

## CCD

CCD is the native token on the Concordium Platform. CCD is a payment token that can be used for a variety of purposes, including as payment for the execution of smart contracts, payments between users, and payments for commercial transactions. 10 billion CCD have been created in the genesis block. After this, the only mechanism to create more CCD is the minting process. The number of CCD that exists on the platform at any time is defined and publicly known. It can be found on [CCDscan](#).

CCD are minted daily at a rate of 10% growth annually. These are distributed as rewards to validators and delegators. The mint rate will decrease when the number of transactions increases, assuring that the validators receive adequate rewards.

## Transactions

To submit a transaction to the blockchain, a fee must be paid in CCD. The price of transactions is fixed in EUR, not in CCD. This means that they are not subject to the fluctuations of CCD. Businesses can thus plan the cost of their operations.

The cost of a basic CCD transfer is set at 0.01 EUR. The costs of more complex operations such as smart contract calls depend on a variety of parameters, including the computational complexity of the operation and the amount of data handled.

## Bakers & Finalizers

Validators are the heart of a decentralized blockchain. Their role is to order the transactions submitted to the chain by grouping them into blocks and adding new blocks at the end of the chain.

In order to become a validator, a user has to stake some CCD, which is then locked in their wallet. They can then run the required software and have a probability of creating blocks and receiving rewards which is proportional to their relative stake. If they decide to shut down their validator, the stake is unlocked after a cool-down period.

On Concordium validators are called **bakers** and we say that they bake blocks. The subset of the bakers consisting of all bakers with a stake of at least 0.1% of all CCD minted are called **finalizers**, and have an extra role: they run a finalization protocol on top of the consensus algorithm, which regularly marks blocks as finalized, and these can never be rolled back.

## Pools

When a user sets up a baker, they can decide to open a pool. The stake in a pool consists of the stake of the baker and any stake added by delegators. The baker can choose whether the pool is open to all delegators, closed to new delegators (but the existing ones can stay), or closed to all delegators (existing delegators are removed). This can be changed by the baker at any time.

The probability of a baker winning the lottery to bake the next block is proportional to their relative pool size. The rewards earned for baking the block are distributed to all users with stake in the pool as described in the rewards section below.

The sizes of pools are limited in the following ways. Firstly, the stake in a pool is capped at 10% of all staked CCD. The purpose of this bound is to foster decentralization and avoid a too large fraction of stake going offline if a machine fails or the software is updated. If this limit is exceeded, then only 10% counts towards the lottery power and rewards. If a user wishes to stake more than this amount, they can run a second baker with a different pool. To improve the stability of the system, the second baker should be run on a different machine in a different location.

The second bound on pool sizes states that the total stake in a pool can be at most 3 times the stake of the baker. Here too, any stake exceeding this amount will not be counted towards the lottery power and rewards. The purpose of this bound is to preserve the fundamental principle of proof-of-stake, namely that the probability of baking should be related to the stake of the baker. The assumption that at least a given threshold (e.g., 2/3) of the stake is controlled by honest people is justified by them having their own money in the game. If there is no bound on how much can be delegated, then a baker could be controlling only other people's funds and the incentive to behave honestly is weaker.

## Delegators

Users that do not wish to run bakers have the option of delegating CCD to bakers and profiting from some of the rewards. A delegator has two options: delegating to a specific baker's pool or choosing passive delegation.

Delegating to a pool has been mentioned in the section above: a delegator adds their stake to the pool of a baker, increasing this baker's probability of baking blocks and earning rewards. These rewards are then shared with all pool members.

**Passive delegation** is an innovation of Concordium. It provides rewards to the delegator equivalent to what one would get if one were to split the stake amongst all bakers proportionally to the bakers' pools, but at a slightly lower rate.

By choosing passive delegation, the return will be the average rewards over all bakers, which mitigates the risk of picking a baker that performs poorly or goes offline. This security comes at an increased cost: a passive delegator only gets 88% of the rewards a baker would get with the same stake, whereas a delegator to a specific baker's pool gets 90%. More details are provided in the rewards section.

## Rewards

The reward distribution explained in this section is illustrated in the figure at the top of page 2. Rewards are computed and distributed once a day. This currently takes place around 8:00 UTC. The period between two payouts is called a pay day.

### Reward sources

Rewards given to bakers and delegators come from two sources.

**Transaction fees:** 90% of these are distributed to bakers and delegators, and the remaining 10% go to the Concordium Foundation.

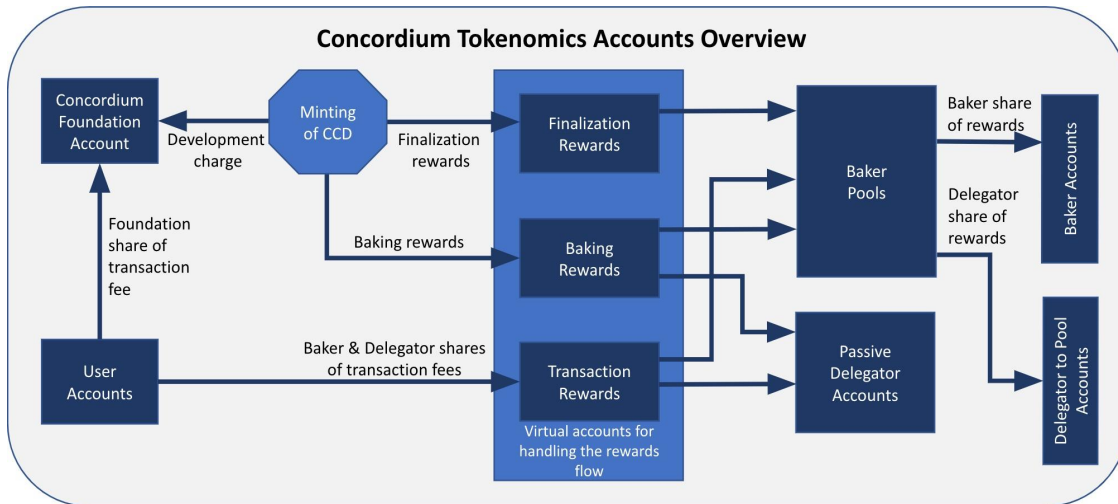


Figure: the accounts involved in the Concordium tokenomics and the flow of CCDs between them.

**Minted CCD:** 85% of this is rewarded to bakers and delegators for the blocks that they produce and 5% go to active finalizers proportionally to the stake in their pool. The remaining 10% go to the Concordium Foundation.

### Reward types

There are three types of rewards distributed to baker pools and passive delegators.

**Transaction rewards:** 45% of the transaction fees of all transactions in a block are directly given to the pool that makes the corresponding block. Another 45% are added to an accumulation account, which is gradually distributed to the pools baking the next blocks. This smoothens the distribution of transaction rewards between pools. The remaining 10% are the Foundation's share, as mentioned above.

**Baking rewards:** the 85% of the minted CCD that go to pools as rewards for baking blocks are distributed at the end of a pay day. The amount of CCD available is divided by the number of blocks baked on that day, and each baker pool is rewarded for the number of blocks that they have baked.

**Finalizer rewards:** the 5% of the minted CCD for finalizers are distributed at the end of a pay day to the bakers that have been active finalizers in that pay day.

### Baker and Delegator Split

Transaction and baking rewards given to a pool are distributed to all pool members proportionally to their stake in the pool. Then 10% of the rewards of delegators are paid as commission to the baker running the pool. The delegators to a pool thus get 90% of their stake's share of the transaction and baking rewards, and a baker gets their stake's share and 10% of the delegators' staked share.

The calculation for passive delegators is similar to that of delegators to pools, but they only get 88% of their stake's share instead of 90%.

Finalization rewards are given only to the baker running the pool. Neither delegators to pools nor passive delegators get any part of the finalization rewards.

Rewards can be automatically re-staked. This option can be changed by the bakers and delegators at any time.

### Cool-downs

Any increase to a baker's or a delegator's stake is effective after the next pay day, given that the transaction was executed at least an hour before the end of the pay day.

If a baker or delegator wishes to decrease their stake, e.g., shut down their baker, there is a 3 week cool-down for bakers and a 2 week cool-down for delegators before the change is effective. During this period the bakers and delegators continue to earn rewards with their full stake. The stake cannot be changed anymore until the end of the cool-down period. The amount unstaked is unlocked and made available in their wallet at the first pay day after the cool-down period.

### Current return on investment

The website [CCDscan](https://ccdscan.com) publishes current data on the blockchain. At the time of writing, the CCD growth is set to 10% annually and approximately 70% of all minted CCD are staked. This results in non-finalizer bakers receiving on average approximately 12% rewards annually, finalizers receiving on average approximately 12.8%, delegators to pools getting on average 10.8%, and passive delegators receiving 10.56% rewards.

The return on investment also depends strongly on the ratio between the total staked CCD and total minted CCD, because if the staked CCD increases (decreases), the same rewards are distributed to bakers and delegators with more (less) stake, so the relative rewards decrease (increase).

Note that the actual value of the return on investment might deviate strongly from the average value for smaller pool sizes and shorter periods of time, because in these cases the variance due to the lottery is much greater. There is, however, no variance in the rewards for passive delegation. So the only change from one day to the next is due to the different amount of transaction fees for that day and the change is the ratio between staked CCD and total CCD.