valuno

# Sustainability indicators for crypto-assets

## Disclosures in accordance with Article 66 (5) MiCAR.

This report was provided by Crypto Risk Metrics.

2025-03-12

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# Preamble

This publication by Valuno Group AB (publ) (LEI: 549300I5OMH3T4UPBN04) serves as proof of compliance with the obligations under MiCAR 66 (5). Furthermore, the requirements are implemented in accordance with the specifications of ESMA (ESMA75-453128700-1229).

# Overview

This is an overview of the core indicator energy consumption, but does not represent the reporting according to MiCAR 66 (5), which includes all prescribed indicators for each crypto asset.

| # | Crypto-Asset Name | Crypto-Asset FFG | Energy consumption (kWh per calendar year) |
|---|---|---|---:|
| 1 | Bitcoin | V15WLZJMF | 167311997711.84552 |
| 2 | Litecoin | D74JZ1VRD | 1217758535.17318 |
| 3 | Bitcoin Cash | 919BF3W7L | 608397217.08691 |
| 4 | Ethereum Eth | D5RG2FHH0 | 2390166.00000 |
| 5 | USD Coin | TJWK5QTRK | 826466.45392 |
| 6 | Cardano ADA | 76QS7QCXB | 813456.24717 |
| 7 | Polkadot DOT | SGD9NLTRG | 630794.60858 |
| 8 | Algorand | K8S6W74KS | 420961.80000 |
| 9 | ChainLink Token | 3R3J70FDR | 10898.48741 |

# Sustainability indicators according to MiCAR 66 (5)

## Bitcoin

## Quantitative information

| Field | Value | Unit |
|---|---:|---:|
| S.1 Name | Valuno Group AB (publ) | / |
| S.2 Relevant legal entity identifier | 549300I5OMH3T4UPBN04 | / |
| S.3 Name of the crypto-asset | Bitcoin | / |
| S.6 Beginning of the period to which the disclosure relates | 2024-03-12 | / |
| S.7 End of the period to which the disclosure relates | 2025-03-12 | / |
| S.8 Energy consumption | 167311997711.84552 | kWh |
| S.10 Renewable energy consumption | 15.1161113934 | % |
| S.11 Energy intensity | 15.24874 | kWh |

| Field | Value | Unit |
|---|---:|---:|
| S.12 Scope 1 DLT GHG emission - Controlled | 0.00000 | tCO2e |
| S.13 Scope 2 DLT GHG emission - Purchased | 68931884.07069 | tCO2e |
| S.14 GHG intensity | 6.28242 | 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.

To determine the energy consumption of a token, the energy consumption of the network(s) lightning_network is calculated first. Based on the crypto asset's gas consumption per network, the share of the total consumption of the respective network that is assigned to this asset is defined. 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.

## 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 the European Environment Agency (EEA) and thus determined.

## 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 the European Environment Agency (EEA) and thus determined.

## Litecoin

## Quantitative information

| Field | Value | Unit |
|---|---:|---:|
| S.1 Name | Valuno Group AB (publ) | / |
| S.2 Relevant legal entity identifier | 549300I5OMH3T4UPBN04 | / |
| S.3 Name of the crypto-asset | Litecoin | / |
| S.6 Beginning of the period to which the disclosure relates | 2024-03-12 | / |
| S.7 End of the period to which the disclosure relates | 2025-03-12 | / |
| S.8 Energy consumption | 1217758535.17318 | kWh |
| S.10 Renewable energy consumption | 15.1161118062 | % |
| S.11 Energy intensity | 0.05190 | kWh |
| S.12 Scope 1 DLT GHG emission - Controlled | 0.00000 | tCO2e |
| S.13 Scope 2 DLT GHG emission - Purchased | 501711.71774 | tCO2e |
| S.14 GHG intensity | 0.02138 | kgCO2e |

# Qualitative information

## S.4 Consensus Mechanism

Litecoin is present on the following networks: binance_smart_chain, litecoin.

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 ensures fast block times and low fees while maintaining a level of decentralization and security.

Core Components:

1. Validators (so-called “Cabinet Members”): Validators on BSC are responsible for producing new blocks, validating transactions, and maintaining the network’s security. To become a validator, an entity must stake a significant amount of BNB (Binance Coin). Validators are selected through staking and voting by token holders. There are 21 active validators at any given time, rotating to ensure decentralization and security.
2. Delegators: Token holders who do not wish to run validator nodes can delegate their BNB tokens to validators. This delegation helps validators increase their stake and improves their chances of being selected to produce blocks. Delegators earn a share of the rewards that validators receive, incentivizing broad participation in network security.
3. Candidates: Candidates are nodes that have staked the required amount of BNB and are in the pool waiting to become validators. They are essentially potential validators who are not currently active but can be elected to the validator set through community voting. Candidates play a crucial role in ensuring there is always a sufficient pool of nodes ready to take on validation tasks, thus maintaining network resilience and decentralization. Consensus Process
4. Validator Selection: Validators are chosen based on the amount of BNB staked and votes received from delegators. The more BNB staked and votes received, the higher the chance of being selected to validate transactions and produce new blocks. The selection process involves both the current validators and the pool of candidates, ensuring a dynamic and secure rotation of nodes.
5. Block Production: The selected validators take turns producing blocks in a PoA-like manner, ensuring that blocks are generated quickly and efficiently. Validators validate transactions, add them to new blocks, and broadcast these blocks to the network.
6. Transaction Finality: BSC achieves fast block times of around 3 seconds and quick transaction finality. This is achieved through the efficient PoSA mechanism that allows validators to rapidly reach consensus. Security and Economic Incentives
7. Staking: Validators are required to stake a substantial amount of BNB, which acts as collateral to ensure their honest behavior. This staked amount can be slashed if validators act maliciously. Staking incentivizes validators to act in the network's best interest to avoid losing their staked BNB.
8. Delegation and Rewards: Delegators earn rewards proportional to their stake in validators. This incentivizes them to choose reliable validators and participate in the network’s security. Validators and delegators share transaction fees as rewards, which provides continuous economic incentives to maintain network security and performance.
9. Transaction Fees: BSC employs low transaction fees, paid in BNB, making it cost-effective for users. These fees are collected by validators as part of their rewards, further incentivizing them to validate transactions accurately and efficiently.

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 is present on the following networks: binance_smart_chain, litecoin.

Binance Smart Chain (BSC) uses the Proof of Staked Authority (PoSA) consensus mechanism to ensure network security and incentivize participation from validators and delegators.

Incentive Mechanisms

1. Validators:
   - Staking Rewards: Validators must stake a significant amount of BNB to participate in the consensus process. They earn rewards in the form of transaction fees and block rewards.
   - Selection Process: Validators are selected based on the amount of BNB staked and the votes received from delegators. The more BNB staked and votes received, the higher the chances of being selected to validate transactions and produce new blocks.
2. Delegators:
   - Delegated Staking: Token holders can delegate their BNB to validators. This delegation increases the validator's total stake and improves their chances of being selected to produce blocks.
   - Shared Rewards: Delegators earn a portion of the rewards that validators receive. This incentivizes token holders to participate in the network's security and decentralization by choosing reliable validators.
3. Candidates:

   Pool of Potential Validators: Candidates are nodes that have staked the required amount of BNB and are waiting to become active validators. They ensure that there is always a sufficient pool of nodes ready to take on validation tasks, maintaining network resilience.
4. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior or failure to perform their duties. Penalties include slashing a portion of their staked tokens, ensuring that validators act in the best interest of the network.
   - Opportunity Cost: Staking requires validators and delegators to lock up their BNB tokens, providing an economic incentive to act honestly to avoid losing their staked assets.

Fees on the Binance Smart Chain

1. Transaction Fees:
   - Low Fees: BSC is known for its low transaction fees compared to other blockchain networks. These fees are paid in BNB and are essential for maintaining network operations and compensating validators.
   - Dynamic Fee Structure: Transaction fees can vary based on network congestion and the complexity of the transactions. However, BSC ensures that fees remain significantly lower than those on the Ethereum mainnet.
2. Block Rewards:
   Incentivizing Validators: Validators earn block rewards in addition to transaction fees. These rewards are distributed to validators for their role in maintaining the network and processing transactions.
3. Cross-Chain Fees:
   Interoperability Costs: BSC supports cross-chain compatibility, allowing assets to be transferred between Binance Chain and Binance Smart Chain. These cross-chain operations incur minimal fees, facilitating seamless asset transfers and improving user experience.
4. Smart Contract Fees:
   Deploying and interacting with smart contracts on BSC involves paying fees based on the computational resources required. These fees are also paid in BNB and are designed to be cost-effective, encouraging developers to build on the BSC platform.

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

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: 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.

To determine the energy consumption of a token, the energy consumption of the network(s) binance_smart_chain is calculated first. Based on the crypto asset's gas consumption per network, the share of the total consumption of the respective network that is assigned to this asset is defined. 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.

# 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 the European Environment Agency (EEA) and thus determined.

# 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 the European Environment Agency (EEA) and thus determined.

# Bitcoin Cash

## Quantitative information

| Field | Value | Unit |
|---|---:|---:|
| S.1 Name | Valuno Group AB (publ) | / |
| S.2 Relevant legal entity identifier | 549300I5OMH3T4UPBN04 | / |
| S.3 Name of the crypto-asset | Bitcoin Cash | / |
| S.6 Beginning of the period to which the disclosure relates | 2024-03-12 | / |
| S.7 End of the period to which the disclosure relates | 2025-03-12 | / |
| S.8 Energy consumption | 608397217.08691 | kWh |
| S.10 Renewable energy consumption | 15.1161113934 | % |
| S.11 Energy intensity | 0.07563 | kWh |
| S.12 Scope 1 DLT GHG emission - Controlled | 0.00000 | tCO2e |
| S.13 Scope 2 DLT GHG emission - Purchased | 250657.25716 | tCO2e |
| S.14 GHG intensity | 0.03116 | 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 “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.

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.

## 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 the European Environment Agency (EEA) and thus determined.

## 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 the European Environment Agency (EEA) and thus determined.

## Ethereum Eth

## Quantitative information

| Field | Value | Unit |
|---|---:|---:|
| S.1 Name | Valuno Group AB (publ) | / |
| S.2 Relevant legal entity identifier | 549300I5OMH3T4UPBN04 | / |
| S.3 Name of the crypto-asset | Ethereum Eth | / |
| S.6 Beginning of the period to which the disclosure relates | 2024-03-12 | / |
| S.7 End of the period to which the disclosure relates | 2025-03-12 | / |
| S.8 Energy consumption | 2390166.00000 | kWh |
| S.10 Renewable energy consumption | 17.4057653342 | % |
| S.11 Energy intensity | 0.00010 | kWh |
| S.12 Scope 1 DLT GHG emission - Controlled | 0.00000 | tCO2e |
| S.13 Scope 2 DLT GHG emission - Purchased | 795.47849 | tCO2e |
| S.14 GHG intensity | 0.00003 | kgCO2e |

# Qualitative information

## S.4 Consensus Mechanism

The Ethereum network uses a Proof-of-Stake Consensus Mechanism to validate new transactions on the blockchain.

Core Components:

1. Validators: Validators are responsible for proposing and validating new blocks. To become a validator, a user must deposit (stake) 32 ETH into a smart contract. This stake acts as collateral and can be slashed if the validator behaves dishonestly.
2. Beacon Chain: The Beacon Chain is the backbone of Ethereum 2.0. It coordinates the network of validators and manages the consensus protocol. It is responsible for creating new blocks, organizing validators into committees, and implementing the finality of blocks.

Consensus Process:

1. Block Proposal: Validators are chosen randomly to propose new blocks. This selection is based on a weighted random function (WRF), where the weight is determined by the amount of ETH staked.
2. Attestation: Validators not proposing a block participate in attestation. They attest to the validity of the proposed block by voting for it. Attestations are then aggregated to form a single proof of the block’s validity.
3. Committees: Validators are organized into committees to streamline the validation process. Each committee is responsible for validating blocks within a specific shard or the Beacon Chain itself. This ensures decentralization and security, as a smaller group of validators can quickly reach consensus.
4. Finality: Ethereum 2.0 uses a mechanism called Casper FFG (Friendly Finality Gadget) to achieve finality. Finality means that a block and its transactions are considered irreversible and confirmed. Validators vote on the finality of blocks, and once a supermajority is reached, the block is finalized.
5. Incentives and Penalties: Validators earn rewards for participating in the network, including proposing blocks and attesting to their validity. Conversely, validators can be penalized (slashed) for malicious behavior, such as double-signing or being offline for extended periods. This ensures honest participation and network security.

## S.5 Incentive Mechanisms and Applicable Fees

Ethereum, particularly after transitioning to Ethereum 2.0 (Eth2), employs a Proof-of-Stake (PoS) consensus mechanism to secure its network. The incentives for validators and the fee structures play crucial roles in maintaining the security and efficiency of the blockchain.

Incentive Mechanisms:

1. Staking Rewards:
   - Validator Rewards: Validators are essential to the PoS mechanism. They are responsible for proposing and validating new blocks. To participate, they must stake a minimum of 32 ETH. In return, they earn rewards for their contributions, which are paid out in ETH. These rewards are a combination of newly minted ETH and transaction fees from the blocks they validate.

  - Reward Rate: The reward rate for validators is dynamic and depends on the total amount of ETH staked in the network. The more ETH staked, the lower the individual reward rate, and vice versa. This is designed to balance the network's security and the incentive to participate.
2. Transaction Fees:
   - Base Fee: After the implementation of Ethereum Improvement Proposal (EIP) 1559, the transaction fee model changed to include a base fee that is burned (i.e., removed from circulation). This base fee adjusts dynamically based on network demand, aiming to stabilize transaction fees and reduce volatility.
   - Priority Fee (Tip): Users can also include a priority fee (tip) to incentivize validators to include their transactions more quickly. This fee goes directly to the validators, providing them with an additional incentive to process transactions efficiently.
3. Penalties for Malicious Behavior:
   - Slashing: Validators face penalties (slashing) if they engage in malicious behavior, such as double-signing or validating incorrect information. Slashing results in the loss of a portion of their staked ETH, discouraging bad actors and ensuring that validators act in the network's best interest.
   - Inactivity Penalties: Validators also face penalties for prolonged inactivity. This ensures that validators remain active and engaged in maintaining the network's security and operation.

Fees Applicable on the Ethereum Blockchain:

1. Gas Fees:
   - Calculation: Gas fees are calculated based on the computational complexity of transactions and smart contract executions. Each operation on the Ethereum Virtual Machine (EVM) has an associated gas cost.
   - Dynamic Adjustment: The base fee introduced by EIP-1559 dynamically adjusts according to network congestion. When demand for block space is high, the base fee increases, and when demand is low, it decreases.
2. Smart Contract Fees:
   Deployment and Interaction: Deploying a smart contract on Ethereum involves paying gas fees proportional to the contract's complexity and size. Interacting with deployed smart contracts (e.g., executing functions, transferring tokens) also incurs gas fees.
   - Optimizations: Developers are incentivized to optimize their smart contracts to minimize gas usage, making transactions more cost-effective for users.
3. Asset Transfer Fees:
   Token Transfers: Transferring ERC-20 or other token standards involves gas fees. These fees vary based on the token's contract implementation and the current network demand.

# 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.

## 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 the European Environment Agency (EEA) and thus determined.

## 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 the European Environment Agency (EEA) and thus determined.

## USD Coin

## Quantitative information

| **Field** | **Value** | **Unit** |
|---|---:|---:|
| S.1 Name | Valuno Group AB (publ) | / |
| S.2 Relevant legal entity identifier | 549300I5OMH3T4UPBN04 | / |
| S.3 Name of the crypto-asset | USD Coin | / |
| S.6 Beginning of the period to which the disclosure relates | 2024-03-12 | / |
| S.7 End of the period to which the disclosure relates | 2025-03-12 | / |
| S.8 Energy consumption | 826466.45392 | kWh |
| S.10 Renewable energy consumption | 16.9725526814 | % |
| S.11 Energy intensity | 0.00002 | kWh |
| S.12 Scope 1 DLT GHG emission - Controlled | 0.00000 | tCO2e |
| S.13 Scope 2 DLT GHG emission - Purchased | 283.24957 | tCO2e |
| S.14 GHG intensity | 0.00001 | kgCO2e |

## Qualitative information

## S.4 Consensus Mechanism

USD Coin is present on the following networks: algorand, avalanche, ethereum, flow, hedera_hbar, solana, stellar, tron.

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.

The Avalanche blockchain network employs a unique Proof-of-Stake consensus mechanism called Avalanche Consensus, which involves three interconnected protocols: Snowball, Snowflake, and Avalanche.

Avalanche Consensus Process:

1. Snowball Protocol:
   - Random Sampling: Each validator randomly samples a small, constant-sized subset of other validators.
   - Repeated Polling: Validators repeatedly poll the sampled validators to determine the preferred transaction.
   - Confidence Counters: Validators maintain confidence counters for each transaction, incrementing them each time a sampled validator supports their preferred transaction.
   - Decision Threshold: Once the confidence counter exceeds a pre-defined threshold, the transaction is considered accepted.
2. Snowflake Protocol:
   - Binary Decision: Enhances the Snowball protocol by incorporating a binary decision process. Validators decide between two conflicting transactions.
   - Binary Confidence: Confidence counters are used to track the preferred binary decision.
   - Finality: When a binary decision reaches a certain confidence level, it becomes final.
3. Avalanche Protocol:
   - DAG Structure: Uses a Directed Acyclic Graph (DAG) structure to organize transactions, allowing for parallel processing and higher throughput.
   - Transaction Ordering: Transactions are added to the DAG based on their dependencies, ensuring a consistent order.
   - Consensus on DAG: While most Proof-of-Stake Protocols use a Byzantine Fault Tolerant (BFT) consensus, Avalanche uses the Avalanche Consensus, Validators reach consensus on the structure and contents of the DAG through repeated Snowball and Snowflake.

The Ethereum network uses a Proof-of-Stake Consensus Mechanism to validate new transactions on the blockchain.

Core Components:

1. Validators: Validators are responsible for proposing and validating new blocks. To become a validator, a user must deposit (stake) 32 ETH into a smart contract. This stake acts as collateral and can be slashed if the validator behaves dishonestly.

2. Beacon Chain: The Beacon Chain is the backbone of Ethereum 2.0. It coordinates the network of validators and manages the consensus protocol. It is responsible for creating new blocks, organizing validators into committees, and implementing the finality of blocks.

Consensus Process:

1. Block Proposal: Validators are chosen randomly to propose new blocks. This selection is based on a weighted random function (WRF), where the weight is determined by the amount of ETH staked.
2. Attestation: Validators not proposing a block participate in attestation. They attest to the validity of the proposed block by voting for it. Attestations are then aggregated to form a single proof of the block's validity.
3. Committees: Validators are organized into committees to streamline the validation process. Each committee is responsible for validating blocks within a specific shard or the Beacon Chain itself. This ensures decentralization and security, as a smaller group of validators can quickly reach consensus.
4. Finality: Ethereum 2.0 uses a mechanism called Casper FFG (Friendly Finality Gadget) to achieve finality. Finality means that a block and its transactions are considered irreversible and confirmed. Validators vote on the finality of blocks, and once a supermajority is reached, the block is finalized.
5. Incentives and Penalties: Validators earn rewards for participating in the network, including proposing blocks and attesting to their validity. Conversely, validators can be penalized (slashed) for malicious behavior, such as double-signing or being offline for extended periods. This ensures honest participation and network security.

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.

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.

Stellar uses a unique consensus mechanism known as the Stellar Consensus Protocol (SCP).

Core Concepts:

1. Federated Byzantine Agreement (FBA):
   - SCP is built on the principles of Federated Byzantine Agreement (FBA), which allows decentralized, leaderless consensus without the need for a closed system of trusted participants.
   - Quorum Slices: Each node in the network selects a set of other nodes (quorum slice) that it trusts. Consensus is achieved when these slices overlap and collectively agree on the transaction state.

2. Nodes and Validators:
   - Nodes: Nodes running the Stellar software participate in the network by validating transactions and maintaining the ledger.
   - Validators: Nodes that are responsible for validating transactions and reaching consensus on the state of the ledger. Consensus Process
3. Transaction Validation:
   Transactions are submitted to the network and nodes validate them based on predetermined rules, such as sufficient balances and valid signatures.
4. Nomination Phase:
   - Nomination: Nodes nominate values (proposed transactions) that they believe should be included in the next ledger. Nodes communicate their nominations to their quorum slices.
   - Agreement on Nominations: Nodes vote on the nominated values, and through a process of voting and federated agreement, a set of candidate values emerges. This phase continues until nodes agree on a single value or a set of values.
5. Ballot Protocol (Voting and Acceptance): Balloting:
   - The agreed-upon values from the nomination phase are then put into ballots. Each ballot goes through multiple rounds of voting, where nodes vote to either accept or reject the proposed values.
   - Federated Voting: Nodes exchange votes within their quorum slices, and if a value receives sufficient votes across overlapping slices, it moves to the next stage.
   - Acceptance and Confirmation: If a value gathers enough votes through multiple stages (prepare, confirm, externalize), it is accepted and externalized as the next state of the ledger.
6. Ledger Update:
   Once consensus is reached, the new transactions are recorded in the ledger. Nodes update their copies of the ledger to reflect the new state. Security and Economic Incentives
7. Trust and Quorum Slices:
   Nodes are free to choose their own quorum slices, which provides flexibility and decentralization. The overlapping nature of quorum slices ensures that the network can reach consensus even if some nodes are faulty or malicious.
8. Stability and Security:
   SCP ensures that the network can achieve consensus efficiently without relying on energy-intensive mining processes. This makes it environmentally friendly and suitable for high-throughput applications.
9. Incentive Mechanisms:
   Unlike Proof of Work (PoW) or Proof of Stake (PoS) systems, Stellar does not rely on direct economic incentives like mining rewards. Instead, the network incentivizes participation through the intrinsic value of maintaining a secure, efficient, and reliable payment network.

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 Coin is present on the following networks: algorand, avalanche, ethereum, flow, hedera_hbar, solana, stellar, tron.

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.

Avalanche uses a consensus mechanism known as Avalanche Consensus, which relies on a combination of validators, staking, and a novel approach to consensus to ensure the network's security and integrity.

1. Validators:

Staking: Validators on the Avalanche network are required to stake AVAX tokens. The amount staked influences their probability of being selected to propose or validate new blocks.

Rewards: Validators earn rewards for their participation in the consensus process. These rewards are proportional to the amount of AVAX staked and their uptime and performance in validating transactions.

Delegation: Validators can also accept delegations from other token holders. Delegators share in the rewards based on the amount they delegate, which incentivizes smaller holders to participate indirectly in securing the network.

2. Economic Incentives:

Block Rewards: Validators receive block rewards for proposing and validating blocks. These rewards are distributed from the network’s inflationary issuance of AVAX tokens.

Transaction Fees: Validators also earn a portion of the transaction fees paid by users. This includes fees for simple transactions, smart contract interactions, and the creation of new assets on the network.

3. Penalties:

- Slashing: Unlike some other PoS systems, Avalanche does not employ slashing (i.e., the confiscation of staked tokens) as a penalty for misbehavior.Instead, the network relies on the financial disincentive of lost future rewards for validators who are not consistently online or act maliciously.
- Uptime Requirements: Validators must maintain a high level of uptime and correctly validate transactions to continue earning rewards. Poor performance or malicious actions result in missed rewards, providing a strong economic incentive to act honestly.

Fees on the Avalanche Blockchain

1. Transaction Fees:
   - Dynamic Fees: Transaction fees on Avalanche are dynamic, varying based on network demand and the complexity of the transactions. This ensures that fees remain fair and proportional to the network's usage.
   - Fee Burning: A portion of the transaction fees is burned, permanently removing them from circulation. This deflationary mechanism helps to balance the inflation from block rewards and incentivizes token holders by potentially increasing the value of AVAX over time.
2. Smart Contract Fees:
   Execution Costs: Fees for deploying and interacting with smart contracts are determined by the computational resources required. These fees ensure that the network remains efficient and that resources are used responsibly.

3. Asset Creation Fees:
   New Asset Creation: There are fees associated with creating new assets (tokens) on the Avalanche network. These fees help to prevent spam and ensure that only serious projects use the network's resources.

Ethereum, particularly after transitioning to Ethereum 2.0 (Eth2), employs a Proof-of-Stake (PoS) consensus mechanism to secure its network. The incentives for validators and the fee structures play crucial roles in maintaining the security and efficiency of the blockchain.

Incentive Mechanisms:

1. Staking Rewards:
   - Validator Rewards: Validators are essential to the PoS mechanism. They are responsible for proposing and validating new blocks. To participate, they must stake a minimum of 32 ETH. In return, they earn rewards for their contributions, which are paid out in ETH. These rewards are a combination of newly minted ETH and transaction fees from the blocks they validate.
   - Reward Rate: The reward rate for validators is dynamic and depends on the total amount of ETH staked in the network. The more ETH staked, the lower the individual reward rate, and vice versa. This is designed to balance the network's security and the incentive to participate.
2. Transaction Fees:
   - Base Fee: After the implementation of Ethereum Improvement Proposal (EIP) 1559, the transaction fee model changed to include a base fee that is burned (i.e., removed from circulation). This base fee adjusts dynamically based on network demand, aiming to stabilize transaction fees and reduce volatility.
   - Priority Fee (Tip): Users can also include a priority fee (tip) to incentivize validators to include their transactions more quickly. This fee goes directly to the validators, providing them with an additional incentive to process transactions efficiently.
3. Penalties for Malicious Behavior:
   - Slashing: Validators face penalties (slashing) if they engage in malicious behavior, such as double-signing or validating incorrect information. Slashing results in the loss of a portion of their staked ETH, discouraging bad actors and ensuring that validators act in the network's best interest.
   - Inactivity Penalties: Validators also face penalties for prolonged inactivity. This ensures that validators remain active and engaged in maintaining the network's security and operation.

Fees Applicable on the Ethereum Blockchain:

1. Gas Fees:
   - Calculation: Gas fees are calculated based on the computational complexity of transactions and smart contract executions. Each operation on the Ethereum Virtual Machine (EVM) has an associated gas cost.
   - Dynamic Adjustment: The base fee introduced by EIP-1559 dynamically adjusts according to network congestion. When demand for block space is high, the base fee increases, and when demand is low, it decreases.
2. Smart Contract Fees:
   Deployment and Interaction: Deploying a smart contract on Ethereum involves paying gas fees proportional to the contract's complexity and size. Interacting with deployed smart contracts (e.g., executing functions, transferring tokens) also incurs gas fees.
   - Optimizations: Developers are incentivized to optimize their smart contracts to minimize gas usage, making transactions more cost-effective for users.

3. Asset Transfer Fees:
   Token Transfers: Transferring ERC-20 or other token standards involves gas fees. These fees vary based on the token's contract implementation and the current network demand.

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.

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’s consensus mechanism, the Stellar Consensus Protocol (SCP), is designed to achieve decentralized and secure transaction validation through a federated Byzantine agreement (FBA) model. Unlike Proof of Work (PoW) or Proof of Stake (PoS) systems, Stellar does not rely on direct economic incentives like mining rewards. Instead, it ensures network security and transaction validation through intrinsic network mechanisms and transaction fees.

Incentive Mechanisms:

1. Quorum Slices and Trust:
   - Quorum Slices: Each node in the Stellar network selects other nodes it trusts to form a quorum slice. Consensus is achieved through the intersection of these slices, creating a robust and decentralized trust network.
   - Federated Voting: Nodes communicate their votes within their quorum slices, and through multiple rounds of federated voting, they agree on the transaction state. This process ensures that even if some nodes are compromised, the network can still achieve consensus securely.
2. Intrinsic Value and Participation:
   - Network Value: The intrinsic value of participating in a secure, efficient, and reliable payment network incentivizes nodes to act honestly and maintain network security. Organizations and individuals running nodes benefit from the network's functionality and the ability to facilitate transactions.
   - Decentralization: By allowing nodes to choose their own quorum slices, Stellar promotes decentralization, reducing the risk of central points of failure and making the network more resilient to attacks. Fees on the Stellar Blockchain
3. Transaction Fees:
   - Flat Fee Structure: Each transaction on the Stellar network incurs a flat fee of 0.00001 XLM (known as a base fee). This low and predictable fee structure makes Stellar suitable for micropayments and high-volume transactions.
   - Spam Prevention: The transaction fee serves as a deterrent against spam attacks. By requiring a small fee for each transaction, Stellar ensures that the network remains efficient and that resources are not wasted on processing malicious or frivolous transactions.
4. Operational Costs:
   Minimal Fees: The minimal transaction fees on Stellar not only prevent spam but also cover the operational costs of running the network. This ensures that the network can sustain itself without placing a significant financial burden on users.
5. Reserve Requirements:
   - Account Reserves: To create a new account on the Stellar network, a minimum balance of 1 XLM is required. This reserve requirement prevents the creation of an excessive number of accounts, further protecting the network from spam and ensuring efficient resource usage.
   - Trustline and Offer Reserves: Additional reserve requirements exist for creating trustlines and offers on the Stellar decentralized exchange (DEX). These reserves help maintain network integrity and prevent abuse.

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) flow, ethereum, avalanche, tron, stellar, algorand, hedera_hbar, solana is calculated first. Based on the crypto asset's gas consumption per network, the share of the total consumption of the respective network that is assigned to this asset is defined. 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.

## 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 the European Environment Agency (EEA) and thus determined.

## 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 the European Environment Agency (EEA) and thus determined.

# Cardano ADA

## Quantitative information

| **Field** | **Value** | **Unit** |
|---|---:|---:|
| S.1 Name | Valuno Group AB (publ) | / |
| S.2 Relevant legal entity identifier | 549300I5OMH3T4UPBN04 | / |
| S.3 Name of the crypto-asset | Cardano ADA | / |
| S.6 Beginning of the period to which the disclosure relates | 2024-03-12 | / |
| S.7 End of the period to which the disclosure relates | 2025-03-12 | / |
| S.8 Energy consumption | 813456.24717 | kWh |
| S.10 Renewable energy consumption | 17.2056910880 | % |
| S.11 Energy intensity | 0.00022 | kWh |
| S.12 Scope 1 DLT GHG emission - Controlled | 0.00000 | tCO2e |
| S.13 Scope 2 DLT GHG emission - Purchased | 273.95502 | tCO2e |
| S.14 GHG intensity | 0.00008 | kgCO2e |

## Qualitative information

## S.4 Consensus Mechanism

Cardano ADA is present on the following networks: binance_smart_chain, cardano.

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 ensures fast block times and low fees while maintaining a level of decentralization and security.

Core Components:

1. Validators (so-called “Cabinet Members”): Validators on BSC are responsible for producing new blocks, validating transactions, and maintaining the network’s security. To become a validator, an entity must stake a significant amount of BNB (Binance Coin). Validators are selected through staking and voting by token holders. There are 21 active validators at any given time, rotating to ensure decentralization and security.
2. Delegators: Token holders who do not wish to run validator nodes can delegate their BNB tokens to validators. This delegation helps validators increase their stake and improves their chances of being selected to produce blocks. Delegators earn a share of the rewards that validators receive, incentivizing broad participation in network security.
3. Candidates: Candidates are nodes that have staked the required amount of BNB and are in the pool waiting to become validators. They are essentially potential validators who are not currently active but can be elected to the validator set through community voting. Candidates

play a crucial role in ensuring there is always a sufficient pool of nodes ready to take on validation tasks, thus maintaining network resilience and decentralization. Consensus Process

4. Validator Selection: Validators are chosen based on the amount of BNB staked and votes received from delegators. The more BNB staked and votes received, the higher the chance of being selected to validate transactions and produce new blocks. The selection process involves both the current validators and the pool of candidates, ensuring a dynamic and secure rotation of nodes.
5. Block Production: The selected validators take turns producing blocks in a PoA-like manner, ensuring that blocks are generated quickly and efficiently. Validators validate transactions, add them to new blocks, and broadcast these blocks to the network.
6. Transaction Finality: BSC achieves fast block times of around 3 seconds and quick transaction finality. This is achieved through the efficient PoSA mechanism that allows validators to rapidly reach consensus. Security and Economic Incentives
7. Staking: Validators are required to stake a substantial amount of BNB, which acts as collateral to ensure their honest behavior. This staked amount can be slashed if validators act maliciously. Staking incentivizes validators to act in the network's best interest to avoid losing their staked BNB.
8. Delegation and Rewards: Delegators earn rewards proportional to their stake in validators. This incentivizes them to choose reliable validators and participate in the network’s security. Validators and delegators share transaction fees as rewards, which provides continuous economic incentives to maintain network security and performance.
9. Transaction Fees: BSC employs low transaction fees, paid in BNB, making it cost-effective for users. These fees are collected by validators as part of their rewards, further incentivizing them to validate transactions accurately and efficiently.

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: 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 ADA is present on the following networks: binance_smart_chain, cardano.

Binance Smart Chain (BSC) uses the Proof of Staked Authority (PoSA) consensus mechanism to ensure network security and incentivize participation from validators and delegators.

Incentive Mechanisms

1. Validators:
   - Staking Rewards: Validators must stake a significant amount of BNB to participate in the consensus process. They earn rewards in the form of transaction fees and block rewards.
   - Selection Process: Validators are selected based on the amount of BNB staked and the votes received from delegators. The more BNB staked and votes received, the higher the chances of being selected to validate transactions and produce new blocks.
2. Delegators:
   - Delegated Staking: Token holders can delegate their BNB to validators. This delegation increases the validator's total stake and improves their chances of being selected to produce blocks.
   - Shared Rewards: Delegators earn a portion of the rewards that validators receive. This incentivizes token holders to participate in the network’s security and decentralization by choosing reliable validators.
3. Candidates:
   Pool of Potential Validators: Candidates are nodes that have staked the required amount of BNB and are waiting to become active validators. They ensure that there is always a sufficient pool of nodes ready to take on validation tasks, maintaining network resilience.
4. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior or failure to perform their duties. Penalties include slashing a portion of their staked tokens, ensuring that validators act in the best interest of the network.
   - Opportunity Cost: Staking requires validators and delegators to lock up their BNB tokens, providing an economic incentive to act honestly to avoid losing their staked assets.

Fees on the Binance Smart Chain

1. Transaction Fees:
   - Low Fees: BSC is known for its low transaction fees compared to other blockchain networks. These fees are paid in BNB and are essential for maintaining network operations and compensating validators.
   - Dynamic Fee Structure: Transaction fees can vary based on network congestion and the complexity of the transactions. However, BSC ensures that fees remain significantly lower than those on the Ethereum mainnet.
2. Block Rewards:
   Incentivizing Validators: Validators earn block rewards in addition to transaction fees. These rewards are distributed to validators for their role in maintaining the network and processing transactions.

3. Cross-Chain Fees:
   Interoperability Costs: BSC supports cross-chain compatibility, allowing assets to be transferred between Binance Chain and Binance Smart Chain. These cross-chain operations incur minimal fees, facilitating seamless asset transfers and improving user experience.
4. Smart Contract Fees:
   Deploying and interacting with smart contracts on BSC involves paying fees based on the computational resources required. These fees are also paid in BNB and are designed to be cost-effective, encouraging developers to build on the BSC platform.

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

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.

To determine the energy consumption of a token, the energy consumption of the network(s) binance_smart_chain is calculated first. Based on the crypto asset's gas consumption per network, the share of the total consumption of the respective network that is assigned to this asset is defined. 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.

## 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 the European Environment Agency (EEA) and thus determined.

## 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 the European Environment Agency (EEA) and thus determined.

# Polkadot DOT

## Quantitative information

| Field | Value | Unit |
|---|---:|---:|
| S.1 Name | Valuno Group AB (publ) | / |
| S.2 Relevant legal entity identifier | 549300I5OMH3T4UPBN04 | / |
| S.3 Name of the crypto-asset | Polkadot DOT | / |
| S.6 Beginning of the period to which the disclosure relates | 2024-03-12 | / |
| S.7 End of the period to which the disclosure relates | 2025-03-12 | / |
| S.8 Energy consumption | 630794.60858 | kWh |
| S.10 Renewable energy consumption | 18.6218856066 | % |
| S.11 Energy intensity | 0.00029 | kWh |
| S.12 Scope 1 DLT GHG emission - Controlled | 0.00000 | tCO2e |
| S.13 Scope 2 DLT GHG emission - Purchased | 186.17194 | tCO2e |
| S.14 GHG intensity | 0.00008 | kgCO2e |

## Qualitative information

## S.4 Consensus Mechanism

Polkadot DOT is present on the following networks: binance_smart_chain, huobi, polkadot.

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 ensures fast block times and low fees while maintaining a level of decentralization and security.

Core Components:

1. Validators (so-called “Cabinet Members”): Validators on BSC are responsible for producing new blocks, validating transactions, and maintaining the network’s security. To become a validator, an entity must stake a significant amount of BNB (Binance Coin). Validators are selected through staking and voting by token holders. There are 21 active validators at any given time, rotating to ensure decentralization and security.
2. Delegators: Token holders who do not wish to run validator nodes can delegate their BNB tokens to validators. This delegation helps validators increase their stake and improves their chances of being selected to produce blocks. Delegators earn a share of the rewards that validators receive, incentivizing broad participation in network security.
3. Candidates: Candidates are nodes that have staked the required amount of BNB and are in the pool waiting to become validators. They are essentially potential validators who are not currently active but can be elected to the validator set through community voting. Candidates play a crucial role in ensuring there is always a sufficient pool of nodes ready to take on validation tasks, thus maintaining network resilience and decentralization. Consensus Process
4. Validator Selection: Validators are chosen based on the amount of BNB staked and votes received from delegators. The more BNB staked and votes received, the higher the chance of being selected to validate transactions and produce new blocks. The selection process

involves both the current validators and the pool of candidates, ensuring a dynamic and secure rotation of nodes.

5. Block Production: The selected validators take turns producing blocks in a PoA-like manner, ensuring that blocks are generated quickly and efficiently. Validators validate transactions, add them to new blocks, and broadcast these blocks to the network.
6. Transaction Finality: BSC achieves fast block times of around 3 seconds and quick transaction finality. This is achieved through the efficient PoSA mechanism that allows validators to rapidly reach consensus. Security and Economic Incentives
7. Staking: Validators are required to stake a substantial amount of BNB, which acts as collateral to ensure their honest behavior. This staked amount can be slashed if validators act maliciously. Staking incentivizes validators to act in the network's best interest to avoid losing their staked BNB.
8. Delegation and Rewards: Delegators earn rewards proportional to their stake in validators. This incentivizes them to choose reliable validators and participate in the network's security. Validators and delegators share transaction fees as rewards, which provides continuous economic incentives to maintain network security and performance.
9. Transaction Fees: BSC employs low transaction fees, paid in BNB, making it cost-effective for users. These fees are collected by validators as part of their rewards, further incentivizing them to validate transactions accurately and efficiently.

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.

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.

# S.5 Incentive Mechanisms and Applicable Fees

Polkadot DOT is present on the following networks: binance_smart_chain, huobi, polkadot.

Binance Smart Chain (BSC) uses the Proof of Staked Authority (PoSA) consensus mechanism to ensure network security and incentivize participation from validators and delegators.

Incentive Mechanisms

1. Validators:
   - Staking Rewards: Validators must stake a significant amount of BNB to participate in the consensus process. They earn rewards in the form of transaction fees and block rewards.
   - Selection Process: Validators are selected based on the amount of BNB staked and the votes received from delegators. The more BNB staked and votes received, the higher the chances of being selected to validate transactions and produce new blocks.
2. Delegators:
   - Delegated Staking: Token holders can delegate their BNB to validators. This delegation increases the validator's total stake and improves their chances of being selected to produce blocks.

  - Shared Rewards: Delegators earn a portion of the rewards that validators receive. This incentivizes token holders to participate in the network’s security and decentralization by choosing reliable validators.

3. Candidates:
   Pool of Potential Validators: Candidates are nodes that have staked the required amount of BNB and are waiting to become active validators. They ensure that there is always a sufficient pool of nodes ready to take on validation tasks, maintaining network resilience.
4. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior or failure to perform their duties. Penalties include slashing a portion of their staked tokens, ensuring that validators act in the best interest of the network.
   - Opportunity Cost: Staking requires validators and delegators to lock up their BNB tokens, providing an economic incentive to act honestly to avoid losing their staked assets.

Fees on the Binance Smart Chain

1. Transaction Fees:
   - Low Fees: BSC is known for its low transaction fees compared to other blockchain networks. These fees are paid in BNB and are essential for maintaining network operations and compensating validators.
   - Dynamic Fee Structure: Transaction fees can vary based on network congestion and the complexity of the transactions. However, BSC ensures that fees remain significantly lower than those on the Ethereum mainnet.
2. Block Rewards:
   Incentivizing Validators: Validators earn block rewards in addition to transaction fees. These rewards are distributed to validators for their role in maintaining the network and processing transactions.
3. Cross-Chain Fees:
   Interoperability Costs: BSC supports cross-chain compatibility, allowing assets to be transferred between Binance Chain and Binance Smart Chain. These cross-chain operations incur minimal fees, facilitating seamless asset transfers and improving user experience.
4. Smart Contract Fees:
   Deploying and interacting with smart contracts on BSC involves paying fees based on the computational resources required. These fees are also paid in BNB and are designed to be cost-effective, encouraging developers to build on the BSC platform.

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.

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.

## 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.

To determine the energy consumption of a token, the energy consumption of the network(s) binance_smart_chain, huobi is calculated first. Based on the crypto asset's gas consumption per network, the share of the total consumption of the respective network that is assigned to this asset is defined. 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.

## 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 the European Environment Agency (EEA) and thus determined.

## 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 the European Environment Agency (EEA) and thus determined.

# Algorand

## Quantitative information

| Field | Value | Unit |
|---|---:|---:|
| S.1 Name | Valuno Group AB (publ) | / |
| S.2 Relevant legal entity identifier | 549300I5OMH3T4UPBN04 | / |
| S.3 Name of the crypto-asset | Algorand | / |
| S.6 Beginning of the period to which the disclosure relates | 2024-03-12 | / |
| S.7 End of the period to which the disclosure relates | 2025-03-12 | / |
| S.8 Energy consumption | 420961.80000 | kWh |

## 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.

# ChainLink Token

## Quantitative information

| **Field** | **Value** | **Unit** |
|---|---:|---:|
| S.1 Name | Valuno Group AB (publ) | / |

| Field | Value | Unit |
|---|---:|---:|
| S.2 Relevant legal entity identifier | 549300I5OMH3T4UPBN04 | / |
| S.3 Name of the crypto-asset | ChainLink Token | / |
| S.6 Beginning of the period to which the disclosure relates | 2024-03-12 | / |
| S.7 End of the period to which the disclosure relates | 2025-03-12 | / |
| S.8 Energy consumption | 10898.48741 | kWh |

# Qualitative information

# S.4 Consensus Mechanism

ChainLink Token is present on the following networks: binance_smart_chain, ethereum.

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 ensures fast block times and low fees while maintaining a level of decentralization and security.

Core Components:

1. Validators (so-called “Cabinet Members”): Validators on BSC are responsible for producing new blocks, validating transactions, and maintaining the network’s security. To become a validator, an entity must stake a significant amount of BNB (Binance Coin). Validators are selected through staking and voting by token holders. There are 21 active validators at any given time, rotating to ensure decentralization and security.
2. Delegators: Token holders who do not wish to run validator nodes can delegate their BNB tokens to validators. This delegation helps validators increase their stake and improves their chances of being selected to produce blocks. Delegators earn a share of the rewards that validators receive, incentivizing broad participation in network security.
3. Candidates: Candidates are nodes that have staked the required amount of BNB and are in the pool waiting to become validators. They are essentially potential validators who are not currently active but can be elected to the validator set through community voting. Candidates play a crucial role in ensuring there is always a sufficient pool of nodes ready to take on validation tasks, thus maintaining network resilience and decentralization. Consensus Process
4. Validator Selection: Validators are chosen based on the amount of BNB staked and votes received from delegators. The more BNB staked and votes received, the higher the chance of being selected to validate transactions and produce new blocks. The selection process involves both the current validators and the pool of candidates, ensuring a dynamic and secure rotation of nodes.
5. Block Production: The selected validators take turns producing blocks in a PoA-like manner, ensuring that blocks are generated quickly and efficiently. Validators validate transactions, add them to new blocks, and broadcast these blocks to the network.
6. Transaction Finality: BSC achieves fast block times of around 3 seconds and quick transaction finality. This is achieved through the efficient PoSA mechanism that allows validators to rapidly reach consensus. Security and Economic Incentives
7. Staking: Validators are required to stake a substantial amount of BNB, which acts as collateral to ensure their honest behavior. This staked amount can be slashed if validators act maliciously. Staking incentivizes validators to act in the network's best interest to avoid losing their staked BNB.

8. Delegation and Rewards: Delegators earn rewards proportional to their stake in validators. This incentivizes them to choose reliable validators and participate in the network's security. Validators and delegators share transaction fees as rewards, which provides continuous economic incentives to maintain network security and performance.
9. Transaction Fees: BSC employs low transaction fees, paid in BNB, making it cost-effective for users. These fees are collected by validators as part of their rewards, further incentivizing them to validate transactions accurately and efficiently.

The Ethereum network uses a Proof-of-Stake Consensus Mechanism to validate new transactions on the blockchain.

Core Components:

1. Validators: Validators are responsible for proposing and validating new blocks. To become a validator, a user must deposit (stake) 32 ETH into a smart contract. This stake acts as collateral and can be slashed if the validator behaves dishonestly.
2. Beacon Chain: The Beacon Chain is the backbone of Ethereum 2.0. It coordinates the network of validators and manages the consensus protocol. It is responsible for creating new blocks, organizing validators into committees, and implementing the finality of blocks.

Consensus Process:

1. Block Proposal: Validators are chosen randomly to propose new blocks. This selection is based on a weighted random function (WRF), where the weight is determined by the amount of ETH staked.
2. Attestation: Validators not proposing a block participate in attestation. They attest to the validity of the proposed block by voting for it. Attestations are then aggregated to form a single proof of the block's validity.
3. Committees: Validators are organized into committees to streamline the validation process. Each committee is responsible for validating blocks within a specific shard or the Beacon Chain itself. This ensures decentralization and security, as a smaller group of validators can quickly reach consensus.
4. Finality: Ethereum 2.0 uses a mechanism called Casper FFG (Friendly Finality Gadget) to achieve finality. Finality means that a block and its transactions are considered irreversible and confirmed. Validators vote on the finality of blocks, and once a supermajority is reached, the block is finalized.
5. Incentives and Penalties: Validators earn rewards for participating in the network, including proposing blocks and attesting to their validity. Conversely, validators can be penalized (slashed) for malicious behavior, such as double-signing or being offline for extended periods. This ensures honest participation and network security.

## S.5 Incentive Mechanisms and Applicable Fees

ChainLink Token is present on the following networks: binance_smart_chain, ethereum.

Binance Smart Chain (BSC) uses the Proof of Staked Authority (PoSA) consensus mechanism to ensure network security and incentivize participation from validators and delegators.

Incentive Mechanisms

1. Validators:
   - Staking Rewards: Validators must stake a significant amount of BNB to participate in the consensus process. They earn rewards in the form of transaction fees and block rewards.

- Selection Process: Validators are selected based on the amount of BNB staked and the votes received from delegators. The more BNB staked and votes received, the higher the chances of being selected to validate transactions and produce new blocks.

2. Delegators:
   - Delegated Staking: Token holders can delegate their BNB to validators. This delegation increases the validator's total stake and improves their chances of being selected to produce blocks.
   - Shared Rewards: Delegators earn a portion of the rewards that validators receive. This incentivizes token holders to participate in the network's security and decentralization by choosing reliable validators.
3. Candidates:
   Pool of Potential Validators: Candidates are nodes that have staked the required amount of BNB and are waiting to become active validators. They ensure that there is always a sufficient pool of nodes ready to take on validation tasks, maintaining network resilience.
4. Economic Security:
   - Slashing: Validators can be penalized for malicious behavior or failure to perform their duties. Penalties include slashing a portion of their staked tokens, ensuring that validators act in the best interest of the network.
   - Opportunity Cost: Staking requires validators and delegators to lock up their BNB tokens, providing an economic incentive to act honestly to avoid losing their staked assets.

Fees on the Binance Smart Chain

1. Transaction Fees:
   - Low Fees: BSC is known for its low transaction fees compared to other blockchain networks. These fees are paid in BNB and are essential for maintaining network operations and compensating validators.
   - Dynamic Fee Structure: Transaction fees can vary based on network congestion and the complexity of the transactions. However, BSC ensures that fees remain significantly lower than those on the Ethereum mainnet.
2. Block Rewards:
   Incentivizing Validators: Validators earn block rewards in addition to transaction fees. These rewards are distributed to validators for their role in maintaining the network and processing transactions.
3. Cross-Chain Fees:
   Interoperability Costs: BSC supports cross-chain compatibility, allowing assets to be transferred between Binance Chain and Binance Smart Chain. These cross-chain operations incur minimal fees, facilitating seamless asset transfers and improving user experience.
4. Smart Contract Fees:
   Deploying and interacting with smart contracts on BSC involves paying fees based on the computational resources required. These fees are also paid in BNB and are designed to be cost-effective, encouraging developers to build on the BSC platform.

Ethereum, particularly after transitioning to Ethereum 2.0 (Eth2), employs a Proof-of-Stake (PoS) consensus mechanism to secure its network. The incentives for validators and the fee structures play crucial roles in maintaining the security and efficiency of the blockchain.

Incentive Mechanisms:

1. Staking Rewards:
   - Validator Rewards: Validators are essential to the PoS mechanism. They are responsible for proposing and validating new blocks. To participate, they must stake a minimum of 32 ETH. In return, they earn rewards for their contributions, which are paid out in ETH. These

rewards are a combination of newly minted ETH and transaction fees from the blocks they validate.
  - Reward Rate: The reward rate for validators is dynamic and depends on the total amount of ETH staked in the network. The more ETH staked, the lower the individual reward rate, and vice versa. This is designed to balance the network's security and the incentive to participate.

2. Transaction Fees:
  - Base Fee: After the implementation of Ethereum Improvement Proposal (EIP) 1559, the transaction fee model changed to include a base fee that is burned (i.e., removed from circulation). This base fee adjusts dynamically based on network demand, aiming to stabilize transaction fees and reduce volatility.
  - Priority Fee (Tip): Users can also include a priority fee (tip) to incentivize validators to include their transactions more quickly. This fee goes directly to the validators, providing them with an additional incentive to process transactions efficiently.
3. Penalties for Malicious Behavior:
  - Slashing: Validators face penalties (slashing) if they engage in malicious behavior, such as double-signing or validating incorrect information. Slashing results in the loss of a portion of their staked ETH, discouraging bad actors and ensuring that validators act in the network's best interest.
  - Inactivity Penalties: Validators also face penalties for prolonged inactivity. This ensures that validators remain active and engaged in maintaining the network's security and operation.

Fees Applicable on the Ethereum Blockchain:

1. Gas Fees:
  - Calculation: Gas fees are calculated based on the computational complexity of transactions and smart contract executions. Each operation on the Ethereum Virtual Machine (EVM) has an associated gas cost.
  - Dynamic Adjustment: The base fee introduced by EIP-1559 dynamically adjusts according to network congestion. When demand for block space is high, the base fee increases, and when demand is low, it decreases.
2. Smart Contract Fees:
   Deployment and Interaction: Deploying a smart contract on Ethereum involves paying gas fees proportional to the contract's complexity and size. Interacting with deployed smart contracts (e.g., executing functions, transferring tokens) also incurs gas fees.
  - Optimizations: Developers are incentivized to optimize their smart contracts to minimize gas usage, making transactions more cost-effective for users.
3. Asset Transfer Fees:
   Token Transfers: Transferring ERC-20 or other token standards involves gas fees. These fees vary based on the token's contract implementation and the current network demand.

## 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 is calculated first. Based on the crypto asset's gas consumption per network, the share of the total consumption of the respective network that is assigned to this asset is defined. 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.