Glow: A Cryptoeconomic System for Producing High Additionality Carbon Credits

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Overview

Glow is a cryptoeconomic system that produces high additionality carbon credits from cost effective solar farms. Additionality is achieved by requiring participating solar farms to contribute 100% of their gross electricity revenue to the Glow incentive pool. Cost effectiveness is ensured by creating a competition for rewards modeled after Bitcoin's proof-of-work incentives.

Introduction

Electricity generation is currently one of the greatest contributors to global CO2 emissions. Switching the global power grid to solar based electricity would reduce global emissions by more than 40%. Despite this, solar is not typically considered a viable source of carbon credits.

The carbon industry today lacks an effective mechanism to distinguish between solar farms that produce enough revenue to be self-sustaining, and solar farms that need financial assistance to be deployed. As a result, most solar based carbon incentives get distributed primarily to solar farms that do not need financial assistance, which significantly reduces the overall impact of the incentives.

Glow introduces a unique mechanism for distributing financial assistance. On Glow, solar farms are only allowed to receive carbon incentives if they agree to contribute 100% of their gross electricity revenue towards the Glow incentive pool. This requirement naturally avoids distributing incentives to solar farms that are profitable without them, because such solar farms would rather keep their revenue than receive carbon credits.

Incentives are distributed according to a competition. A finite pool of rewards is distributed between all competing solar farms proportional to the number of carbon credits that they generate. This type of competition naturally finds an equilibrium where only the most efficient competitors can remain profitable.

By combining both the novel revenue requirement with a competition for rewards, Glow is able to significantly increase the total impact of each incentive dollar.

All assets and incentives are tracked on the Ethereum blockchain, which provides both transparency and fidelity when monitoring solar farms and distributing rewards.

Design

Glow is a blockchain project that features two tokens and a governance system. The Glow token (GLW) is a fixed-inflation token that rewards solar farms for producing carbon credits. The Glow Carbon Credit (GCC) is a token that represents one ton of CO2 emissions that were avoided thanks to solar production.

Carbon credits are verified by a set of elected off-chain actors known as "Glow Certification Agents" (GCAs). The GCAs are responsible for auditing solar farms and providing on-chain reports about the carbon impact of the solar farms.

Governance happens using a "propose, select, review, ratify" system. Governance actions can be proposed by anybody. Each week, one proposal is selected by individuals who commit capital to incentivizing new solar. Every selected proposal undergoes a month long review by the "Veto Council", a group of elected entities that have unilateral authority to reject a selected proposal. Finally, Glow token holders need to ratify all high impact proposals with a token vote.

There is no mechanism within Glow to upgrade the code, nor is there any

mechanism for adjusting the inflation schedule or token supply.

The Glow Token (GLW)

The core of the Glow economy is the Glow token, an ERC20 token. Each week, 230,000 new Glow tokens are minted and distributed:

- 175,000 to solar farms
- 40,000 to on-chain grants
- 10,000 to elected carbon credit certifiers
- 5,000 to elected veto council members

This creates a total of 12.00 million tokens per year through inflation.

The Glow Carbon Credit (GCC)

The main product of Glow is the Glow Carbon Credit, an ERC20 token that represents one ton of CO2 that was not emitted into the atmosphere as a result of Glow incentives.

The GCC token can be freely traded, and can also be redeemed for a cash reward. Owners of GCC tokens cannot claim that they are carbon neutral, as the GCC can always be redeemed for cash.

Solar Farms

Solar farms join Glow by agreeing to add 100% of their electricity revenue to the incentive pool as USDC. Solar farms earn USDC rewards from the incentive pool proportional to the number of carbon credits that they produce. Solar farms earn Glow tokens proportional to the amount of USDC that they add to the incentive pool.

The Carbon Credit Auction

The carbon credits produced by solar farms are tokenized as GCC and auctioned off by the protocol. Glow uses a descending price auction, where the price is continuously reducing with a half life of 1 week.

One batch of carbon credits get certified each week. Those carbon credits are then added to the auction continuously throughout the week, in a linear fashion.

The auction price increases each time that someone purchases GCC, proportional to the percentage of available GCC that was purchased. For example, if someone purchases 35% of the available GCC, the price will jump by 35%. The price will not increase by more than 100% in any 24 hour window.

The Impact Catalyst

The impact catalyst is a solidity contract that provides liquidity to a GCC/USDC pair on Uniswap. Glow participants can obtain carbon neutrality by sending either USDC or GCC to the impact catalyst.

When the impact catalyst receives an asset, it will automatically sell roughly half of the asset on Uniswap, such that it has equal values of USDC and GCC. It will then permanently become a liquidity provider in the Uniswap pool with those assets. This permanent liquidity creates a guaranteed redemption value for GCC, and also acts as a ballast against price volatility.

Glow Certification Agents (GCAs)

Glow allows up to five elected Glow Certification Agents. A GCA can be either an individual or an institution. The GCAs are responsible for auditing solar farms and declaring the total contributions of each farm on-chain.

Glow governance establishes guidelines that the GCAs must adhere to when auditing solar farms. If the GCAs stray from the guidelines, they can be slashed by governance.

Each solar farm is monitored by exactly one GCA. When a GCA retires or is otherwise removed from their position, all solar farms that they were monitoring are migrated to a new GCA.

Veto Council Members

Glow allows up to 7 elected Veto Council members. The Veto Council members are responsible for observing the network and putting a stop or pause on any suspicious, worrying, or misguided activity.

Rewards Distribution

Rewards are distributed on a weekly basis using "rewards buckets". After each week ends, GCAs have one week to submit a report that declares the total amount of carbon credits and electricity revenue generated by each solar farm.

After the reports are committed, the Veto Council has one week to check the reports for anomalies. If no anomalies are found by the end of the week, the reports will finalize and rewards will be distributed.

If any anomalies are found, a member of the veto council can single-handedly choose to delay the rewards distribution by 16 weeks. This gives governance enough time to slash any GCAs that produced a bad report.

When a GCA gets slashed, all non-finalized rewards buckets get reset, and the reports must be re-submitted by the remaining GCAs. This cycle can be repeated as many times as necessary to ensure that all finalized reports are high integrity.

Electricity Revenue Management

Collecting revenue from a solar farm on a continuous basis has operational overheads in the physical world, especially in the event of delinquent payments. Glow avoids these overheads by selling the rights to the future electricity revenues of each solar farm, passing on all overheads to the buyer. The methodology for choosing a price is determined by the governance-approved operational procedures.

The final price is called the Glow 'protocol fee', and must be paid in USDC. The USDC gets distributed as rewards in the 208 rewards buckets that follow the moment the USDC is paid. The first 16 weeks get no rewards at all, and

the remaining 192 weeks each get an equal portion of the protocol fee.

Governance

There are five types of governance actions:

- Grant allocations
- Veto Council elections and slashings
- Glow Certification Agent elections and slashings
- Updating the Certification Procedures
- Requesting Commentary from the Veto Council

Anybody can propose a governance action. Once created, a proposal has 16 weeks to be selected for review. After 16 weeks, the proposal expires.

Users select proposals by voting with nominations. Users earn one nomination for each USDC of value that they send to the impact catalyst. Once issued, nominations have a half life of 52 weeks. If a user sends assets to the impact catalyst on behalf of someone else, the nominations also go to the benefactor.

Every week, the proposal with the greatest number of nominations is selected for review. The veto council has 4 weeks to veto the proposal. A single veto from any member of the veto council is enough to immediately expire the proposal. Election proposals cannot be vetoed.

For elections and updates to the certification procedures, Glow token holders vote on whether to accept the proposal. Glow token holders receive one vote per staked Glow token that they own. A proposal passes if 60% of votes are in favor. This vote happens throughout the 4 weeks where the veto council is reviewing the proposal. A vote may be changed at any time.

Glow tokens must be staked to participate in governance. Glow tokens cannot be transferred while staked or unstaking. The unstaking period is 5 years.

Grants Allocation

A grants proposal can choose to allocate Glow tokens in the grants budget to a specific wallet or to a smart contract. The grants proposal itself contains the

hash of a document which describes how the grant money is intended to be used. Grants proposals can use smart contracts to add accountability, milestones, or other parameters to the grants distribution.

If the amount of tokens allocated by a grants proposal is greater than the number of tokens in the grants budget, the proposal will fail to execute and then expire.

Veto Council Elections and Slashings

The veto council is composed of up to 7 members, who earn 5,000 Glow tokens per week divided evenly as compensation. The tokens vest linearly over a period of 2 years.

A veto council election can target up to one seat of the veto council. If the seat is currently unoccupied, the election can put a new person in that seat. If the seat is occupied, the existing member can be either removed or slashed. If removed, their unvested compensation will continue to vest. If slashed, their unvested compensation will stop vesting. The election can either replace the existing member with someone new, or it can leave the seat unoccupied.

GCA Elections and Slashings

Glow can have up to five GCAs. The GCAs must work together to certify solar farms, monitor their carbon credit production, and report the production quantities for each week on the blockchain.

GCAs collectively receive 10,000 Glow tokens per week as compensation, and vote on how to divide their compensation. Each GCA submits a distribution plan which establishes how many tokens they think each GCA should receive. The distribution plans are averaged together, and the result determines the final compensation of each GCA. The tokens vest over a period of 2 years.

A GCA election may elect, remove, or slash any number of GCAs. GCAs that get removed will continue to vest any unvested compensation. GCAs that get slashed will not receive any unvested compensation.

Veto Council members are allowed to endorse GCA elections. For each veto council member that endorses a GCA election, the threshold for ratification by Glow token holders is reduced by 5%, down to a minimum requirement of 35%. Once five veto council members have endorsed a GCA election, additional endorsements do not have any effect.

Updating the Certification Procedures

Glow Certification Agents are required to follow the certification procedures that are established through governance. A hash of the current certification procedures is kept on-chain. The procedures can be updated using a governance proposal.

Requesting Commentary from the Veto Council

Users are able to request that the Veto Council provide commentary on a topic related to Glow. If a request for commentary proposal passes, each veto council member is expected to educate themselves on the topic and provide a well thought out commentary.

The on-chain proposal contains a hash of the request, which should explain the topic and explain what response is expected from the veto council.

Bootstrapping

At launch, Glow will have one pre-selected GCA and three pre-selected veto council members, and pre-determined certification procedures. The grants program will have a balance of 6 million Glow tokens, and a 90 million token premine will be distributed to the early builders of the Glow protocol and ecosystem.

During the first 16 weeks of the protocol, the veto council will be instructed to veto all proposals unless they are superficial or otherwise trivial, giving users a playground to safely explore the governance process.

At launch, 12 million Glow tokens will be placed into a solidity contract and sold using a bonding curve. The initial price shall be set by the development team on the day of the launch, and shall increase continuously as more tokens are sold such that the price doubles each time that 1 million tokens are sold. The USDC that is collected by the early liquidity contract will be distributed between the rewards buckets as though it were a protocol fee.