midnight

Midnight tokenomics and incentives whitepaper

June 2025 / Version 1.0

Abstract

This white paper describes the composite tokenomics of Midnight, centered around NIGHT, Midnight's native utility token, and DUST, the network resource used to pay for transaction fees; it outlines their key functions, utilities, and properties, including the unique token-generates-resource dynamic relationship; it describes Midnight's approach to incentives and rewards to promote block production and network security; it offers a view of Midnight's cooperative tokenomics and mechanisms for network access expansion and a multi-chain future; and it describes the initial distribution mechanism and token allocation.

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1. Introduction

Early blockchain implementations, with their unrestricted access to data and metadata, evolved around radical transparency as a way to enable trustless integrity within a decentralized environment. Unwarranted side-effects to this approach include exposing sensitive data, like financial information, medical records, and trade secrets, compromising on data protection to the point of facing compliance issues. This makes most major public blockchains unsuitable for many real world use cases.

Traditional tokenomic models rely on a single token and require users to spend tokens for every transaction, creating economic uncertainty due to token price volatility. Further, their Initial token distributions often favor insiders and early investors, concentrating control among a small group while failing to provide the opportunity for broad, meaningful community participation. On a larger scale, these same blockchains take a closed-loop, inward-looking approach to their economies, in which value is siloed and mostly bounded by the confines of a single network. This adversarial approach focuses too much on competition, and too little on cooperation. This winner-take-all mentality has led to a highly fragmented ecosystem that fails to unlock the immense value that lies in cross-chain collaboration.

The Midnight protocol introduces a novel approach to blockchain tokenomics designed to overcome these challenges. This approach achieves privacy, scalability, and interoperability through a distinctive dual-component tokenomics system designed to foster predictable operations, broad participation, and cross-chain value creation. Broadly, the core pillars underpinning Midnight's tokenomics are:

- **Operational predictability:** Midnight's native token, NIGHT, continually generates DUST, the renewable resource used to pay for transactions. NIGHT holders can execute transactions for as long as they hold enough tokens to generate the amount of DUST required. This design provides predictable operating costs that are not directly linked to the price of the native token.

- **Rational privacy:** DUST is a shielded resource, meaning Midnight transactions – like interacting with a DApp – do not leave a trail of metadata in the same way a single-token architecture would. Unlike privacy coins, the DUST resource is designed with compliance with laws and regulations in mind.

- **Cooperative tokenomics:** Midnight's multichain architecture expands access and extends its utility beyond the network and across the Web3 space, fostering cooperation and cross-chain value creation. Users can pay for transactions with other blockchains' native tokens, or even with fiat currencies. Much like traditional Web2 models, DApp operators can sponsor their users' operations.

- **Fair by design:** through a free, multi-phase, transparent, and fair token distribution beginning with the Glacier Drop, Midnight aims to bootstrap a diverse community of engaged participants.

While the technical architecture sits outside of the scope of this whitepaper, the components and mechanisms that make up Midnight's tokenomics and incentives system are described below.

2. The NIGHT token

NIGHT is Midnight's utility token whose main function is to generate DUST, the resource used to execute transactions on the Midnight network. It is intended that NIGHT will also be used for block production rewards, ecosystem growth incentives, and on-chain governance in relation to the Midnight network. One unit of NIGHT is further divided into one million subunits called STARs. The key features of NIGHT are expected to be as follows:

Key features/properties

- **Unshielded:** the NIGHT token is unshielded, meaning NIGHT transactions are stored and publicly visible on the blockchain – including metadata, such as wallet addresses, values, and timestamps.
- **Transferable:** NIGHT can be freely transferred between wallets, listed on exchanges, and independently wrapped, bridged, and represented across various networks, including Cardano and Midnight.
- **Token supply:** 24 billion NIGHT tokens minted on Cardano, which are mirrored on the Midnight network.
- **Non-expendable:** NIGHT is not expendable to execute transactions.
- **Disinflationary:** the expansion of the circulating supply via block rewards slows down over time, until the full supply is circulating and no more inflation occurs.
- **Broad distribution:** the broad, open, and inclusive nature of the NIGHT token initial distribution (as described in the corresponding section) ensures that the benefits of the network are widely shared across the Web3 space and beyond.
- **Multi-chain:** in contrast with wrapped token representations, NIGHT exists natively and maintains the same properties and rights both on Cardano, as a Cardano Native Asset, and on Midnight, as the blockchain's native token.

NIGHT stakeholders

The core network constituents and NIGHT token stakeholders in the Midnight economy are:

- **NIGHT token holders:** the collective of users who make use of the NIGHT token and who are expected to control future network and ecosystem development via a decentralized governance mechanism.
- **Midnight block producers (MBPs):** network participants who elect to run Midnight validating nodes, block producers receive rewards for validating Midnight blocks and securing the network.

- **Midnight Foundation:** a foundation whose mission is to promote long-term ecosystem development and stewardship.
- **Midnight TGE:** a subsidiary of the Midnight Foundation, whose primary role is to run and manage the NIGHT token supply creation, issuance, and distribution.
- **On-chain Treasury:** a pool of funds earmarked for ecosystem growth activities, initially locked by the protocol and expected to be managed by the community via a future decentralized governance framework.
- **Reserve:** a special constituent of the Midnight economy, the Reserve is a protocol-managed pool of tokens whose function is to issue block production rewards to Midnight block producers.

Genesis and token states

The NIGHT token has a supply of 24 billion tokens. The total NIGHT supply will be minted on the Cardano blockchain at the beginning of the token distribution, after which tokens can exist in either one of two states: *uncirculated or circulating*.

- **Uncirculated** tokens consist of NIGHT tokens earmarked for block production rewards held by the Reserve.
- **Circulating** tokens consist of all other tokens, including those belonging to the community and other core network constituents.

NIGHT tokens may enter into circulation in two ways: as part of the token distribution process or as block production rewards. All issuance of tokens into circulation outside the token distribution phases happens in the form of block production rewards coming from the pool of *uncirculated* tokens allocated to the Reserve.

Multi-chain token

When the Midnight mainnet launches, the genesis block will contain a mirror image of the NIGHT tokens on Cardano. As a result, NIGHT will exist natively on Cardano (as a Cardano Native Asset) and on the Midnight mainnet (as the network's native token).

Circulating NIGHT tokens will manifest in one of two states: *protocol-locked* and *protocol-unlocked:*

- **Protocol-locked** tokens cannot be moved or perform any functions, such as generating DUST resources or being used for governance actions.
- **Protocol-unlocked** tokens can be moved by their owners and carry full utility.

Every *protocol-unlocked* token on Cardano will initially be *protocol-locked* on Midnight, and vice-versa. This ensures an initial state where no token will be unlocked on both chains at once. A cross-chain software protocol will then ensure that whenever tokens are issued/put in circulation on Midnight, a corresponding amount of tokens will be automatically locked on Cardano, such that this constraint is never violated on an ongoing basis.

This is designed to ensure that the effective total supply of NIGHT does not exceed 24 billion. This cross-chain mechanism will be enforced at the protocol level and only applies to NIGHT tokens that are natively issued on Cardano and Midnight.

There is a planned protocol-level bridge that will enable one-way transfers of NIGHT tokens natively from Cardano to Midnight. These tokens will enter circulation in the *protocol-unlocked* state on the Midnight network (thus becoming *protocol-locked* on Cardano, as per the cross-chain software protocol). However, there will not be, by mainnet launch, a protocol-level bridging mechanism to natively facilitate transfers in the opposite direction, from Midnight to Cardano. It is expected that a two-way bridging mechanism will be developed after mainnet launch. However, any third party can potentially build independent bridges or their own cross-chain applications to represent NIGHT tokens across any network they choose. NIGHT tokens that may be wrapped, bridged, or otherwise represented in these (or other) networks by third parties do not carry the rights or utility of the underlying tokens they represent. Such third party solutions have no negative effect on the integrity of the cross-chain software protocol.

When expected developments in the network enable the conditions that allow the distribution of block rewards to begin, *uncirculated* tokens from the Reserve will enter circulation in both networks, in a *protocol-locked* state on Cardano and a *protocol-unlocked* state on Midnight. This pool is finite; once the Reserve is exhausted, the circulating supply will match the total supply in accordance with the rules encoded and enforced by the protocol itself.

Cross-chain token invariants

The total supply of NIGHT is balanced across the Cardano and Midnight networks. It must not be possible for the "same" token to be held by any wallet on both chains at the same time. In reality, this is not meaningful because NIGHT tokens are fungible and have different representations on each of the two chains. However, as a metaphor, it captures the key scarcity requirement for Midnight, related to the preservation of tokens in a ledger.

Another approximation of the cross-chain invariants is based on the total number of tokens in each of the three states on both chains. Let $S = 24$ *billion* be the total supply of NIGHT. The three states are: in *reserve (R)*, *locked (L)*, and *unlocked (U)*. The chains are Cardano *(C)* and Midnight *(M)*, making up for six combinations of token states and locations, hereby designated $C.R$, $C.L$, $C.U$, $M.R$, $M.L$, and $M.U$.

Since every token is represented on both chains, it is possible to begin with the firm invariant that:

$$C.R + C.L + C.U = M.R + M.L + M.U = S$$

The idealized invariants as tokens move between states are given by the following equations:

1. $C.R = M.R$ (both chains faithfully track the uncirculated reserve)
2. $C.L = M.U$ (all tokens unlocked on Midnight are locked on Cardano)
3. $C.U = M.L$ (all tokens unlocked on Cardano are locked on Midnight)

The idealized invariants are not possible in practice because it takes time for a change on one chain to be reflected on the other. Instead, they are replaced with invariants that account for this propagation delay.

The direction of the invariants is chosen to always err on the side of having fewer tokens unlocked than would be unlocked in the idealized system, preventing double-spend exploits across the chain. The actual invariants are:

1. $C.R \leq M.R$

   If Cardano has released block rewards from C.R, Midnight will eventually observe that fact and release corresponding tokens as well; Midnight will not release reward tokens it has not seen released on Cardano.

2. $M.U \leq C.L$

   If a token is unlocked on Midnight, it must first be locked on Cardano.

3. $C.U \leq M.L + (M.R - C.R)$

   The number of unlocked tokens C.U on Cardano may exceed the number of locked tokens M.L on Midnight, but the difference between those totals must be bounded by the number of reserve tokens M.R on Midnight minus the number of reserve tokens C.R on Cardano.

Together, these invariants enforce the following inequality, akin to a version of "the same token cannot be held by any wallet on both chains at the same time":

$$M.U + C.U \leq S$$

These invariants hold even when Cardano cannot observe Midnight. This allows Midnight to roll out cross-chain observability in stages without violating these key invariants.

In the first stage, as part of a planned protocol-layer, one-way bridge, Midnight will be able to observe the movement of tokens from *C.U* to *C.L*. When that occurs, Midnight will be able to follow this and move the corresponding number of tokens from *M.L* to *M.U*.

When network conditions and development allow for block rewards distribution to begin, uncirculated Reserve tokens will periodically move from *C.R* to *C.L* as Cardano releases block rewards. Observing this, Midnight would then move the corresponding number of tokens from *M.R* to *M.U*.

Later, when Cardano is able to observe state changes on Midnight, a two-way protocol-layer bridge will be established, allowing Cardano to also track movement of tokens from *M.U* to *M.L*. Cardano will then be able to observe this and move corresponding tokens from *C.L* to *C.U*.

The token invariants are maintained through all these possible roll-out stages, ensuring the integrity of the token supply.

At a later stage, ownership of the Reserve tokens may move from *C.R* to *M.R*, allowing Midnight to control the release of reward tokens. This change has a significant but symmetrical impact on the invariants. Once the supply has moved, it is Cardano that might lag Midnight in its understanding of the circulating tokens. As soon as that transfer of control is effected, the new invariants are:

1. $M.R \leq C.R$
2. $C.U \leq M.L$
3. $M.U \leq C.L + (C.R - M.R)$

These revised invariants reflect the delay in Cardano's ability to reflect Midnight's release of tokens from M.R. Just as before, they ensure the integrity of the token supply.

Block productions rewards

Sometime after the Midnight mainnet launch, the distribution of NIGHT tokens from the Reserve as rewards to Midnight block producers will start. This distribution will follow the network's block production reward distribution logic (described in the corresponding section further down this document). Once the Reserve of uncirculated NIGHT tokens is exhausted, the circulating supply will match the total supply, and rules encoded and enforced by the protocol itself guarantee that no new tokens will be created or come into circulation.

Decentralized on-chain governance

Following the launch of the Midnight network, a phased approach is expected to be implemented to progressively decentralize the Midnight governance framework, expanding on-chain governance participation.

This approach aims to enable the creation and establishment of a comprehensive set of community-centric governance tools and processes, including the drafting and submission of proposals, Treasury access to fund such proposals, voting mechanisms, vote tallying, outcome communication, and automated protocol updates for proposals approved through governance action.

The governance framework will be designed to uphold high standards of security, and to ensure the integrity of the Midnight network while enabling remediation capabilities through decentralized means. The full specification and mechanics of such governance are expected to be detailed in a future document.

Governance at launch

Before phasing into the development of a decentralized governance mechanism, the network will adopt a federated governance structure, whereby a select committee of stakeholders with equal governance powers will be able to submit and vote on proposals and protocol upgrades. A specific governance threshold of their combined approvals will be required to pass governance actions on Midnight parameters and protocol upgrades. This will be represented through a multisig mechanism.

This committee is expected to be composed of various entities that have yet to be identified or formed, and is expected to be responsible for, among other things, the following:

- Updating Midnight-related parameters on the Cardano network (e.g., governance committee members, federated block producers).
- Updating the Midnight protocol (version upgrades and hard forks) and the protocol's core parameters (e.g., block size, ledger parameters).

As the Midnight network matures and its governance framework evolves, it is intended that all components of the system, including critical elements such as monetary policy, may become subject to change through on-chain governance, provided a predefined voting threshold is met. This ensures that the network retains flexibility to adapt to future needs and stakeholder consensus.

On-chain Treasury

The on-chain Treasury is a pool of NIGHT tokens belonging to the protocol and initially locked, whose purpose will be to fund Midnight network ecosystem growth activities and projects that are selected via the on-chain governance mechanics. NIGHT tokens allotted to the Treasury will be stored in the ledger, owned by the protocol, and initially locked, with a view to being unlocked when the expected on-chain decentralized governance mechanism for the Midnight network is implemented.

Neither the use of NIGHT for governance purposes nor the use of NIGHT from the on-chain Treasury to promote ecosystem growth initiatives will be available at mainnet launch. These functionalities are expected to be developed and implemented in the future.

NIGHT-generates-DUST

Midnight's dual-component tokenomics segregates block production rewards from transaction handling fees, and splits these functions between the NIGHT token and the DUST resource.

NIGHT tokens generate DUST, the shielded network resource whose only use is to pay for transaction fees that power operations on the Midnight network – that is, to enable the execution of transactions while managing network congestion and mitigating the risk of denial-of-service attacks. NIGHT will generate DUST indefinitely, meaning DUST is akin to a renewable resource (in contrast with the traditional subtractive approach that requires tokens to be expended when making a transaction).

In order to start generating DUST, a NIGHT holder must explicitly designate a DUST recipient address. DUST can only be generated in addresses on the Midnight network. The amount of NIGHT tokens held directly determines the rate at which DUST is generated into a DUST address.

At any given point in time, a variable minimum amount of DUST – dynamically adjusted according to current network demand – will be required to execute transactions via the Midnight network. While DUST will be consumed upon use, no NIGHT tokens will be expended to execute Midnight transactions.

Conceptually, this means that whoever holds NIGHT can effectively execute transactions on Midnight for free for as long as they hold enough NIGHT tokens to generate the minimum required DUST. The more NIGHT someone holds, the more DUST they generate for each period of time. This means that the higher the NIGHT holding, the higher the density of transactions – i.e., the number of transactions per unit of time – the holder has.

3. The DUST resource

DUST is the shielded and renewable resource used to access *network capacity*: its single function is to enable users to execute transactions on Midnight. DUST decays over time, so it has value but cannot retain value.

DUST is analogous to electrical energy powering the Midnight network. DUST addresses serve as energy storage units, similar to battery packs. NIGHT tokens function like renewable-energy power plants, such as wind turbines, that charge battery packs up to a maximum energy storage capacity that is proportional to the size of the generating NIGHT token balance.

A NIGHT-turbine can connect to any battery pack, regardless of ownership, effectively designating its generated electricity to that storage. However, DUST-electricity is non-transferrable: once stored in a battery pack, it cannot be transferred to another battery pack; it can only be used to execute Midnight transactions. When disconnected from its generating turbine, the stored electricity has a finite shelf life, decaying linearly at the same rate it was generated.

A paper detailing the design of DUST and transaction handling dynamics is expected to be published separately.

Key features/properties

- **Shielded:** DUST allows for transactions to take place without exposing users' metadata. Wallet addresses and transaction details (like values and timestamps) are not disclosed to counterparties or made available on the public ledger.
- **Consumable:** DUST is consumed when used – meaning it is burned and does not cycle back into circulation.
- **MEV-resistance:** DUST shielding and burn reduce MEV likelihood since attackers cannot identify potential victims.
- **Renewable:** DUST is continually generated by NIGHT balances in perpetuity. This property encourages more active participation and interaction with the network, potentially leading to a more vibrant ecosystem.
- **Decaying:** a DUST balance decays when disassociated from the NIGHT address that generates it, meaning it cannot act as a store of value. For example, when a NIGHT token is transferred, the balance of DUST in the original holder's DUST wallet will decrease to 0. The recipient of the transferred NIGHT token will have to issue a new gesture to resume DUST generation at a new address.
- **Unlimited:** as it is generated continually and indefinitely, there is no limit to how much DUST can be generated over time. However, the available supply at any given point in time is capped by the number of NIGHT tokens generating DUST.

- **Non-transferable:** DUST cannot be transferred between addresses, meaning it can neither be bought nor sold – insulating it from supply shocks and volatility. This property also strengthens its utility solely as a resource to power transactions, while also addressing regulatory aspects that are commonplace with shielded assets that can act as stores of value.

- **Non-pegged:** there is no fixed 1:1 parity between the DUST and NIGHT supplies; the supply of the resource that is available at a given moment fluctuates with usage and network dynamics.

DUST mechanics

DUST is a *network resource* – meaning it is used to conduct transactions and operate in the network. On the surface, DUST is similar to a token or other fungible crypto-assets in that it is also represented by balances held at specific blockchain addresses. However, unlike traditional tokens, DUST does not exist independently of NIGHT; it does not have *permanence*. Its existence is determined and sustained by its continuous association with the NIGHT token. This association happens between NIGHT and DUST addresses in a process called designation, by which a NIGHT token holder appoints a DUST address as the recipient for resource generation.

DUST addresses are shielded, and DUST expenditures are recorded on the public blockchain using cryptographic techniques that make them visible only to the DUST owner. DUST addresses and balances are only known to the holders of the associated NIGHT token addresses who designate them.

Designation and generation

DUST comes into being when a NIGHT token holder designates a DUST address as the recipient, thus initializing the DUST generation at that address. The designated address is DUST-specific, separate, and non-derivable from the originating NIGHT address.

From that moment onwards, for as long as the associated NIGHT balance remains unchanged, the DUST balance in that address will increase over time – linearly, with each passing block – until it reaches its *DUST cap* (or until the association is severed).

A NIGHT holder can designate any DUST address as the destination for their DUST generation. This means that the DUST recipient address may or may not be controlled by the associated NIGHT balance holder (who can also *redesignate* addresses as often as they wish). This flexibility enables different categories of DUST beneficiaries, allowing for new, interesting use cases and functionalities.

DUST cap

The *DUST cap*, or the maximum amount of DUST resources that can be stored in a DUST address, is proportional to – and limited by – the balance of the associated NIGHT token address(es). As long as this balance remains unchanged, that NIGHT address will continually generate DUST to a designated DUST address – up until either its DUST cap is reached, or the association between the DUST address and the generating NIGHT is severed by the NIGHT holder. When the DUST cap is reached, DUST generation halts until some of the DUST is used.

Using DUST

In contrast with other blockchains, transaction fees on Midnight are not collected by block producers or anyone else. There is no DUST tipping mechanism to compensate block producers during transactions – nor would it make sense to have one, as the resource is not transferrable and cannot act as a store of value. When DUST is used during a transaction, it is expended and burned. If, after a transaction, the DUST balance at a given address falls below the cap, and that address remains designated as a recipient by a NIGHT address, the generation then resumes until the balance again reaches the cap (or until the association is severed).

Changes to the associated NIGHT balance

If the balance of the associated NIGHT address *increases*, or if additional NIGHT addresses designate their generation to a single DUST recipient (increasing the aggregate associated balance), the cap for that address increases proportionally, and new resources are generated until the balance hits the new cap.

If, conversely, the balance *decreases* (such as when a NIGHT holder sends some or all of their NIGHT tokens to another address), the DUST balance in the designated address decays until it reaches the new cap. If no NIGHT tokens are left, the DUST at that address will decay to zero.

Severing the association

Once a DUST address is designated, the generation process happens until the NIGHT token holder explicitly severs the association between the addresses. They can do so by:

- Transferring the associated NIGHT tokens to another NIGHT address
- Redesignating the DUST production to another DUST address
- Undesignating the production of DUST

Once severed, the DUST generation to the disassociated address stops, and the resources therein start to decay.

Dust decay and prevention of double-spending

When the association between a DUST address and the NIGHT address that generates it is severed (e.g., if the NIGHT holder either transfers or explicitly redesignates/undesignates their tokens), the DUST balance therein decays over time – with each passing block – until it disappears.

This decay happens linearly. For a given amount of NIGHT, the *aggregate* amount of associated DUST in existence can never go above the cap – as for every unit that gets generated, another unit decays. Ultimately, this mechanism prevents the double-spending of resources: even if a NIGHT holder redesignates their generation to other DUST addresses in an attempt to try and accumulate resources, the cap is still enforced.

DUST beneficiaries

- Three broad categories of users can benefit from the utility of DUST: *NIGHT* holders, *DUST* recipients, and DUST sponsees. Each of them is able to transact, both directly or indirectly, as described below.

→ **NIGHT holders:** generate DUST by designating a DUST address of their choice. This address then functions as a resource faucet, continuously generating DUST for the use of its owner for as long as it remains the designated address. NIGHT holders can be the recipient of their generated DUST and can thus transact on Midnight when choosing to do so. From a user perspective:

- *I hold NIGHT, and my NIGHT generates DUST to an address I control.*
- *I hold NIGHT, and my NIGHT generates DUST to an address I do not control.*

→ **DUST recipients:** receive DUST from someone else (a NIGHT holder), and can actively use it to execute transactions without ever having to own tokens themselves. For example, a non-profit application that requires DUST to operate can rely on designations to run their operations without having to acquire NIGHT. From a user perspective:

- *I hold DUST in an address I control, but I do not hold the associated NIGHT or any NIGHT.*
- *I hold DUST in an address I control, but I hold unassociated NIGHT.*

→ **DUST sponsees:** do not receive DUST; instead, their transactions are "covered" by a DUST recipient (who themselves may or may not hold NIGHT) when they execute a transaction. Usually, this will happen when a user interacts with the interface of an application that runs on Midnight. For example, a decentralized e-commerce application can sponsor the usage of their application, covering the DUST cost of every customer who makes a purchase without the users ever being exposed to the complexities of Web3. DUST sponsees are not required to hold NIGHT or have direct access to DUST. In fact, they do not even need to know that there is a blockchain, as the application can handle the entire process on their behalf. From a user perspective:

- *I hold neither DUST nor NIGHT, and my transactions are paid for by a DUST holder.*

Transaction handling and congestion control

Midnight's transaction handling approach aims to strike a balance between mitigating network congestion – both organic and malicious – and ensuring that transaction costs can maintain a relative degree of stability. To achieve that, Midnight applies a dynamic pricing model that automatically – and continually – adjusts the cost of transactions to account for network demand and computational resources utilization.

[1] Midnight transactions are denominated in the DUST resource; the use of terms like fee, cost, or price does not imply real-world monetary value. As already established, DUST cannot hold value or be transferred between addresses.

Transaction fees

Midnight transaction fees are made up of three components that are used to calculate the DUST cost of each individual transaction:

- **A minimum fee**, a small fixed fee payable in every transaction;
- **A congestion rate**, a dynamic multiplier based on network demand;
- **A transaction weight**, based on computational resources required.

Minimum fee

The *minimum fee* is a configurable system parameter that is payable in every transaction, irrespective of network usage, transaction size, or complexity. It ensures every transaction has a minimum cost. Its primary function is to prevent denial-of-service (DDoS) attacks by making it prohibitively expensive – in DUST terms – for an attacker to indefinitely sustain millions of small transactions that might disrupt the network over extended periods.

Congestion rate

The *congestion rate* is the dynamic component of the transaction fee that is adjusted at each block to account for network demand and utilization. It is a variable multiplier, measured in DUST-per-byte, that applies to each operation's *transaction weight* (see next subsection). The goal of the congestion rate is to ensure that the cost of transactions can rise or fall to match network conditions. Lower transaction costs during quiet periods should stimulate more activity, whereas higher fees during high-traffic periods should discourage transactions. Congestion rate is based on the following factors:

- The *fee adjustment factor*, a function of the current block's utilization rate in relation to the block utilization target;
- The *congestion rate* for the previous block/epoch.

The congestion rate at block *n* can be summarized as:

$$CongestionRate_n = CongestionRate_{n-1} * (1 + FeeAdjustmentFactor)$$

By taking into account not just the current block utilization, but also that of the previous block, this model can react to trends in network usage.

Transaction weight

Initially, the *transaction weight* will reflect the amount of storage space required by an individual transaction, measured in kilobytes (KB). Given that a Midnight block is limited in size (by a system parameter), there are only so many transactions that can fit within a single block. Transaction weight is expected to be expanded to include other relevant factors for network activity, such as compute and disk read usage.

Transaction fee summary

The transaction fee composition for a given transaction at block n can be fundamentally described as:

$$TxFee_n = CongestionRate_n * TxWeight + MinFee$$

Block utilization target

Midnight targets a block utilization rate of 50%. This value is a system parameter that can be adjusted via governance action. The goal of this target is to balance critical factors like network security, decentralization, and the economic principles surrounding scarcity of block space.

There are no inherent technical restrictions preventing a blockchain from increasing the size of its blocks. Block space is an abstract concept within blockchain technology, and block size limits are calculated design choices. However, such changes can have profound implications to the network. From a security and decentralization standpoint, smaller blocks are generally preferred. Larger blocks require more processing power and storage capacity, which can lead to centralization – as only a few powerful participants might be able to afford the computational resources to operate full nodes. This can undermine network security, as decentralization is key to the robustness and integrity of blockchain systems.

Economically, block space is a scarce resource bound by both size and time interval. Fundamentally, the available block space per time window is what bounds Midnight's transaction throughput. Imposing a size limit, or targeting a specific level of block fullness, such as 50%, instead of maximizing it to 100%, strategically controls this scarcity. Operating at full capacity leaves no room for fluctuations in demand, potentially leading to consistently high transaction fees and delayed transaction processing during peak times. Conversely, setting too low a target disincentivizes transactions and all network activity.

Optimally, setting a target at 50% fullness ensures there is always spare capacity available to accommodate sudden increases in transaction volume without significant delays or fee increases.

Dynamic pricing

The mechanism by which this operates can be described as *dynamic pricing*. When demand for block space increases and blocks begin filling beyond the 50% target, transaction fees start to rise. This increment in fees continues until the cost becomes prohibitive for some users – who then opt out, causing a reduction in demand.

Congestion and transaction spam

Dynamic pricing comes into play not just to regulate costs in times of peak demand, but also when it comes to disincentivizing sustained transaction congestion – malicious or not – in which rational or irrational participants flood the network with valueless transactions.

Most blockchains have built-in incentives against transaction spamming because each transaction incurs a *monetary cost* that depletes a scarce resource.

Midnight's NIGHT-generates-DUST mechanism does not prevent attackers from spamming the network with useless transactions for as long as their NIGHT holdings allow; similarly, block producers might be incentivized to fill blocks with valueless transactions to capture the variable share of block rewards. Both scenarios resemble a smaller version of a demand spike.

However, the increased DUST cost coupled with the intrinsic computational costs of generating ZK proofs have the effect of disincentivizing transaction spamming. Whenever a shielded resource like DUST is consumed by use, a ZK proof is needed to justify the existence of ownership of the DUST amount being spent – which incur computational costs. If transaction fees rise due to high demand, transactions without enough DUST are rejected for insufficient DUST, requiring resubmission – which includes a new ZK proof to support the new DUST spend. Generating a ZK proof is much more costly than verifying it, creating an asymmetric, self-inflicted cost for potential attackers. This design discourages rational actors, and irrational actors will eventually deplete their DUST holdings, preventing sustained attacks.

A self-regulating stabilizer

If, conversely, blocks consistently run below 50%, transaction fees will decrease, making it economically viable for more users to execute transactions. This elasticity in transaction costs serves as an automatic stabilizer for the network, adjusting to the demand and supply of block space, and ensuring that blocks are neither too empty (which would suggest underutilized network capacity and unnecessarily low transaction fees) nor too full (which could lead to slow transaction times and high fees).

This self-regulating system helps maintain the block fullness near the targeted 50% under typical conditions. This equilibrium mechanism not only optimizes network efficiency, but also stabilizes transaction costs over time – which is essential for both regular users and businesses relying on the network. Thus, the 50% block fullness target isn't just a technical parameter; it's a crucial economic setting that ensures the blockchain remains secure, decentralized, and functionally efficient.

4. Cooperative tokenomics

Despite their permissionless nature, the tokenomics of most major public blockchains motivate network participants to remain within the boundaries of a single ecosystem, accessible via a single token, reducing the economic incentives to work with – and across – other networks.

Midnight aims to break free from this paradigm to create a truly interoperable layer with cross-chain incentives, becoming the **connecting tissue across all kinds of networks**, be these blockchains or not. This section explores some emerging functionalities, enabled by Midnight's cooperative tokenomics and multichain architecture, that support this vision of an **interconnected** and **interoperable** future for Web3.

Expanding network access: capacity marketplace

Capacity marketplace is a concept that describes the different potential solution designs that can offer non-Midnight users frictionless access to Midnight network capacity while also benefiting the Midnight economy. In essence, the development of a capacity marketplace would benefit:

- **Non-Midnight end-users:** could tap into Midnight apps and functionality without having to hold NIGHT or understand DUST mechanics – or to even know they exist. Any token – and even fiat – could potentially be used to access Midnight transactions.
- **DApp operators:** can sponsor transactions for their users using any token (or even fiat currencies) if they don't have access to sufficient DUST.
- **NIGHT holders:** could get a potential revenue stream by leasing or selling their unused DUST.
- **Midnight Treasury:** could unlock a new source of funding, be expanded to hold assets other than NIGHT on Midnight, and even diversify and hold assets in other networks.

Defining network capacity

It is useful to define what is meant by *network capacity*. For the purposes of this exploration, capacity represents the amount of on-chain work that can be performed by the network. Midnight network capacity is bounded in time by how much work can be performed at each block. Capacity is measured – and dynamically priced – in units of DUST resource. A Midnight DApp user utilizes DUST to secure network capacity and execute transactions.

Accessing network capacity

From an end-user perspective, Midnight capacity can be accessed *directly* (by owning and using DUST to execute transactions) or *indirectly* (by having one's transactions be sponsored by a DUST holder).

- **Direct access:** DUST can be accessed and used directly by users who either own NIGHT tokens – and thus designate their own DUST address to receive the generated resources – or who are the recipients of DUST generated by NIGHT tokens owned by someone else.

- **Indirect access:** Although access to network capacity requires DUST, from an end-user perspective, access to Midnight can be abstracted by application developers. DUST resources required to execute transactions can be paid by – or on behalf of – the end-user, granting them access to Midnight DApps without requiring them to own, use, or even be aware of the underlying blockchain. This allows for effectively tokenless, blockchain-abstracting applications.

Capacity marketplace paradigms

A marketplace's function is to match buyers and sellers while allowing for optimal price discovery. With blockchain technology, marketplaces exist on a spectrum ranging from mostly off-chain, centralized applications, to decentralized solutions enabled by protocol-level primitives.

Midnight's capacity marketplace is expected to offer different solutions that compete on efficiency, price, and specialization. Below are some examples of potential offerings.

Off-chain marketplace models

The simplest form of matching is a peer-to-peer exchange, where a NIGHT holder designates their DUST generation to an address controlled by another user in exchange for a payment settled off-chain, either directly or facilitated via a broker. For that reason, off-chain marketplaces are more centralized and require a level of trust between parties. However, when trust exists, they can also be highly efficient and flexible – for example, enabling fiat payments. Examples of this paradigm include:

- **DUST generation leasing:** NIGHT holders lease their DUST by designating the DUST generation directly to a lessee's DUST wallet. The lessee can then use DUST however they want, for as long as they maintain the lease. Arrangements between parties, as well as any payments, are settled off-chain.

- **Broker-managed leasing:** NIGHT holders lease their DUST via specialized brokers, who then coordinate the DUST generation lease from one or more lessors to one or more DUST lessees. Brokers then facilitate payments to lessors, collecting a fee for their services. This model has the advantage of being scalable, thus enabling competition and potentially more efficiency.

- **Babel Station:** a service that allows users to create and submit transactions without including DUST by means of Midnight's implementation of ZSwap[2]– a transaction scheme that provides a provably secure and data-protecting mechanism for atomic asset swaps. Users submit their transactions with a ZSwap intent – an offer or statement of a desired future – including non-NIGHT tokens (or fiat) as payment.

[2] https://docs.midnight.network/learn/understanding-midnights-technology/zswap

If accepted, the station operator submits the transaction containing the necessary DUST on behalf of the user. The Babel Station acts as a "DUST filling station", giving anyone on-demand indirect access to Midnight network capacity.

On-chain marketplace models

Beyond off-chain models, future protocol upgrades could enable a larger, trustless, self-organized on-chain capacity marketplace, further expanding on the off-chain models described above.

- **Ledger-native capacity leasing:** once ledger-native capacity leasing functionality is available, NIGHT holders would be able to delegate lease management and payment collection to a ledger-native mechanism. Brokerage models could leverage this capability to manage leasing, opening up a path to a multichain, multi-asset Treasury.

- **On-chain capacity exchange:** the same protocol capability could enable the spot purchase of unused DUST generation via an exchange interface. Exchanges could provide matching and coordinate payments, while the on-chain protocol mechanism would minimize the level of trust required.

In both cases, the required protocol-level capability could potentially carry a built-in fee to support the Midnight Treasury. This fee would create new revenue streams for the network and deepen the integration between Midnight and the broader Web3 economy.

Efficient capacity pricing

An evolving capacity marketplace would allow for ever more efficient price discovery based on the efficiency and convenience of each solution, enabling service specialization within and outside the Midnight network. Intermediated solutions, like Babel Stations and exchanges, can potentially support fiat transactions, providing an entry point to convert fiat currencies into stable tokens.

Diversified Treasury

The Midnight on-chain Treasury will initially be funded exclusively with NIGHT tokens – first from the initial token distribution, and subsequently with a portion of block production rewards, as described in the block production section. The on-chain capacity marketplace could transform the Midnight economy by expanding the scope and reach of the Treasury.

A fee levied on capacity leased or purchased with non-NIGHT tokens via protocol-level on-chain mechanism would go to the Midnight Treasury. This design would enrich and diversify the Treasury to include multiple types of assets and assets across different blockchains. Fees collected outside of the Midnight network would be under the control of the Treasury, further underpinning the value of NIGHT as a Treasury-backed token. This would have the effect of not only strengthening the long-term sustainability of Midnight, but of creating deeper interconnection across blockchains.

Expanding network reach: multichain

Beyond the multi-resource consensus system that allows Midnight to tap into Cardano's robust proof-of-stake layer to secure the network while bootstrapping, the Cardano Partner Chain framework brings other features to enable the vision of a truly multichain future: cross-chain observability and multichain signatures.

Cross-chain observability

With cross-chain observability, when a user performs an action on one chain, it is possible to trigger an agent that can act on another chain. This functionality underpins the future development of cross-chain use cases, such as on-chain capacity exchanges.

For example: a user would like to execute transactions on Midnight and pay with ETH on Ethereum. The user would lock ETH on Ethereum and leverage cross-chain observability to access the capacity to execute transactions on Midnight via a cross-chain agent. In this scenario, the ETH payment via the capacity marketplace would be split between the capacity (DUST resource) provider, the cross-chain observer, and the Midnight Treasury (via fee on the protocol-level function).

Multichain signatures

Multichain signatures allow Midnight-managed Treasury to receive inflows of fees from such on-chain services denominated in other tokens, building up diverse reserves in smart contracts native to their respective blockchains.

5. Block production and incentives

A core utility of NIGHT will be to incentivize Midnight block producers to build and validate new blocks on the network.

Block production at launch

Block production plays a fundamental role in the security of a blockchain – and, consequently, in the broader utility and value for all network participants. It is also where many networks are most vulnerable in their early days, when the incentives at stake are not yet established and can be exploited by potential attackers.

To mitigate that risk, the task of producing blocks and securing the network at launch will be performed *exclusively* by a set of trusted *permissioned nodes*, with a view to progressively decentralize, open up, and become fully permissionless. These initial block producers **will not receive block production rewards.**

Moving toward permissionlessness

In time, as per the Cardano Partner Chain framework, this progressive decentralization will open up consensus participation to those Cardano SPOs who choose to also take on a role as Midnight block producers, thus becoming eligible to receive block production rewards.

Depending on factors that will not be known until after mainnet is operational, the transition to a fully permissionless system may involve a gradual process with an intermediary, hybrid stage. During this stage, both permissioned nodes and participating SPOs acting as Midnight block producers would work alongside each other to validate Midnight blocks.

Cardano SPOs and Midnight block production

When the expected developments in the Midnight mainnet allow, the role of producing blocks will require that prospective Midnight block producers be Cardano SPOs. To be considered an eligible candidate for block rewards, a Cardano SPO will have to register with a unique smart contract on Cardano that oversees the Midnight block production candidate pool. NIGHT block rewards will be tallied and made available for withdrawal, on the Midnight ledger, by participating SPOs and the delegators whose stake enables those SPOs' block production.

Becoming a Midnight block producer will not interfere with an SPO's capacity, probability of being selected to validate Cardano blocks, or receiving ADA rewards for their contribution to Cardano security. There will be no impediments to performing roles in both networks. SPOs acting as Midnight block producers will be selected in proportion to their delegated ADA stake. Delegated ADA will not move and will remain under control of their holders on Cardano.

NIGHT block rewards, when operational, will be issued to each block producer's designated address(es) on the Midnight network, according to the rules and principles outlined below.

Producing Midnight blocks

As part of the Substrate framework[3], the Midnight network plans on leveraging Grandpa[4] (GHOST-based recursive Ancestor Deriving Prefix Agreement) to determine which blocks are finalized and AURA[5] (Authority Round) to determine who produces the next block, using a round-robin system where validators take turns producing blocks at regular time intervals. The process will work as follows:

1. **Epoch distribution snapshot:** at the beginning of each Midnight epoch, a snapshot of the global stake distribution across candidates during the previous epoch will be taken to determine the current total active stake.

2. **Committee formation and slot leader election:** a committee of *n* block producers (where *n* is a configurable committee size system parameter) will be selected from the pool of all eligible candidates and assigned to lead random slots. Their stake weighs the probability of being selected to ensure representation is proportional to stakes.

Block rewards and the Reserve

Block producers process transactions according to protocol rules to achieve consensus over the network's state, thus maintaining its integrity. The more participants and the more resources that are deployed towards consensus and block production, the higher the overall resilience and security of the system. The Midnight protocol uses NIGHT to incentivize participants to perform these crucial tasks.

The NIGHT supply is minted at the outset of the token distribution. This supply includes all tokens – including those earmarked for block rewards, which are kept in the on-chain Reserve and out of circulation. The Reserve is managed by the Midnight protocol itself, and tokens therein are used for block rewards.

Moreover, block rewards come exclusively from the Reserve. Unlike many other blockchains, no new tokens are minted and no NIGHT-denominated fees are paid during transactions. Midnight transactions fees are paid in DUST (which by its non-transferrable and decaying nature cannot function as an economic incentive). This system ensures sustainable operations: for users, there is no recurrent capital expenditure for merely transacting on Midnight (given that DUST is a renewable resource), reducing operational costs and the accounting burden that would ensue.

Finally, the distribution of block rewards is inextricably connected to – and a function of – the Reserve, as detailed below.

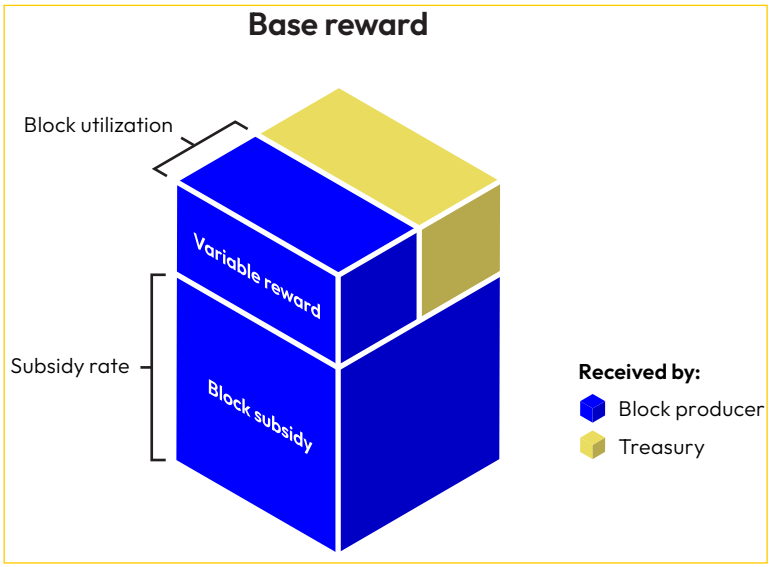
[3] https://docs.polkadot.com/develop/parachains/intro-polkadot-sdk/#substrate
[4] https://github.com/w3f/consensus/blob/master/pdf/grandpa-old.pdf
[5] https://openethereum.github.io/Aura.html

Understanding Midnight block rewards

Midnight block rewards are dispensed by a dedicated, protocol-managed token Reserve, based on a constant *base distribution rate* that is used to calculate the *base reward* – the amount of tokens distributed at each block. While the rate is constant (in relation to the Reserve), the number of distributed reward tokens decreases with each new block as the number of tokens in the Reserve decreases. This pattern forms a decreasing curve that, in practice, means that the Reserve can last for a very long time (in the order of hundreds of years).

To incentivize efficiency in transaction processing, each base reward is further divided into a *fixed subsidy* and a variable *component* based on *block space utilization*. The ratio of the split is defined by the *subsidy rate*, a protocol-level system parameter.

The fixed subsidy is distributed entirely to block producers, while the variable part of the reward is split between block producers and the on-chain Treasury according to the "fullness" of the block. The "fuller" a block is, the larger the share of variable reward that goes to the block producer. These mechanisms are described in detail below.



Block rewards distribution

Block rewards are distributed as a *fixed* percentage of the remaining NIGHT held in the Reserve at each block. This percentage corresponds to a system parameter called the *base distribution rate* (more on this below). As the number of outstanding tokens in Reserve decreases with every block reward, this mechanism translates to a smooth, decelerating distribution curve. To illustrate how this works, imagine a theoretical example where the Reserve allocation is 1,000 tokens, of which the protocol distributes 10% of the remaining tokens with each block. From there, the example progression goes:

1. Block T: 1000 starting tokens, 100 tokens distributed as rewards;
2. Block T+1: 900 starting tokens, 90 tokens distributed as rewards;
3. Block T+2: 810 starting tokens, 81 tokens distributed as rewards;
4. (...) and so on, decelerating at each step.

Using this method brings several benefits:

- **Simplicity:** the baseline distribution of rewards can be easily adjusted via a single parameter: *the base distribution rate*.
- **Predictability:** at any point in time, block producers can calculate the amount of rewards they will receive based on their relative stake, and the community can confidently estimate how long the Reserve will last
- **Sustainability:** rewards decrease with every block, following a smooth, tapering curve pattern that means that the Reserve would not be depleted for hundreds of years, in most cases (depending on the initial allocation).

Base distribution rate

The *base distribution rate (R)* is a system constant that expresses the percentage of outstanding Reserve tokens that are distributed at each block (or, to put it another way, the share of tokens that leaves the Reserve with each passing block). The initial value of *R* can only be determined after the token distribution ends and NIGHT allocations are defined, and it is fundamentally a function of the following parameters:

- The percentage of tokens allocated to both the *Reserve (B) and Treasury (T)* (in relation to the total supply) at the end of the token distribution period;
- An *initial inflation rate* for the circulating supply – that is, the initial rate at which tokens enter into circulation with respect to NIGHT already in circulation.
- The network's *blocktime (t)*, the average time it takes for block producers to produce one block in the network (in seconds).

The initial (annual) inflation rate on Midnight is set at π. This value is lower than the initial expansion rates observed on Ethereum (5%) and Cardano (7%), and it is close to what most economists consider a healthy inflation rate[6]. It should be stressed that the use of the term "inflation" here is relative to the expansion of the circulating supply. Tokens merely move from the Reserve and into circulation via block production rewards. This initial rate decreases with time, as fewer tokens enter circulation at each block relative to the ones already circulating.

The network's blocktime (the number of seconds it takes to produce one block) is not yet determined, as Midnight is still undergoing tests and optimization. The *actual* block time is bound to vary until the Midnight mainnet is deployed. Even then, as the protocol evolves, blocktime may change to reflect advances in technology or community decisions. At mainnet launch, it is expected that the network's blocktime will sit *within the range of one and ten seconds (1 to 10s)*. This value will determine the number of blocks produced in a year (γ).

[6] https://www.federalreserve.gov/faqs/economy_14400.htm

Calculating the base distribution rate

Given that the inflation rate is expressed in annual terms, to solve for the *base distribution rate (R)* per block, one must first solve for the *annual base distribution rate* (R_a):

$$R_a = \frac{\pi(1 - B - T)}{B}$$

Where R_a represents the percentage of tokens dispensed from the Reserve to match the inflation of the circulating supply set at π during the first year.

For example: if the Reserve B represents 40% of the supply, and the initial Treasury allocation T amounts to 12%, in order to achieve a ~3.14% inflation rate in the circulating supply during the first year, then the base distribution rate of the Reserve tokens should be equal to approximately 4.16%.

From there, the base distribution rate per block can be calculated by dividing R_a by the number of Midnight blocks (γ) produced in a year:

$$R = R_a \div \gamma$$

Base reward

The base distribution rate is then used to determine the *base reward* (N_b) for each block – that is, the total number of tokens distributed as rewards at each block – by simply multiplying the current *outstanding number of tokens in Reserve* (B_o) by R:

$$N_b = B_o \times R$$

Incentivizing full blocks

Since DUST is not transferable and does not function as a store of value, a challenge emerges: incentivizing block producers to include transactions in their blocks rather than opting to produce empty blocks (which would undermine the network's functionality and value).

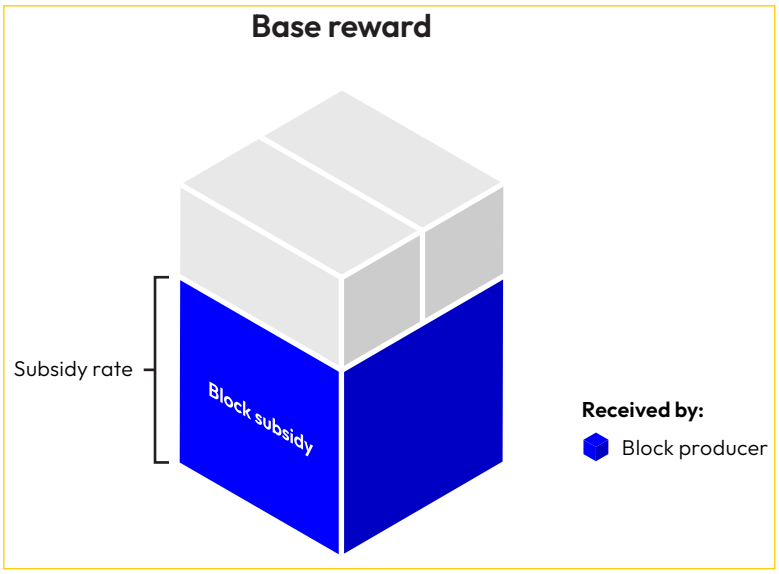
To address this issue, the base reward is split between a *fixed subsidy* and a *variable component* based on block utilization. The ratio of the split is determined by a *subsidy rate* (described below).

The *fixed subsidy* component ensures that block producers receive a baseline incentive for each block they produce, regardless of the block's fullness.

The *variable* component is designed to incentivize block producers to include as many transactions as possible in their blocks (as measured by utilized block space), increasing the network's efficiency and utility. Block producers receive variable reward in proportion to how "full" the produced block is; the remaining part – corresponding to the block's non-utilized space – is received by the on-chain Treasury.

Subsidy rate

The *subsidy rate (S)* is a system parameter that expresses the proportion of the base reward that is distributed to block producers irrespective of block utilization.



For example: a subsidy rate at 80% means that, for any given block, 80% of the NIGHT base reward is received by its producer, even if the block is empty. The remaining 20% - the variable reward component - is split between the block producer and the Treasury in proportion to block space utilization (see below).

At launch, the value of the subsidy rate is set to 95%, on the high end of the spectrum, to ensure that early block producers are incentivized to participate, while accounting for the fact that reaching peak adoption and demand for block space may take time. This high value also minimizes the incentive for block producers to stuff blocks with their own transactions and in doing so, raising DUST utilization. The subsidy rate can be adjusted via governance action: in the future, it is expected that it will be adjusted towards 50% so that block producers have a stronger incentive to create full blocks, thus increasing the overall efficiency of the system.

Calculating the block subsidy

One can determine the *fixed block subsidy* (N_f) of a given block by simply multiplying the base reward by the subsidy rate:

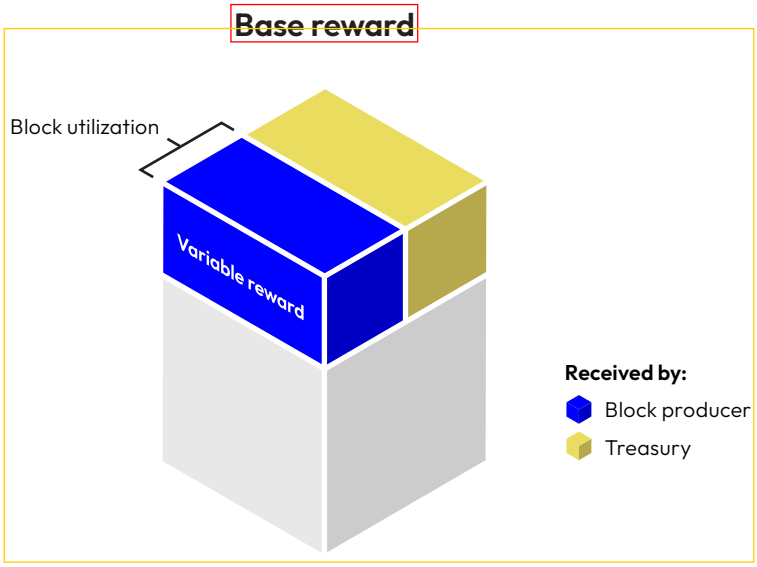
$$N_f = N_b \times S$$

The block subsidy is received entirely by the block producer. The difference between base reward and block subsidy corresponds to the *variable reward* (N_v).

For example: if the subsidy rate is set at 80%, then four-fifths of a block's base rewards are received by its producer - even if the block is completely empty. The remaining 20% make up the variable reward.

Variable reward

The *variable reward* (N_v) received by block producers corresponds to the difference between the base reward and the fixed block subsidy, weighed by each block's *utilization ratio (U)* – the percentage of block space that is utilized with respect to the maximum possible block size. The value of *U* depends solely on transaction dynamics and network usage; the higher a block's utilization ratio is, the larger a share of the variable reward goes to that block's producer.



Calculating the variable reward

Calculating the *variable component* (N_v) of the block reward requires one to simply multiply the block utilization rate by the difference between base reward and block subsidy.

$$N_v = U \times (N_b - N_f)$$

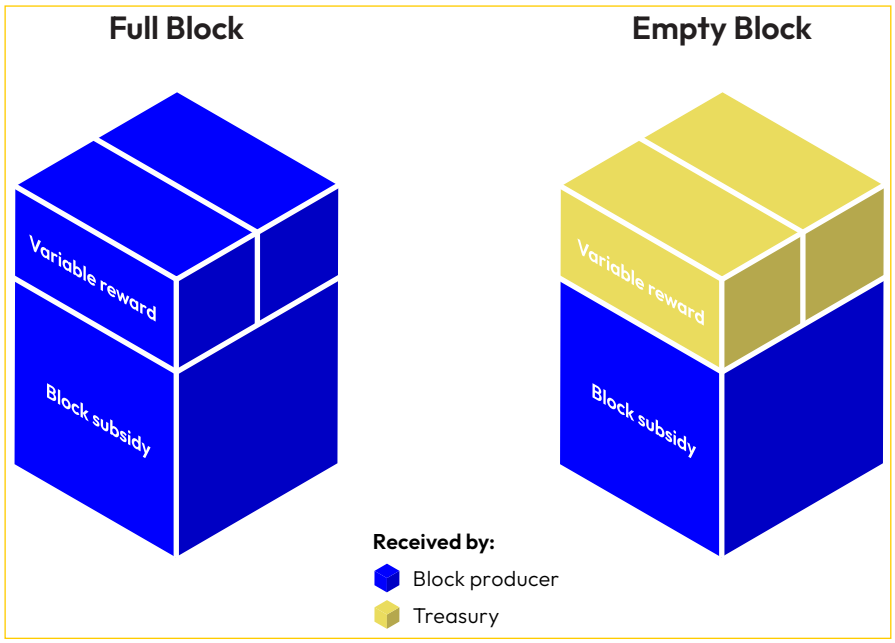
Following the previous example: the remaining 20% of the base reward is dispensed in proportion to how full the block is. If the block is completely full, the producer receives the full amount (i.e., 20% of the base reward); if the block is only 50% full, then the producer receives only half of the variable part (i.e., 10% of the base reward). The remaining half (the other 10%) goes to the Treasury.

Actual reward

For any given block, the *actual reward* (N_a) received by the block producer is the sum of the fixed and variable components, and it cannot be higher than the base reward for that block.

$$N_a = N_f + N_v$$

For a full block, the actual reward is *equal* to the base reward; conversely, for a completely empty block, it is equal to the fixed block subsidy.



Note that the actual reward can, and most likely will be, lower than the base reward, as completely full blocks should not be the norm (that would be a sign of network congestion). Summing up the example above, given a *subsidy rate of 80%* and a *block utilization rate of 50%*, the producer would receive *90% of the base reward* for that block.

Treasury share

Whatever is left from the block reward (corresponding to the share of non-utilized block space) is sent to the *Treasury share* (N_t).

$$N_t = N_b - N_a$$

Summary: calculating block rewards

In summary, the steps to determining block rewards are:

1. Determine the *base distribution rate* (R), based on the proportion of tokens allocated to the *Reserve (B) and Treasury (T)*, (π as annual inflation rate, and γ as number of blocks produced in a year) by the end of the initial token distribution, in relation to the total supply:

$$R = \frac{\pi\ (1 - B - T)}{B} \div \gamma$$

2. Determine the *block's base reward* (N_b) by multiplying the *current outstanding tokens in the Reserve* (B_o) by the *base distribution rate* (R):

$$N_b = B_o \times R$$