treasury.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Fantom's incentive model promotes network security through staking rewards, transaction fees, and delegation options, encouraging broad participation.

Incentive Mechanisms:

1. Staking Rewards for Validators:
   - Earning Rewards in FTM: Validators who participate in the consensus process earn rewards in FTM tokens, proportional to the amount they have staked. This incentivizes validators to actively secure the network.

- Dynamic Staking Rate: Fantom's staking reward rate is dynamic, adjusting based on total FTM staked across the network. As more FTM is staked, individual rewards may decrease, maintaining a balanced reward structure that supports long-term network security.

2. Delegation for Token Holders:
   Delegated Staking: Users who do not operate validator nodes can delegate their FTM tokens to validators. In return, they share in the staking rewards, encouraging wider participation in securing the network.

Applicable Fees:

- Transaction Fees in FTM: Users pay transaction fees in FTM tokens. The network's high throughput and DAG structure keep fees low, making Fantom ideal for decentralized applications (dApps) requiring frequent transactions.
- Efficient Fee Model: The low fees and scalability of the network make it cost-effective for users, fostering a favorable environment for high-volume applications.

The Gnosis Chain's incentive and fee models encourage both validator participation and network accessibility, using a dual-token system to maintain low transaction costs and effective staking rewards.

Incentive Mechanisms:

- Staking Rewards for Validators GNO Rewards: Validators earn staking rewards in GNO tokens for their participation in consensus and securing the network.
- Delegation Model: GNO holders who do not operate validator nodes can delegate their GNO tokens to validators, allowing them to share in staking rewards and encouraging broader participation in network security.
- Dual-Token Model GNO: Used for staking, governance, and validator rewards, GNO aligns long-term network security incentives with token holders' economic interests.
- xDai: Serves as the primary transaction currency, providing stable and low-cost transactions. The use of a stable token (xDai) for fees minimizes volatility and offers predictable costs for users and developers.

Applicable Fees:

Transaction Fees in xDai Users pay transaction fees in xDai, the stable fee token, making costs affordable and predictable. This model is especially suited for high-frequency applications and dApps where low transaction fees are essential. xDai transaction fees are redistributed to validators as part of their compensation, aligning their rewards with network activity. Delegated Staking Rewards Through delegated staking, GNO holders can earn a share of staking rewards by delegating their tokens to active validators, promoting user participation in network security without requiring direct involvement in consensus operations.

Optimism charges lower transaction fees than Ethereum Layer 1, as transactions are bundled in the rollup and written to the Ethereum main chain in compressed form. Gas fees on Optimism continue to be paid in ETH. The incentive model is based on increased efficiency for users (lower fees, faster confirmation) and on the role of sequencers. Sequencers are central actors who collect, organize, and include transactions in the rollup. Their revenue comes from the gas fees they charge.

Polygon PoS uses economic incentives to support validator participation, transaction processing, and network operation. Validators stake POL tokens and participate in block production, validation, voting, and checkpoint finalisation. Validators may receive rewards connected to their participation in the network, including rewards linked to validation activities and transaction-fee allocation,

depending on the applicable protocol rules. Token holders who do not operate validator infrastructure may delegate POL tokens to validators. Delegators may receive a share of rewards attributable to the validator to whom they delegate, subject to the validator's commission and applicable protocol rules. Delegation increases the validator's effective stake and may affect its role in the validator set and related network processes. Following the Rio upgrade, Polygon PoS introduced a Validator-Elected Block Producer model, under which validators elect the block producer or block producers for a span. Publicly described protocol changes associated with this model also provide for redistribution of fees, including maximum extractable value-related fees where applicable, to non-producing validators under the relevant protocol design. This changes the incentive structure from the previous model in which block production selection was more directly described by reference to stake-weighted producer selection. Polygon PoS includes protocol specifications for validator penalties, including slashing-related concepts. Transactions on Polygon PoS require payment of network fees in POL. Fees apply to ordinary token transfers, smart contract deployment, and smart contract interaction. The amount of fees may vary depending on network demand, transaction complexity, and computational resources required. Because Polygon PoS processes transactions independently from Ethereum, transaction fees are generally designed to be lower than equivalent activity on the Ethereum mainnet, although actual fees may change according to network conditions and protocol parameters.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.
   - Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.
2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.

2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.
3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) arbitrum, avalanche, binance_smart_chain, ethereum, fantom, gnosis_chain, optimism, polygon, solana 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.

Aave Token

AAVE | H618RN577

Quantitative information

Quantitative sustainability indicators for Aave Token

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Aave Token	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	3624.52363	kWh/a

Qualitative information

S.4 Consensus Mechanism

Aave Token is present on the following networks: Avalanche, Binance Smart Chain, Ethereum, Gnosis Chain, Huobi, Near Protocol, Polygon, Solana.

The Avalanche C-Chain uses the Snowman++ consensus mechanism, which is Avalanche's consensus model for linear blockchains and is implemented through the ProposerVM wrapper. Under this model, validators repeatedly query a small random subset of other validators and converge on a preferred block once the required confidence thresholds are met. Only Primary Network validators are entitled to validate the C-Chain. To participate as a validator on Avalanche mainnet, a node must stake a minimum number of token. Token holders may also participate indirectly by delegating an existing validator. Validator identity and admission to staking require the relevant staking credentials, including BLS proofs of possession under the current staking framework. For block production, Snowman++ uses stake-weighted proposer windows. Through the ProposerVM, block-building opportunities are assigned to proposers in 5-second windows, after which block production may fall back more broadly to validators if necessary. This mechanism is intended to regulate block production while preserving network liveness. Consensus voting itself remains based on repeated sub-sampled polling rather than fixed validator committees. Avalanche documentation describes the finality model as sub-second and treated by the protocol as final and irreversible once accepted, while noting that safety is probabilistic in the formal sense because the probability of conflicting acceptance can be reduced to an arbitrarily low level through the protocol parameters. The protocol does not rely on slashing of staked principal. Instead, validator reward eligibility depends on compliance with protocol conditions, including uptime requirements.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 "Cabinet" validators and 24 "Candidate" validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Gnosis Chain – Consensus Mechanism Gnosis Chain employs a dual-layer structure to balance scalability and security, using Proof of Stake (PoS) for its core consensus and transaction finality.

Core Components:

- Two-Layer Structure Layer 1: Gnosis Beacon Chain The Gnosis Beacon Chain operates on a Proof of Stake (PoS) mechanism, acting as the security and consensus backbone. Validators stake GNO tokens on the Beacon Chain and validate transactions, ensuring network security and finality.
- Layer 2: Gnosis xDai Chain processes transactions and dApp interactions, providing high-speed, low-cost transactions. Layer 2 transaction data is finalized on the Gnosis Beacon Chain, creating an integrated framework where Layer 1 ensures security and finality, and Layer 2 enhances scalability. Validator Role and Staking Validators on the Gnosis Beacon Chain stake GNO tokens and participate in consensus by validating blocks. This setup ensures that validators have an economic interest in maintaining the security and integrity of both the Beacon Chain (Layer 1) and the xDai Chain (Layer 2). Cross-Layer Security Transactions on Layer 2 are ultimately finalized on Layer 1, providing security and finality to all activities on the Gnosis Chain. This architecture allows Gnosis Chain to combine the speed and cost efficiency of Layer 2 with the security guarantees of a PoS-secured Layer 1, making it suitable for both high-frequency applications and secure asset management.

The Huobi Eco Chain (HECO) blockchain employs a Hybrid-Proof-of-Stake (HPoS) consensus mechanism, combining elements of Proof-of-Stake (PoS) to enhance transaction efficiency and scalability.

Key Features of HECO's Consensus Mechanism:

1. Validator Selection: HECO supports up to 21 validators, selected based on their stake in the network.
2. Transaction Processing: Validators are responsible for processing transactions and adding blocks to the blockchain.
3. Transaction Finality: The consensus mechanism ensures quick finality, allowing for rapid confirmation of transactions.
4. Energy Efficiency: By utilizing PoS elements, HECO reduces energy consumption compared to traditional Proof-of-Work systems.

The NEAR Protocol uses a unique consensus mechanism combining Proof of Stake (PoS) and a novel approach called Doomslug, which enables high efficiency, fast transaction processing, and secure finality in its operations.

Core Concepts:

1. Doomslug and Proof of Stake:
   - NEAR's consensus mechanism primarily revolves around PoS, where validators stake NEAR tokens to participate in securing the network. However, NEAR's implementation is enhanced with the Doomslug protocol.
   - Doomslug allows the network to achieve fast block finality by requiring blocks to be confirmed in two stages. Validators propose blocks in the first step, and finalization occurs when two-thirds of validators approve the block, ensuring rapid transaction confirmation.
2. Sharding with Nightshade:
   - NEAR uses a dynamic sharding technique called Nightshade. This method splits the network into multiple shards, enabling parallel processing of transactions across the network, thus significantly increasing throughput. Each shard processes a portion of transactions, and the outcomes are merged into a single "snapshot" block.
   - This sharding approach ensures scalability, allowing the network to grow and handle increasing demand efficiently.

Consensus Process:

1. Validator Selection:
   - Validators are selected to propose and validate blocks based on the amount of NEAR tokens staked. This selection process is designed to ensure that only validators with significant stakes and community trust participate in securing the network.
2. Transaction Finality:
   - NEAR achieves transaction finality through its PoS-based system, where validators vote on blocks. Once two-thirds of validators approve a block, it reaches finality under Doomslug, meaning that no forks can alter the confirmed state.
3. Epochs and Rotation:
   - Validators are rotated in epochs to ensure fairness and decentralization. Epochs are intervals in which validators are reshuffled, and new block proposers are selected, ensuring a balance between performance and decentralization.

Polygon PoS is an EVM-compatible sidechain that operates with a Proof-of-Stake consensus mechanism and periodically submits checkpoints to the Ethereum mainnet. The network maintains its own validator set and processes transactions independently from Ethereum, while using Ethereum smart contracts for staking-related functions and checkpoint verification. Polygon PoS therefore uses Ethereum as a staking and checkpointing layer, but does not rely on Ethereum for full transaction execution or transaction data availability. The Polygon-side architecture consists of two

primary node layers. The Bor layer is responsible for transaction execution and block production. The Heimdall layer is responsible for validator coordination, staking-related monitoring, consensus, and checkpoint finalisation. Heimdall is based on Cosmos SDK and CometBFT and aggregates blocks produced by Bor into periodic Merkle-root checkpoints that are submitted to smart contracts on the Ethereum mainnet. Validators participate in the network by staking POL tokens. Token holders may delegate POL tokens to validators, contributing to the validator's effective stake and participating indirectly in network validation. Following the Rio upgrade, Polygon PoS uses a Validator-Elected Block Producer model. Under this model, validators elect the block producer or block producers for a span, rather than relying on the previous stake-weighted selection model for multiple block producers over shorter intervals. Block production and transaction execution are performed on the Bor layer, while Heimdall validators coordinate consensus and checkpoint finalisation. At regular intervals, Heimdall validators aggregate blocks into a Merkle root and submit the resulting checkpoint to Ethereum smart contracts. These checkpoints provide an additional verification layer and support cross-chain verification, including in the context of asset transfers between Polygon PoS and Ethereum. This design enables higher transaction throughput and lower transaction costs than the Ethereum mainnet, while maintaining a technical connection to Ethereum through staking contracts and periodic checkpointing. Polygon PoS should therefore be understood as an independent sidechain or commit-chain architecture, rather than a rollup that inherits full execution and data availability security from Ethereum.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence

to order transactions within the block, ensuring that all transactions are processed in the correct order.

4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.
2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

S.5 Incentive Mechanisms and Applicable Fees

Aave Token is present on the following networks: Avalanche, Binance Smart Chain, Ethereum, Gnosis Chain, Huobi, Near Protocol, Polygon, Solana.

The Avalanche C-Chain is secured economically through the native AVAX token. Validator incentives are based primarily on staking rewards, not on redistribution of C-Chain transaction fees. A fixed amount of 360 million AVAX was minted at genesis, while additional AVAX is minted over time as validator rewards, subject to Avalanche's capped token supply framework. Validator rewards are paid at the end of the staking period and are determined by factors such as the validator's stake and compliance with staking conditions. Unlike some proof-of-stake systems, the Avalanche Primary Network does not use slashing of bonded principal as an ordinary penalty mechanism. Instead, the main protocol-level economic consequence for underperformance is the loss of reward eligibility. Where a validator fails to satisfy the applicable uptime requirement during its staking term, that validator does not receive the corresponding staking reward. Transaction fees apply on the C-Chain for transfers and smart-contract execution. The fee model follows EIP-1559 logic, meaning that transactions are priced through a dynamic base fee mechanism. In contrast to Ethereum's validator tip model, C-Chain transaction fees are burned rather than distributed to validators. This means that C-Chain fees function as a supply-reduction mechanism and are intended in part to offset inflation arising from the minting of validator rewards. In addition to ordinary transaction and smart-contract execution fees, Avalanche documentation also recognises protocol fees in connection with other network operations on other chains of the Primary Network, such as certain import or export operations and staking-related actions. However, for the C-Chain itself, the core applicable fee category is the gas fee for transaction inclusion and contract execution, and those fees are handled through the protocol burn mechanism rather than paid to validators or a treasury.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

The Gnosis Chain's incentive and fee models encourage both validator participation and network accessibility, using a dual-token system to maintain low transaction costs and effective staking rewards.

Incentive Mechanisms:

- Staking Rewards for Validators GNO Rewards: Validators earn staking rewards in GNO tokens for their participation in consensus and securing the network.

- Delegation Model: GNO holders who do not operate validator nodes can delegate their GNO tokens to validators, allowing them to share in staking rewards and encouraging broader participation in network security.
- Dual-Token Model GNO: Used for staking, governance, and validator rewards, GNO aligns long-term network security incentives with token holders' economic interests.
- xDai: Serves as the primary transaction currency, providing stable and low-cost transactions. The use of a stable token (xDai) for fees minimizes volatility and offers predictable costs for users and developers.

Applicable Fees:

Transaction Fees in xDai Users pay transaction fees in xDai, the stable fee token, making costs affordable and predictable. This model is especially suited for high-frequency applications and dApps where low transaction fees are essential. xDai transaction fees are redistributed to validators as part of their compensation, aligning their rewards with network activity. Delegated Staking Rewards Through delegated staking, GNO holders can earn a share of staking rewards by delegating their tokens to active validators, promoting user participation in network security without requiring direct involvement in consensus operations.

The Huobi Eco Chain (HECO) blockchain employs a Hybrid-Proof-of-Stake (HPoS) consensus mechanism, combining elements of Proof-of-Stake (PoS) to enhance transaction efficiency and scalability.

Incentive Mechanism:

1. Validator Rewards:
   Validators are selected based on their stake in the network. They process transactions and add blocks to the blockchain. Validators receive rewards in the form of transaction fees for their role in maintaining the blockchain's integrity.
2. Staking Participation:
   Users can stake Huobi Token (HT) to become validators or delegate their tokens to existing validators. Staking helps secure the network and, in return, participants receive a portion of the transaction fees as rewards.

Applicable Fees:

1. Transaction Fees (Gas Fees):
   Users pay gas fees in HT tokens to execute transactions and interact with smart contracts on the HECO network. These fees compensate validators for processing and validating transactions.
2. Smart Contract Execution Fees:
   Deploying and interacting with smart contracts incur additional fees, which are also paid in HT tokens. These fees cover the computational resources required to execute contract code.

NEAR Protocol employs several economic mechanisms to secure the network and incentivize participation.

Incentive Mechanisms to Secure Transactions:

1. Staking Rewards:
   Validators and delegators secure the network by staking NEAR tokens. Validators earn around 5% annual inflation, with 90% of newly minted tokens distributed as staking rewards. Validators propose blocks, validate transactions, and receive a share of these rewards based on their staked tokens. Delegators earn rewards proportional to their delegation, encouraging broad participation.

2. Delegation:
   Token holders can delegate their NEAR tokens to validators to increase the validator's stake and improve the chances of being selected to validate transactions. Delegators share in the validator's rewards based on their delegated tokens, incentivizing users to support reliable validators.
3. Slashing and Economic Penalties:
   Validators face penalties for malicious behavior, such as failing to validate correctly or acting dishonestly. The slashing mechanism enforces security by deducting a portion of their staked tokens, ensuring validators follow the network's best interests.
4. Epoch Rotation and Validator Selection:
   Validators are rotated regularly during epochs to ensure fairness and prevent centralization. Each epoch reshuffles validators, allowing the protocol to balance decentralization with performance.

Fees on the NEAR Blockchain:

1. Transaction Fees:
   Users pay fees in NEAR tokens for transaction processing, which are burned to reduce the total circulating supply, introducing a potential deflationary effect over time. Validators also receive a portion of transaction fees as additional rewards, providing an ongoing incentive for network maintenance.
2. Storage Fees:
   NEAR Protocol charges storage fees based on the amount of blockchain storage consumed by accounts, contracts, and data. This requires users to hold NEAR tokens as a deposit proportional to their storage usage, ensuring the efficient use of network resources.
3. Redistribution and Burning:
   A portion of the transaction fees (burned NEAR tokens) reduces the overall supply, while the rest is distributed to validators as compensation for their work. The burning mechanism helps maintain long-term economic sustainability and potential value appreciation for NEAR holders.
4. Reserve Requirement:
   Users must maintain a minimum account balance and reserves for data storage, encouraging efficient use of resources and preventing spam attacks.

Polygon PoS uses economic incentives to support validator participation, transaction processing, and network operation. Validators stake POL tokens and participate in block production, validation, voting, and checkpoint finalisation. Validators may receive rewards connected to their participation in the network, including rewards linked to validation activities and transaction-fee allocation, depending on the applicable protocol rules. Token holders who do not operate validator infrastructure may delegate POL tokens to validators. Delegators may receive a share of rewards attributable to the validator to whom they delegate, subject to the validator's commission and applicable protocol rules. Delegation increases the validator's effective stake and may affect its role in the validator set and related network processes. Following the Rio upgrade, Polygon PoS introduced a Validator-Elected Block Producer model, under which validators elect the block producer or block producers for a span. Publicly described protocol changes associated with this model also provide for redistribution of fees, including maximum extractable value-related fees where applicable, to non-producing validators under the relevant protocol design. This changes the incentive structure from the previous model in which block production selection was more directly described by reference to stake-weighted producer selection. Polygon PoS includes protocol specifications for validator penalties, including slashing-related concepts. Transactions on Polygon PoS require payment of network fees in POL. Fees apply to ordinary token transfers, smart contract deployment, and smart contract interaction. The amount of fees may vary depending on network demand, transaction complexity, and computational resources required. Because Polygon PoS processes transactions independently from Ethereum, transaction fees are generally designed to be lower than

equivalent activity on the Ethereum mainnet, although actual fees may change according to network conditions and protocol parameters.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

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2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
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   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
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3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) avalanche, binance_smart_chain, ethereum, gnosis_chain, huobi, near_protocol, polygon, solana 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.

Pepe

PEPE | J41R6PF81

Quantitative information

Quantitative sustainability indicators for Pepe

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Pepe	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	3553.63385	kWh/a

Qualitative information

S.4 Consensus Mechanism

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

S.5 Incentive Mechanisms and Applicable Fees

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by

EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) ethereum 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.

SKY Governance Token

SKY | G4GDNF84C

Quantitative information

Quantitative sustainability indicators for SKY Governance Token

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	SKY Governance Token	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	2650.65551	kWh/a

Qualitative information

S.4 Consensus Mechanism

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SHIBA INU

SHIB | M4HFTFNPC

Quantitative information

Quantitative sustainability indicators for SHIBA INU

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	SHIBA INU	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	2256.49101	kWh/a

Qualitative information

S.4 Consensus Mechanism

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EURC

EURC | 13XTMPZT3

Quantitative information

Quantitative sustainability indicators for EURC

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	EURC	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	2136.05579	kWh/a

Qualitative information

S.4 Consensus Mechanism

EURC is present on the following networks: Avalanche, Base, Ethereum, Solana, Stellar.

The Avalanche C-Chain uses the Snowman++ consensus mechanism, which is Avalanche's consensus model for linear blockchains and is implemented through the ProposerVM wrapper. Under this model, validators repeatedly query a small random subset of other validators and converge on a preferred block once the required confidence thresholds are met. Only Primary Network validators are entitled to validate the C-Chain. To participate as a validator on Avalanche mainnet, a node must stake a minimum number of token. Token holders may also participate indirectly by delegating an existing validator. Validator identity and admission to staking require the relevant staking credentials, including BLS proofs of possession under the current staking framework. For block production, Snowman++ uses stake-weighted proposer windows. Through the ProposerVM, block-building opportunities are assigned to proposers in 5-second windows, after which block production may fall back more broadly to validators if necessary. This mechanism is intended to regulate block production while preserving network liveness. Consensus voting itself remains based on repeated sub-sampled polling rather than fixed validator committees. Avalanche documentation describes the finality model as sub-second and treated by the protocol as final and irreversible once accepted, while noting that safety is probabilistic in the formal sense because the probability of conflicting acceptance can be reduced to an arbitrarily low level through the protocol parameters. The protocol does not rely on slashing of staked principal. Instead, validator reward eligibility depends on compliance with protocol conditions, including uptime requirements.

Base does not operate its own consensus mechanism or decentralised validator set comparable to a Layer-1 blockchain. As an optimistic rollup Layer-2 network, Base relies on Ethereum's Proof-of-Stake

consensus for the finality and settlement of data and state commitments posted to Ethereum Layer 1. Transaction ordering on Base is performed by a sequencer, currently operated by Coinbase. This sequencing function provides transaction ordering and execution on the Layer-2 network but does not constitute a decentralised consensus mechanism. The validity of Layer-2 state transitions is supported by an optimistic fault-proof mechanism, under which incorrect state commitments may be challenged during the applicable dispute period. Accordingly, Base's security model depends on Ethereum Layer 1 for settlement and finality, while Layer-2 transaction ordering remains dependent on the sequencer.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.

3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.
4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.
2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

Consensus is reached through the Stellar Consensus Protocol (SCP), which is based on federated Byzantine agreement. This mechanism allows fast finality without mining or staking, but it depends on validators choosing other validators which they trust to reach agreement, called a quorum set. As a result, validator diversity and governance choices play a critical role in security, and concentration of influence among large operators may increase systemic risks.

S.5 Incentive Mechanisms and Applicable Fees

EURC is present on the following networks: Avalanche, Base, Ethereum, Solana, Stellar.

The Avalanche C-Chain is secured economically through the native AVAX token. Validator incentives are based primarily on staking rewards, not on redistribution of C-Chain transaction fees. A fixed amount of 360 million AVAX was minted at genesis, while additional AVAX is minted over time as validator rewards, subject to Avalanche's capped token supply framework. Validator rewards are paid at the end of the staking period and are determined by factors such as the validator's stake and compliance with staking conditions. Unlike some proof-of-stake systems, the Avalanche Primary Network does not use slashing of bonded principal as an ordinary penalty mechanism. Instead, the main protocol-level economic consequence for underperformance is the loss of reward eligibility. Where a validator fails to satisfy the applicable uptime requirement during its staking term, that validator does not receive the corresponding staking reward. Transaction fees apply on the C-Chain for transfers and smart-contract execution. The fee model follows EIP-1559 logic, meaning that transactions are priced through a dynamic base fee mechanism. In contrast to Ethereum's validator

tip model, C-Chain transaction fees are burned rather than distributed to validators. This means that C-Chain fees function as a supply-reduction mechanism and are intended in part to offset inflation arising from the minting of validator rewards. In addition to ordinary transaction and smart-contract execution fees, Avalanche documentation also recognises protocol fees in connection with other network operations on other chains of the Primary Network, such as certain import or export operations and staking-related actions. However, for the C-Chain itself, the core applicable fee category is the gas fee for transaction inclusion and contract execution, and those fees are handled through the protocol burn mechanism rather than paid to validators or a treasury.

Base does not have a native protocol token and does not operate a staking, validator reward or token issuance mechanism. Transaction fees on Base are paid in ETH. The economic incentives within the network are primarily related to transaction processing and network security. Transactions are executed on Base and periodically submitted to Ethereum Layer 1 in batches. As the cost of a Layer-1 submission is shared among multiple Layer-2 transactions, the average transaction cost per transaction may be lower than executing the same transactions directly on Ethereum Layer 1. The integrity of withdrawals from Base is supported by a fault-proof mechanism. Withdrawals are subject to a dispute period during which participants may challenge incorrect state commitments. The dispute process incorporates economic incentives intended to encourage honest behaviour and discourage invalid claims.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.
   - Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.
2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.

3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.
3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

Stellar does not use block rewards or mining. Instead, validators operate without direct protocol-level rewards. While this design keeps costs low, it may reduce incentives for validator participation compared to staking-based models. The sustainability of validator engagement depends largely on external factors such as institutional involvement and ecosystem adoption.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) avalanche, base, ethereum, solana, stellar 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.

ENA

ENA | SPRSCSVSW

Quantitative information

Quantitative sustainability indicators for ENA

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	ENA	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	1915.86724	kWh/a

Qualitative information

S.4 Consensus Mechanism

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Ondo

ONDO | WKH09L3DV

Quantitative information

Quantitative sustainability indicators for Ondo

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Ondo	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	1699.65319	kWh/a

Qualitative information

S.4 Consensus Mechanism

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SPX6900

SPX | V9FVRLGKC

Quantitative information

Quantitative sustainability indicators for SPX6900

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	SPX6900	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	1531.70399	kWh/a

Qualitative information

S.4 Consensus Mechanism

SPX6900 is present on the following networks: Base, Ethereum, Solana.

Base does not operate its own consensus mechanism or decentralised validator set comparable to a Layer-1 blockchain. As an optimistic rollup Layer-2 network, Base relies on Ethereum's Proof-of-Stake consensus for the finality and settlement of data and state commitments posted to Ethereum Layer 1. Transaction ordering on Base is performed by a sequencer, currently operated by Coinbase. This sequencing function provides transaction ordering and execution on the Layer-2 network but does not constitute a decentralised consensus mechanism. The validity of Layer-2 state transitions is supported by an optimistic fault-proof mechanism, under which incorrect state commitments may be challenged during the applicable dispute period. Accordingly, Base's security model depends on Ethereum Layer 1 for settlement and finality, while Layer-2 transaction ordering remains dependent on the sequencer.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to

slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.
4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.

2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

S.5 Incentive Mechanisms and Applicable Fees

SPX6900 is present on the following networks: Base, Ethereum, Solana.

Base does not have a native protocol token and does not operate a staking, validator reward or token issuance mechanism. Transaction fees on Base are paid in ETH. The economic incentives within the network are primarily related to transaction processing and network security. Transactions are executed on Base and periodically submitted to Ethereum Layer 1 in batches. As the cost of a Layer-1 submission is shared among multiple Layer-2 transactions, the average transaction cost per transaction may be lower than executing the same transactions directly on Ethereum Layer 1. The integrity of withdrawals from Base is supported by a fault-proof mechanism. Withdrawals are subject to a dispute period during which participants may challenge incorrect state commitments. The dispute process incorporates economic incentives intended to encourage honest behaviour and discourage invalid claims.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.

- Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.

2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.
3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) base, ethereum, solana 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.

Bonk

BONK | H6KJTT0CP

Quantitative information

Quantitative sustainability indicators for Bonk

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Bonk	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	1305.25449	kWh/a

Qualitative information

S.4 Consensus Mechanism

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.
4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.
2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

S.5 Incentive Mechanisms and Applicable Fees

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.

- Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.

2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.
3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) solana 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.

Arbitrum

ARB | 44TP35HF9

Quantitative information

Quantitative sustainability indicators for Arbitrum

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Arbitrum	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	954.62834	kWh/a

Qualitative information

S.4 Consensus Mechanism

Arbitrum is present on the following networks: Arbitrum, Ethereum.

Arbitrum is an optimistic rollup that processes transactions on a Layer 2 network and relies on Ethereum for data availability and settlement. A sequencer orders incoming transactions, executes them and publishes compressed transaction batches to Ethereum. Arbitrum nodes can independently reconstruct and verify the resulting Layer 2 state using the transaction data published on the parent chain. Validators submit assertions representing the state of the network. Under the BoLD dispute protocol, conflicting or incorrect assertions may be challenged and resolved through an interactive fraud-proof process on Ethereum. Once an assertion has been confirmed and the applicable challenge process has been completed, the corresponding Layer 2 state is accepted for settlement purposes.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network

upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

S.5 Incentive Mechanisms and Applicable Fees

Arbitrum is present on the following networks: Arbitrum, Ethereum.

Transactions on Arbitrum are subject to fees paid in ETH. The total fee generally consists of a Layer 2 execution component, which covers the computational resources required to process the transaction, and a parent-chain data component, which reflects the cost of publishing compressed transaction data to Ethereum. The amount payable therefore depends on the computational complexity of the transaction, the volume and compressibility of its data and the prevailing cost of data publication on Ethereum. Participants that submit or challenge state assertions under the dispute protocol must provide economic bonds. These bonds are intended to discourage incorrect assertions and compensate successful participants in the dispute process. Withdrawals through the canonical bridge become executable after the relevant Layer 2 state has been confirmed and the applicable challenge period has elapsed.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) arbitrum, ethereum 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.

World Liberty Financial

WLFI | 3XVWCVFSX

Quantitative information

Quantitative sustainability indicators for World Liberty Financial

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	World Liberty Financial	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	944.77585	kWh/a

Qualitative information

S.4 Consensus Mechanism

World Liberty Financial is present on the following networks: Binance Smart Chain, Ethereum, Solana.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs

of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.
4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.

- Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.

2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

S.5 Incentive Mechanisms and Applicable Fees

World Liberty Financial is present on the following networks: Binance Smart Chain, Ethereum, Solana.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks,

attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.
   - Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.
2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.
3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) binance_smart_chain, ethereum, solana 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.

Lido DAO Token

LDO | 8W8GLGL65

Quantitative information

Quantitative sustainability indicators for Lido DAO Token

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Lido DAO Token	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	822.70983	kWh/a

Qualitative information

S.4 Consensus Mechanism

Lido DAO Token is present on the following networks: Arbitrum, Binance Smart Chain, Ethereum, Solana, Terra Classic.

Arbitrum is an optimistic rollup that processes transactions on a Layer 2 network and relies on Ethereum for data availability and settlement. A sequencer orders incoming transactions, executes them and publishes compressed transaction batches to Ethereum. Arbitrum nodes can independently reconstruct and verify the resulting Layer 2 state using the transaction data published on the parent chain. Validators submit assertions representing the state of the network. Under the BoLD dispute protocol, conflicting or incorrect assertions may be challenged and resolved through an interactive fraud-proof process on Ethereum. Once an assertion has been confirmed and the applicable challenge process has been completed, the corresponding Layer 2 state is accepted for settlement purposes.

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be

selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.

4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.
2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

Terra blockchain operates on a Delegated Proof of Stake (DPoS) consensus mechanism, which ensures fast, scalable, and secure transaction processing.

Core Components:

- Delegated Proof of Stake (DPoS):
  - Validators: A limited set of validators are responsible for validating transactions, proposing blocks, and securing the network. Validators are selected based on the amount of LUNA tokens staked, either directly or delegated by token holders.
  - Delegation: LUNA holders can delegate their tokens to validators, allowing them to participate in staking rewards without running their own validator nodes.
  - Rotational Leadership: Validators are selected in a round-robin manner to propose new blocks, ensuring fairness and efficiency in block production.
- Tendermint BFT (Byzantine Fault Tolerance):
  - Terra integrates the Tendermint Core consensus engine, providing fast block finality and resilience against up to one-third of malicious or faulty validators.
  - Finality: Transactions are confirmed once a block is added, reducing the risk of chain reorganizations and ensuring immediate finality.
  - Governance Integration: LUNA token holders participate in governance by voting on proposals related to protocol upgrades, parameter changes, and community decisions, aligning stakeholder incentives with network health.

S.5 Incentive Mechanisms and Applicable Fees

Lido DAO Token is present on the following networks: Arbitrum, Binance Smart Chain, Ethereum, Solana, Terra Classic.

Transactions on Arbitrum are subject to fees paid in ETH. The total fee generally consists of a Layer 2 execution component, which covers the computational resources required to process the transaction, and a parent-chain data component, which reflects the cost of publishing compressed transaction data to Ethereum. The amount payable therefore depends on the computational complexity of the transaction, the volume and compressibility of its data and the prevailing cost of data publication on Ethereum. Participants that submit or challenge state assertions under the dispute protocol must provide economic bonds. These bonds are intended to discourage incorrect assertions and compensate successful participants in the dispute process. Withdrawals through the canonical bridge become executable after the relevant Layer 2 state has been confirmed and the applicable challenge period has elapsed.

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators. This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.
   - Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.
2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.
3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

The Terra blockchain's incentive structure is designed to reward network participants, ensure security, and sustain ecosystem growth, while its fee model aligns with its focus on scalability and cost-efficiency.

Incentive Mechanisms:

- Validators: Validators earn staking rewards for their role in securing the network and validating transactions. Rewards are distributed in LUNA tokens, derived from transaction fees and seigniorage revenue.

- Delegators: LUNA holders who delegate their tokens to validators receive a share of staking rewards, proportional to the amount delegated, incentivizing broad participation.
- Seigniorage Rewards: Validators and delegators benefit from seigniorage revenue, generated when new stablecoins (e.g., TerraUSD) are minted. A portion of this revenue is allocated to reward LUNA stakers.
- Stability Incentives: LUNA token holders are incentivized to stake and participate in governance to maintain the stability of Terra's ecosystem and its algorithmic stablecoins.
- Governance Participation Rewards: Validators and delegators have governance voting rights, enabling them to shape the network's future. Participation in governance aligns incentives with long-term ecosystem health.

Applicable Fees:

- Transaction Fees: Users pay fees in LUNA or stablecoins for transactions such as fund transfers, smart contract execution, and staking. These fees are distributed among validators and delegators, providing additional incentives for network security and functionality.
- Dynamic Fee Model: Transaction fees are dynamically adjusted based on network congestion and transaction size. This ensures efficient resource allocation while keeping fees affordable for users.
- Seigniorage Fee: A portion of revenue from stablecoin minting is directed to the treasury and distributed to stakers, reinforcing network participation and development.
- Burning Mechanism: A portion of fees and seigniorage revenue may be burned, reducing LUNA supply over time and contributing to its deflationary tokenomics.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) arbitrum, binance_smart_chain, ethereum, solana, terra_classic 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.

Quant

QNT | L8M8X31JL

Quantitative information

Quantitative sustainability indicators for Quant

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Quant	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	693.20049	kWh/a

Qualitative information

S.4 Consensus Mechanism

Quant is present on the following networks: Energi, Ethereum.

Energi operates on a Proof of Stake (PoS) consensus mechanism supported by a masternode system. Validators, or "stakers," secure the network by locking up NRG tokens to validate transactions and maintain network integrity.

Core Components:

1. Proof of Stake (PoS):
   Validators lock up NRG tokens and earn rewards for confirming transactions based on their staked amount, ensuring active participation in network security.
2. Masternode System:
   - Collateral Requirement: To operate a masternode, users must lock up 1,000 NRG as collateral. Masternodes contribute to transaction validation, security, and governance, playing a central role in network functionality.
   - Governance Participation: Masternodes vote on network proposals, protocol changes, and community initiatives, enabling decentralized decision-making.
3. Self-Funding Treasury:
   A portion of block rewards funds the treasury, which supports development, marketing, and community projects, ensuring Energi's growth and development over time

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice

rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

S.5 Incentive Mechanisms and Applicable Fees

Quant is present on the following networks: Energi, Ethereum.

Energi incentivizes both stakers and masternodes with block rewards, supporting network security and governance. Transaction fees contribute to network sustainability.

Incentive Mechanisms:

Staking and Masternode Rewards:
- Staker Rewards: Validators earn a portion of block rewards for transaction validation.
- Masternode Rewards: Masternodes receive rewards for their roles in governance and network support, ensuring active engagement in network development.

Applicable Fees:

1. Transaction Fees:
   Low Cost: Users pay transaction fees in NRG, which are generally low and provide additional rewards for validators and masternodes, supporting network operations.
2. Balanced Reward Structure:
   Inflation Control: Energi's rewards structure is designed to maintain inflation balance with sustainable rewards, incentivizing long-term network participation.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) energi, ethereum 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.

Worldcoin

WLD | BJD0TZ8V1

Quantitative information

Quantitative sustainability indicators for Worldcoin

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Worldcoin	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	542.93051	kWh/a

Qualitative information

S.4 Consensus Mechanism

Worldcoin is present on the following networks: Ethereum, Optimism.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Since Optimism is based on Ethereum, it ultimately inherits its security via the Ethereum blockchain and the proof-of-stake consensus. Within the rollup system, Optimism relies on a "fault proof" procedure. By default, transactions are assumed to be correct ("optimistic"). Only in the event of suspected faults is a fault proof initiated, in which incorrect transactions can be challenged by challengers. This model allows for high efficiency while ensuring correctness.

S.5 Incentive Mechanisms and Applicable Fees

Worldcoin is present on the following networks: Ethereum, Optimism.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Optimism charges lower transaction fees than Ethereum Layer 1, as transactions are bundled in the rollup and written to the Ethereum main chain in compressed form. Gas fees on Optimism continue to be paid in ETH. The incentive model is based on increased efficiency for users (lower fees, faster confirmation) and on the role of sequencers. Sequencers are central actors who collect, organize, and include transactions in the rollup. Their revenue comes from the gas fees they charge.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) ethereum, optimism 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.

Optimism

OP | 9NRMM2RC4

Quantitative information

Quantitative sustainability indicators for Optimism

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Optimism	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	432.57668	kWh/a

Qualitative information

S.4 Consensus Mechanism

Since Optimism is based on Ethereum, it ultimately inherits its security via the Ethereum blockchain and the proof-of-stake consensus. Within the rollup system, Optimism relies on a "fault proof" procedure. By default, transactions are assumed to be correct ("optimistic"). Only in the event of suspected faults is a fault proof initiated, in which incorrect transactions can be challenged by challengers. This model allows for high efficiency while ensuring correctness.

S.5 Incentive Mechanisms and Applicable Fees

Optimism charges lower transaction fees than Ethereum Layer 1, as transactions are bundled in the rollup and written to the Ethereum main chain in compressed form. Gas fees on Optimism continue to be paid in ETH. The incentive model is based on increased efficiency for users (lower fees, faster confirmation) and on the role of sequencers. Sequencers are central actors who collect, organize, and include transactions in the rollup. Their revenue comes from the gas fees they charge.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) optimism 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.

OFFICIAL TRUMP

TRUMP | LJDPGNXXK

Quantitative information

Quantitative sustainability indicators for OFFICIAL TRUMP

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	OFFICIAL TRUMP	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	394.87909	kWh/a

Qualitative information

S.4 Consensus Mechanism

OFFICIAL TRUMP is present on the following networks: Solana, Tron.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.
   - Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.
2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.
4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.
2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

The Tron blockchain operates on a Delegated Proof of Stake (DPoS) consensus mechanism, designed to improve scalability, transaction speed, and energy efficiency.

Core Components:

1. Delegated Proof of Stake (DPoS): Tron uses DPoS, where token holders vote for a group of delegates known as Super Representatives (SRs)who are responsible for validating transactions and producing new blocks on the network. Token holders can vote for SRs based on their stake in the Tron network, and the top 27 SRs (or more, depending on the protocol version) are selected to participate in the block production process. SRs take turns producing blocks, which are added to the blockchain. This is done on a rotational basis to ensure decentralization and prevent control by a small group of validators.

2. Block Production: The Super Representatives generate new blocks and confirm transactions. The Tron blockchain achieves block finality quickly, with block production occurring every 3 seconds, making it highly efficient and capable of processing thousands of transactions per second.
3. Voting and Governance: Tron's DPoS system also allows token holders to vote on important network decisions, such as protocol upgrades and changes to the system's parameters. Voting power is proportional to the amount of TRX (Tron's native token) that a user holds and chooses to stake. This provides a governance system where the community can actively participate in decision-making.
4. Super Representatives: The Super Representatives play a crucial role in maintaining the security and stability of the Tron blockchain. They are responsible for validating transactions, proposing new blocks, and ensuring the overall functionality of the network. Super Representatives are incentivized with block rewards (newly minted TRX tokens) and transaction feesfor their work.

S.5 Incentive Mechanisms and Applicable Fees

OFFICIAL TRUMP is present on the following networks: Solana, Tron.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.
   - Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.
2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.

3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

The Tron blockchain uses a Delegated Proof of Stake (DPoS) consensus mechanism to secure its network and incentivize participation.

Incentive Mechanism:

1. Super Representatives (SRs) Rewards:
   - Block Rewards: Super Representatives (SRs), who are elected by TRX holders, are rewarded for producing blocks. Each block they produce comes with a block reward in the form of TRX tokens.
   - Transaction Fees: In addition to block rewards, SRs receive transaction fees for validating transactions and including them in blocks. This ensures they are incentivized to process transactions efficiently.
2. Voting and Delegation:
   - TRX Staking: TRX holders can stake their tokens and vote for Super Representatives (SRs). When TRX holders vote, they delegate their voting power to SRs, which allows SRs to earn rewards in the form of newly minted TRX tokens.
   - Delegator Rewards: Token holders who delegate their votes to an SR can also receive a share of the rewards. This means delegators share in the block rewards and transaction fees that the SR earns.
   - Incentivizing Participation: The more tokens a user stakes, the more voting power they have, which encourages participation in governance and network security.
3. Incentive for SRs:
   SRs are also incentivized to maintain the health and performance of the network. Their reputation and continued election depend on their ability to produce blocks consistently and efficiently process transactions.

Applicable Fees:

1. Transaction Fees:
   - Fee Calculation: Users must pay transaction fees to have their transactions processed. The transaction fee varies based on the complexity of the transaction and the network's current demand. This is paid in TRX tokens. Transaction
   - Fee Distribution: Transaction fees are distributed to Super Representatives (SRs), giving them an ongoing income to maintain and support the network.
2. Storage Fees:
   Tron charges storage fees for data storage on the blockchain. This includes storing smart contracts, tokens, and other data on the network. Users are required to pay these fees in TRX tokens to store data.
3. Energy and Bandwidth:
   Energy: Tron uses a resource model that allows users to access network resources like bandwidth and energy through staking. Users who stake their TRX tokens receive \energy

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) solana, tron 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.

Render Token

RNDR | XR0JSKLNZ

Quantitative information

Quantitative sustainability indicators for Render Token

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Render Token	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	358.07810	kWh/a

Qualitative information

S.4 Consensus Mechanism

Render Token is present on the following networks: Ethereum, Solana.

Ethereum uses a Proof-of-Stake (PoS) consensus mechanism introduced with The Merge on 2022-09-15, which replaced the previous Proof-of-Work consensus model. The PoS mechanism is implemented through Gasper, combining Casper-FFG for finality with the LMD-GHOST fork-choice rule for chain selection. Validators participate in consensus by staking ETH through the Beacon Chain. Validators are pseudo-randomly selected to propose new blocks, while other validators attest to the validity of proposed blocks. The network operates using 12-second slots grouped into epochs of 32 slots. Under normal network conditions, finality is typically achieved after two epochs, approximately 12.8 minutes, through Casper-FFG. The LMD-GHOST fork-choice rule determines the canonical chain based on the accumulated weight of validator attestations. Validators that engage in certain malicious behaviour, such as equivocation or contradictory attestations, may be subject to slashing penalties, while offline validators may incur inactivity penalties. Subsequent network upgrades, including Dencun (2024-03-13), Pectra (2025-05-07) and Fusaka (2025-12-03), introduced protocol changes affecting Ethereum's consensus mechanism and Layer 2 functionality.

Solana uses a unique combination of Proof of History (PoH) and Proof of Stake (PoS) to achieve high throughput, low latency, and robust security.

Core Concepts:

1. Proof of History (PoH):
   - Time-Stamped Transactions: PoH is a cryptographic technique that timestamps transactions, creating a historical record that proves that an event has occurred at a specific moment in time.

- Verifiable Delay Function: PoH uses a Verifiable Delay Function (VDF) to generate a unique hash that includes the transaction and the time it was processed. This sequence of hashes provides a verifiable order of events, enabling the network to efficiently agree on the sequence of transactions.

2. Proof of Stake (PoS):
   - Validator Selection: Validators are chosen to produce new blocks based on the number of SOL tokens they have staked. The more tokens staked, the higher the chance of being selected to validate transactions and produce new blocks.
   - Delegation: Token holders can delegate their SOL tokens to validators, earning rewards proportional to their stake while enhancing the network's security.

Consensus Process:

1. Transaction Validation:
   Transactions are broadcast to the network and collected by validators. Each transaction is validated to ensure it meets the network's criteria, such as having correct signatures and sufficient funds.
2. PoH Sequence Generation:
   A validator generates a sequence of hashes using PoH, each containing a timestamp and the previous hash. This process creates a historical record of transactions, establishing a cryptographic clock for the network.
3. Block Production:
   The network uses PoS to select a leader validator based on their stake. The leader is responsible for bundling the validated transactions into a block. The leader validator uses the PoH sequence to order transactions within the block, ensuring that all transactions are processed in the correct order.
4. Consensus and Finalization:
   Other validators verify the block produced by the leader validator. They check the correctness of the PoH sequence and validate the transactions within the block. Once the block is verified, it is added to the blockchain. Validators sign off on the block, and it is considered finalized.

Security and Economic Incentives:

1. Incentives for Validators:
   - Block Rewards: Validators earn rewards for producing and validating blocks. These rewards are distributed in SOL tokens and are proportional to the validator's stake and performance.
   - Transaction Fees: Validators also earn transaction fees from the transactions included in the blocks they produce. These fees provide an additional incentive for validators to process transactions efficiently.
2. Security:
   - Staking: Validators must stake SOL tokens to participate in the consensus process. This staking acts as collateral, incentivizing validators to act honestly. If a validator behaves maliciously or fails to perform, they risk losing their staked tokens.
   - Delegated Staking: Token holders can delegate their SOL tokens to validators, enhancing network security and decentralization. Delegators share in the rewards and are incentivized to choose reliable validators.
3. Economic Penalties:
   Slashing: Validators can be penalized for malicious behavior, such as double-signing or producing invalid blocks. This penalty, known as slashing, results in the loss of a portion of the staked tokens, discouraging dishonest actions.

S.5 Incentive Mechanisms and Applicable Fees

Render Token is present on the following networks: Ethereum, Solana.

Ethereum's Proof-of-Stake (PoS) mechanism secures the network through validator incentives and protocol-defined penalties. Validators are required to stake ETH in order to participate in block proposal and attestation activities. A minimum of 32 ETH is required to activate a validator. Following the Pectra upgrade on 2025-05-07, EIP-7251 increased the maximum effective balance per validator from 32 ETH to 2,048 ETH. Validators may receive protocol-defined rewards for proposing blocks, attesting to valid blocks and participating in sync committees. Rewards consist of newly issued ETH and transaction-related fees. Transaction fees on Ethereum follow the mechanism introduced by EIP-1559, under which each transaction includes a base fee that is burned at the protocol level and an optional priority fee paid to the validator proposing the relevant block. Validators that engage in certain malicious behaviour, including equivocation or contradictory attestations, may be subject to slashing penalties. Validators that fail to participate correctly in consensus activities may also incur inactivity penalties. These mechanisms are intended to support validator participation and the economic security of the Ethereum network.

Solana uses a combination of Proof of History (PoH) and Proof of Stake (PoS) to secure its network and validate transactions.

Incentive Mechanisms:

1. Validators:
   - Staking Rewards: Validators are chosen based on the number of SOL tokens they have staked. They earn rewards for producing and validating blocks, which are distributed in SOL. The more tokens staked, the higher the chances of being selected to validate transactions and produce new blocks.
   - Transaction Fees: Validators earn a portion of the transaction fees paid by users for the transactions they include in the blocks. This provides an additional financial incentive for validators to process transactions efficiently and maintain the network's integrity.
2. Delegators:
   - Delegated Staking: Token holders who do not wish to run a validator node can delegate their SOL tokens to a validator. In return, delegators share in the rewards earned by the validators. This encourages widespread participation in securing the network and ensures decentralization.
3. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior, such as producing invalid blocks or being frequently offline. This penalty, known as slashing, involves the loss of a portion of their staked tokens. Slashing deters dishonest actions and ensures that validators act in the best interest of the network.
   - Opportunity Cost: By staking SOL tokens, validators and delegators lock up their tokens, which could otherwise be used or sold. This opportunity cost incentivizes participants to act honestly to earn rewards and avoid penalties. Fees Applicable on the Solana Blockchain

Transaction Fees:

1. Low and Predictable Fees:
   Solana is designed to handle a high throughput of transactions, which helps keep fees low and predictable. The average transaction fee on Solana is significantly lower compared to other blockchains like Ethereum.
2. Fee Structure:
   Fees are paid in SOL and are used to compensate validators for the resources they expend to process transactions. This includes computational power and network bandwidth.

3. Rent Fees:
   State Storage: Solana charges rent fees for storing data on the blockchain. These fees are designed to discourage inefficient use of state storage and encourage developers to clean up unused state. Rent fees help maintain the efficiency and performance of the network.
4. Smart Contract Fees:
   Execution Costs: Similar to transaction fees, fees for deploying and interacting with smart contracts on Solana are based on the computational resources required. This ensures that users are charged proportionally for the resources they consume.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) ethereum, solana 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.

Aster

ASTER | H8BH7VR5W

Quantitative information

Quantitative sustainability indicators for Aster

Field	Value	Unit
S.1 Name	BTC Direct Europe B.V.	/
S.2 Relevant legal entity identifier	724500C4D3LQAKCEZ198	/
S.3 Name of the crypto-asset	Aster	/
S.6 Beginning of the period to which the disclosure relates	2025-09-15	/
S.7 End of the period to which the disclosure relates	2026-09-15	/
S.8 Energy consumption	120.53535	kWh/a

Qualitative information

S.4 Consensus Mechanism

Binance Smart Chain (BSC) uses a hybrid consensus mechanism called Proof-of-Staked-Authority (PoSA), which combines elements of Delegated-Proof-of-Stake (DPoS) and Proof-of-Authority (PoA). This method is intended to support fast block times and low fees while maintaining a level of decentralisation and security. Validators are responsible for producing blocks, validating transactions, and maintaining network security. The validator set consists of up to 45 validators, including 21 “Cabinet” validators and 24 “Candidate” validators, selected based on bonded stake. A subset of validators is selected per epoch to participate in block production. Token holders may delegate BNB to validators to support their selection. Delegators share in the rewards generated by validators, providing an economic incentive to participate in staking. Validator candidates are nodes that have staked BNB but are not part of the primary validator subset for a given epoch. They may be selected into the active set based on staking rank and can participate in block production with lower probability. Validators are ranked based on the amount of bonded BNB and are updated periodically. Validators must stake BNB as collateral and may be subject to slashing in cases of misbehaviour, including double-signing, malicious voting, or prolonged downtime.

S.5 Incentive Mechanisms and Applicable Fees

Validators must self-delegate BNB in order to participate in the validator system. Validator selection is staking-based, and validators that rank highly enough enter the active set and participate in block production and transaction validation. Validators are rewarded from transaction fees collected on the network. When a block is produced, most of the block fee is allocated to the validator that proposed the block. A portion is retained as validator commission, while the remainder is allocated for distribution through the validator credit structure. BNB holders may delegate BNB to validators.

This increases the validator's total stake and may improve its position in the validator ranking. Delegators share in the rewards earned by the validator they support, after deduction of the validator's commission. BSC distinguishes between Cabinet, Candidate and Inactive validators. The current model provides that the top 21 validators form the Cabinet, while the validators ranked from 22 to 45 are Candidates. Candidate validators have a smaller chance of producing blocks, but they remain part of the broader validator structure and support network resilience. Validator roles are updated every 24 hours based on the latest staking information. Validators may be penalised for misconduct or poor performance. Slashable events include double signing, malicious fast-finality voting and unavailability. Depending on the violation, consequences may include removal from the validator set, loss of staking rewards and slashing of part of the validator's self-delegated BNB. The staking model therefore creates an economic incentive for validators and delegators to support reliable validator performance. Transaction fees on BSC are paid in BNB and are intended to compensate validators for maintaining the network. BSC is designed as a comparatively low-fee network, and smart-contract transactions and transfers require gas fees in BNB. BSC does not rely on a separate protocol-level block reward. Instead, staking rewards are derived from transaction fees. Most of the block fee is allocated to the proposing validator, then split between validator commission and delegator-linked reward distribution. Part of transaction-fee revenue is collected through the System Reward Contract and used for designated system purposes, including fast-finality rewards. Deploying and interacting with smart contracts on BSC requires payment of gas fees in BNB. These fees depend on the computational resources required and form part of the network's overall fee and validator-incentive model.

S.9 Energy consumption sources and methodologies

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

To determine the energy consumption of a token, the energy consumption of the network(s) binance_smart_chain 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.

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Provision of ESG data for crypto-assets in compliance with MiCA requirements. The data is based on ISO-certified measurements, is legally robust, can be easily integrated, and is trusted by leading regulated market participants operating in different regulatory environments.

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