

Spark: Currency for a cleaner world

Using blockchain to decentralise the decision making around the price of legal pollution

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A digital currency that was 1:1 pegged to the price of carbon allowances would force industrial polluters to compete for remaining allowances at a higher price or to invest in cleaner tech altogether, helping reduce global pollution for everyone's benefit.
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Abstract. A digital currency that was 1:1 pegged to the price of carbon, such that for each token issued a basket of carbon allowances was bought and held in reserve, would force industrial polluters to compete for remaining allowances at a higher price or to invest in cleaner tech altogether, reducing global pollution for everyone's benefit. Simultaneously the currency would provide an asset-backed solution to cryptocurrency investors seeking to protect themselves from market volatility. Carbon allowances are bought from multiple regional exchanges to create a "carbon basket" that symbolises the global nature of emissions. The basket price is calculated using a fair and transparent methodology that prevents undisclosed profit during the purchase or sale of spot carbon allowances back into the marketplace. Open-source access to the Spark registry reserves and trading system provides 24/7 validation. As an additional safeguard, the Spark reporting systems and reserve balances are audited by a qualified third party auditor. The system is built on top of a delegated Proof-of-Stake consensus protocol, minimising the energy consumption requirements compared with alternative approaches that would otherwise undermine the currency's positive environmental impact.

1. Introduction

Addressing climate change has come to rely almost exclusively on the altruistic merits of a minority who are conscious of the long-term and sustained impact our consumerism has on the environment. Without these individuals and companies little else would be done to solve a pressing challenge of our time: current CO₂ emissions are too high to continue to support Earth's biodiversity, with far-reaching implications for the abundance of many species and, of course, our own prosperity.

One of the largest present-day initiatives to address global warming and CO₂ emissions is the Paris Agreement, signed by 178 member states and countries. However, even the most optimistic estimates forecast that this agreement cannot meet its goals quickly enough, and that the gap between objectives and deliverables will continue to widen, emphasising the importance of finding a better way to incentivise change, and acting on it now.^[1]

Meanwhile at the everyday level, individual efforts to combat climate change can feel trivial next to the colossal scale of industry, and since these efforts are a burden on time or financial resources, a burgeoning majority ask *Why Bother?*

What is needed is a solution that can be powered by the mass market effortlessly without weighing heavily on consumers to enact their part: A collective solution that works in the background to everyday life and as part of the fabric of our everyday culture. In this context, the system we propose is designed to weave together the relationship between currency and industrial

^[1] United Nations Environment Programme, 2017, The Emissions Gap Report

pollution levels so that the former may positively and significantly influence the latter, thereby affecting vast global change for good. Additionally, to benefit early adopters throughout the cryptocurrency community, the system provides a transparent tool that is effective at reducing market volatility in the present day, while its value is pegged to increasingly scarce carbon allowances.

2. The Race to Solve Climate Change

In order to cap pollution, national and state level Government regulators across major economies such as Europe, US and China issue a finite number of permits (called “carbon allowances”) that grant polluters the legal right to emit one tonne of carbon dioxide. Permits are homogenous: they do not expire while in circulation and each has equal entitlement without any distinction from one year to the next. By law regulators must reduce the number of available permits over time, forcing emitting industries to buy from an ever decreasing supply in the marketplace. As they compete, the price of these permits (called the “carbon price”) increases until it becomes cheaper and more attractive to invest in cleaner low carbon technology or cease polluting altogether. Carbon allowances are traded globally across regional marketplaces via carbon exchanges. The allowances purchased by each company and/or individual are held in carbon registries and cannot be transferred between regions. These exchanges and registries are accessible to anyone with the prerequisite expertise, but have specific regional rules and requirements. In this paper we define a carbon basket as a selection of global allowances, weighted by region.



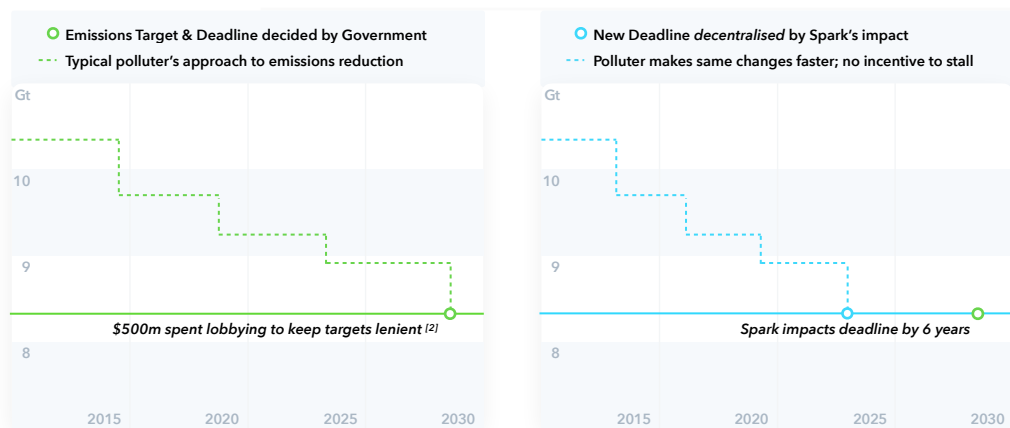
> Fig. 1 Controlling global pollution levels

To create objectives around lowering pollution levels, under the Paris Agreement 178 member states and countries have agreed to take action in limiting global warming to 1.5° C, recognizing that climate change is one of the greatest societal challenges of our time. However there is a major discrepancy between the ambitions set out in the Paris Agreement and the real-life policies that Governments have drawn up, particularly in relation to the rate of decrease in the number of carbon allowances, which directly impacts the carbon price. In some countries the only way to influence these decisions is by voting, but voting blends in other political issues that don't make it a vote on carbon price alone. Some governments aren't democratic at all. By 2030, scenarios suggest that the world will be emitting 12 billion metric tonnes more carbon dioxide than is permitted in order to limit global warming to 2° C, and there is no working incentive in place to close this policy gap quickly enough. A means of disruption is required. Nothing less.

The solution also needs to take effect quickly because investing in alternative strategies like renewable technologies will take too long to be effective. For example, solar and wind are already saturated in their current form: When it is windy or sunny there is too much power for the grid and conversely when

Large companies are highly effective at lobbying governments to remain lenient in their pollution policy changes, resulting in minimal action with promises of a better tomorrow.

there is no sunshine or wind the grid collapses without expensive coal or gas to back it up. Australia is a case study of how badly wrong this can go, with rolling blackouts. The advent of cheap, scalable batteries that are built from non-complex metals are needed for such grids to achieve mass adoption, but this is 20 years away. Other far off options are: carbon capture and storage which is limited in scale due to the sheer number of point sources of CO₂ and the volume of CO₂ that would need to be buried; or nuclear which is very expensive and resisted by society. Sadly the world doesn't have 10-20 years to wait for these solutions to take shape: most climate scientists admit it is already too late to stop the positive feedback loops that are going to send us into a disastrous hot age, and that it is now a question of slowing the process down and limiting it in scale. The interim measure is to force existing players to cut activities, change behaviours or invest in better efficiencies or lower carbon alternatives. This can be done through policy but large companies are highly effective at lobbying governments to remain lenient, resulting in minimal action with promises of a better tomorrow. In 2016, lobbyists spent more than \$500m obstructing change.



> Fig. 2 Spark prevents polluters from stalling their emissions decision-making

The system we are proposing is a way to enact change, and quickly, forcing emitters to make the necessary and tough decisions that are needed to preserve our environment, biodiversity and prosperity. By empowering the global community to issue and retire currency that – as a byproduct of existing – voices their say on the carbon price to reveal its true value, we can aptly and effectively decentralise the process via blockchain and make the world a cleaner place.

3. Empowering Investors and Consumers to help

Many consumers already try to make their own positive impact on climate change. In the west, the average carbon footprint per person is approximately 10 tonnes of equivalent CO₂ emissions per year (CO₂e) which can be reduced by making environmentally conscious lifestyle decisions, such as driving a hybrid car, for example, or recycling more, or wasting less food, or (very rarely) paying to offset the carbon footprint of purchases, such as air fares. Overall there are a number of ways to drive down an individual's carbon footprint to about 8 tonnes CO₂e per year, creating a 20% emissions saving. However, not only does it require a sufficient investment of time and money to enact these small changes – relegating such emission savings to a diligent minority, not the

[2] InfluenceMap, March 2016, How much big oil spends on obstructive climate lobby



mass market – but the overall saving is not enough compared to the scale of industry and the rate of increase in CO₂ globally.

A global problem needs a global solution. We believe it is fundamentally important to make joining a climate change initiative as frictionless as possible so that it has scope for mass adoption. Our solution functions as an undercurrent to everyday life rather than a burden. Our narrative is uncomplicated and compelling, and designed to spark conversation between everyday people as cryptocurrencies, one day, take root in the mainstream.

This maximises the chance of the currency being adopted outside of the core investor community, because the currency's usefulness is easy to measure. This also increases the likelihood of integration among retailers looking for a way to attract an environmentally conscious customer base (e.g. Tesco, Shell), which is a longer term vision of the project.

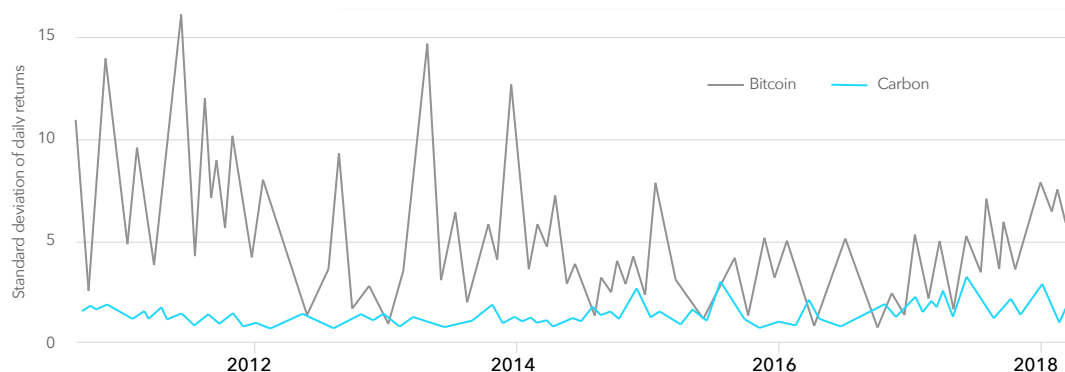
4. Reducing Cryptocurrency Volatility

Blockchain assets are volatile, often with limited liquidity. Bitcoin price fluctuations have been up to ten times larger than fluctuations in the US dollar over the same period. There is a clear and widespread need for investors to suppress such high volatility.

Pegging a cryptocurrency to an underlying real-world asset has two benefits. Firstly, it preserves the core functionality of cryptocurrencies such as their ability to be easily traded on exchanges, low fees, or the fact they are widely integrated and accepted. Secondly, it has the additional benefit of limiting volatility to that of the underlying asset.

Although pegging to a fiat currency is popular, this serves to support the notion of national debt and lacks any kind of altruistic merit that can have a positive impact on society.

Pegs are typically created and maintained using a number of methods including collateralization techniques, derivatives, or by holding 1:1 reserves of the asset. We feel that the first two approaches are inherently difficult to maintain, and more complex to explain to a wider audience (possibly inhibiting adoption).



> Fig. 3 Bitcoin versus Carbon price volatility

Some pegged cryptocurrencies purport to holding 1:1 reserves, but provide no proof of reserves nor audit trail. Without a decentralised proof of reserves mechanic in place or a trusted, internationally recognised, third party, approved auditor monitoring the issuance and retirement of tokens on a

regular basis, the entire system is open to fraud. Furthermore, criticism around proof of reserves can lead to the dissolution of banking agreements, creating difficulties for customers trying to withdraw or add funds and putting the currency at risk of stalling operationally.

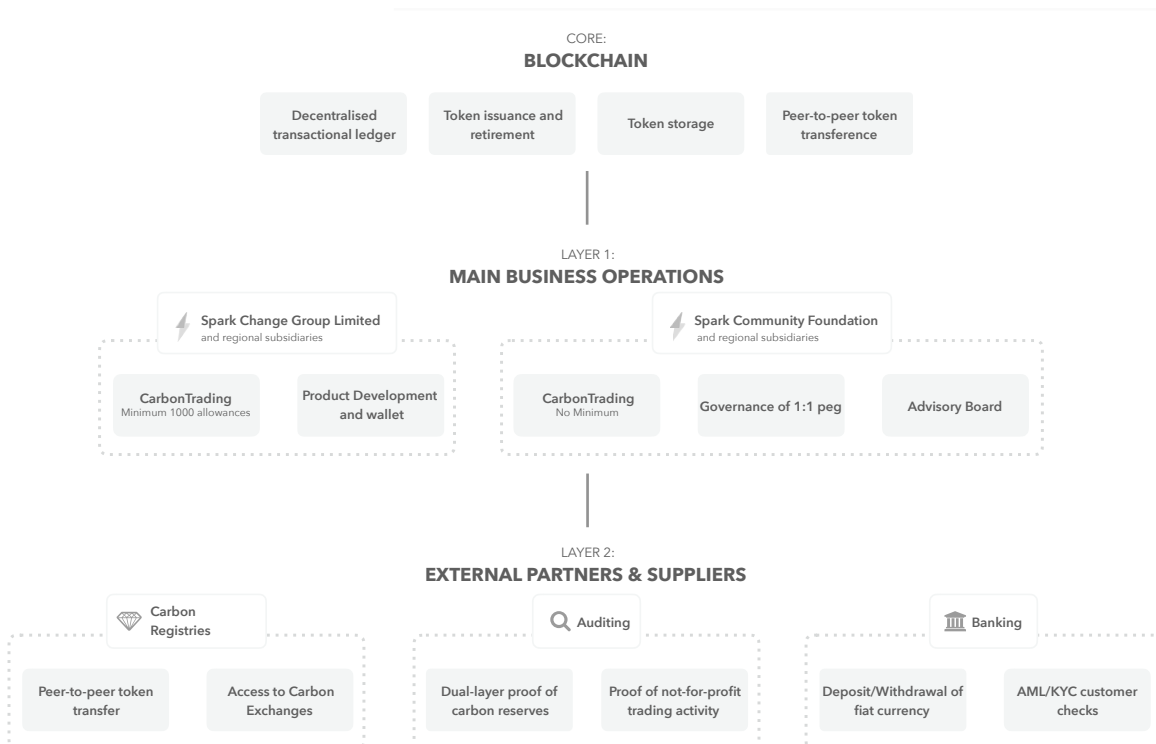
We propose a system that pegs the tokens to carbon allowances, which are historically less volatile than Bitcoin (see Fig. 3). Working with a leading blockchain provider, the goal is to create an improved cryptocurrency that is i) more stable and ii) requires no high-energy consensus mining approach. Proof of reserves will be published by a Big 4 international auditor and the peg will be maintained in a dynamic open-source process written into the blockchain.

5. Technology and Partner ecosystem

To implement a carbon-pegged solution we will need to leverage an ecosystem of partners as follows:

Blockchain Provider The transactional ledger is embedded in the EOSIO blockchain using an eco-friendly, delegated proof-of-stake for its consensus protocol and providing core functionality to:

- Issue (create) and retire (destroy) digital tokens (Spark)
- Track and report the number of Spark in circulation
- Enable Spark customers to transfer and store Spark in a: peer-to-peer, cryptographically secure environment; multi-signature and cold storage system



> Fig. 4 Operational roles

Spark Change Group is responsible for:

- a) Accepting fiat deposits and issuing the corresponding Spark; sending fiat withdrawals and retiring the corresponding Spark
- b) Buying and selling (and holding in reserve) carbon allowances that back all Spark in circulation, in an open-source, transparent process designed to maintain the 1:1 peg
- c) Developing and maintaining a Spark browser-based wallet that lets customers send, receive, store and convert Spark conveniently, with low risk of hacking or cyber theft
- d) Managing integrations with Bitcoin/blockchain wallets, exchanges, and, later on, retailers

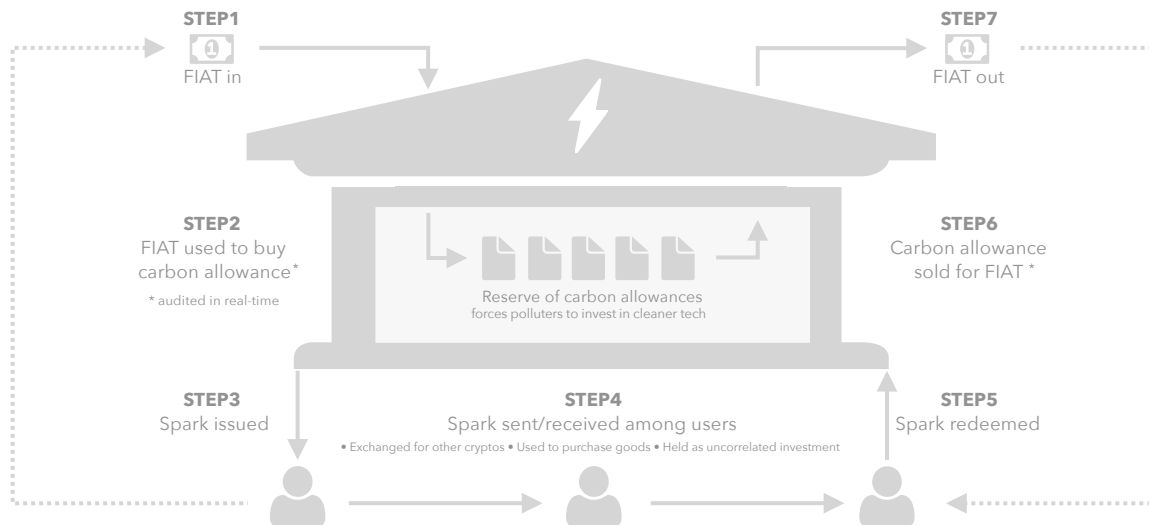
Carbon Exchanges Carbon allowances are bought and sold across international markets via an integrated trading system operated (in accordance with regional regulatory requirements) by regional subsidiaries of Spark Change Group.

Third Party Auditor Acts as a centralised, independent source of trust, monitoring the carbon trading carried out by Spark Change Group and publishing the results to ensure the integrity of the 1:1 peg.

Banking Partners We will will adhere to KYC/AML processes, be fully compliant in the eyes of the law, and only employ multi-jurisdictional banking partners with a low risk of insolvency.

6. Issuing and Retiring Tokens

There are 7 steps to processing funds, as illustrated:



> Fig. 5 How It Works: Transfer of Funds

Step1 Customer deposits fiat currency into Spark Change Group's bank account, having completed industry standard account opening authentication.

Step2 The fiat currency (minus a small transaction fee) is used to buy carbon allowances (see p. 8) from one of several regional carbon registry accounts operated by Spark Change Group. The process is audited.

Step3 For every \$X added (where X is the Spark Price, denoted by the average spot value of one carbon allowance from a blend of global markets), 1 Spark is issued, adding to the overall number of Spark in circulation. The customer's account is credited.

Step4 Spark can be freely traded with other cryptocurrencies via a peer-to-peer open-source network, used to purchase goods or held as an uncorrelated investment.

Step5 The customer deposits Spark with Spark Change Group for redemption into fiat currency.

Step6 The equivalent carbon allowance(s) are sold back to the regional carbon registries in exchange for fiat.

Step7 Spark Change Group destroys the Spark and forwards the fiat currency to the customer's bank account, withholding its transaction fee.

Note that users can obtain Spark via an exchange or another individual. However, Spark Change Group is the only party that can issue or retire Spark into circulation, allowing system solvency to be maintained.

7. Buying and Selling Carbon Allowances

The Spark Change Foundation is responsible for the buying and selling of Carbon Allowances, ensuring that the process of peg maintenance remains visible to Spark customers and does not result in any undisclosed profit to Spark Change Group shareholders. Once sufficiently high volumes are reached, it is possible to fully automate trading via API integration so that the Spark price is derived from each exchange's live bid-ask pricing. An Advisory Board provides extensive industry experience to guide the operation of the Foundation, and Spark customers (each granted one vote per Spark) can vote in majority favour of any guidelines put forward, creating a fair and democratic means of governance. The Foundation operates regional Foundation Subsidiaries as a prerequisite regulatory requirement to trade regional carbon registry accounts. The Spark Change Group, responsible for receiving and sending customer fiat and driving the overall Spark vision and product development, operates under a direct service agreement with the Foundation.

Carbon allowances are bought from multiple regional exchanges to create a "carbon basket". In this way, Spark symbolises the global nature of emissions and the associated challenges of transborder climate change. Furthermore the currency is not beholden to a single regulatory market. The ambition is for the basket to be "weighted" to reflect the relative emissions footprint of the economies that underpin the various carbon trading markets worldwide. Based on analysis of historical market size and liquidity, the "target weighting" is set to 60% Europe and 40% US/Canada, and may be changed subject to conditions approved by the Foundation.

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> Fig. 6 Spark is pegged 1:1 to a real-world asset: carbon allowances

Since the number of annual carbon allowances is fixed by law, industrial polluters are forced to compete for fewer permits, at a higher price; permits that must be bought. Therefore, as Spark gains in popularity, the carbon price increases. With the 1:1 peg intact, the value of Spark increases too.

The Spark Price is maintained as close as possible to the live exchange traded bid-ask price of the carbon allowances included in the basket, using the weighted values. For example, using the 60:40 weighting above if the carbon price was \$20 and \$10 in Europe and US/Canada, respectively, the price of Spark would be $(20 \times 0.6) + (10 \times 0.4) = \16 .

Depth to the bid-ask price is proportional to the bid-ask of carbon allowances on the respective exchanges, net of any bona fide third party transaction costs such as exchange fees or registry transfer fees.

In order to maintain the target weighting of the basket, which is an essential component to maintaining the peg itself, we must consider the following:

► *Minimum lot sizes*

Restrictions exist when buying and selling carbon allowances at exchanges. A minimum “lot size” typically of 1000 carbon allowances is required to trade. Thus in order to maintain the weighting of the carbon basket when buying from multiple exchanges, the number of allowances bought must equal each exchange’s weighting (expressed in its lowest terms) multiplied by the minimum lot size.

In an example scenario, with the carbon basket weighted in the ratio 60:30:10 (expressed 6:3:1 in its lowest terms), then 6,000, 3,000 and 1,000 allowances are bought from each of the respective exchanges (totalling 10,000 allowances) to ensure the peg is maintained.

This is an impractical trading volume for everyday customers wishing to issue or retire relatively small quantities (or fractions) of Spark. The solution addresses this by providing customers with the option to purchase or sell Spark directly to/from the Foundation (see “The Role of the Spark Foundation”).

► *Adding and removing exchanges*

In the event a carbon registry limits the number of allowances a single business entity may hold, that registry will be removed from the basket (once the holding limit is reached) while the weighting between the remaining registries is preserved for further issuances of Spark.

Thus, in a scenario where the weighted basket is 60:30:10 comprised of allowances from registries A, B and C; if registry B introduces a holding limit it is removed from the basket when Spark reaches the limit, and the new weighting is 60:10.

The Advisory Board will also consider the depth and liquidity of new exchanges that come into force under regulation (e.g. the Chinese National ETS), and propose whether such exchanges should be added to the basket. Any proposed additions will trigger a majority vote among Spark customers to decide whether the exchange is added or not, as well as the corresponding revised weighting to the carbon basket.

► *Out of hours trading*

The window for issuing and retiring Spark will be 1200 to 1700 GMT during which period exchanges in both Europe and the US will be open. Outside of

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The solution bypasses restrictions to buy and sell a minimum “lot size” of 1000 carbon allowances per trade, by operating a secondary marketplace for small size transactions.

these hours Spark may be bought, sold and transferred between parties and orders for issuing and retiring Spark may be placed with the Spark Change Group. These will be executed once the subsequent window for retiring or issuing Spark opens, subject to prevailing liquidity.

8. Role of the Spark Foundation

The Foundation plays three key roles to help maintain the peg, as follows:

► *Provision of a central marketplace to buy and sell Spark*

Customers can buy and sell Spark directly to the Foundation. There is no minimum order quantity. Buying and selling in this way helps to prune any deviation that may arise between the real-life and target weighting.

Additionally the central marketplace will minimise any liquidity mismatches that may occur due to insufficient availability (or liquidity) at a given point of time on a specific exchange.

To facilitate this process, the Foundation will buy, sell and hold its own inventory of carbon allowances. Trading will be conducted in such a way that results in a positive cash amount retained within the Foundation (relative to the proceeds received or paid out for the Spark issuance/retirement). This positive cash flow remains within the Foundation and is used to fund the subsequent shortfall in proceeds to sell or buy the required allowances to return the basket of allowances to the target weighting. Note that under certain circumstances, beholden to the relative movements of the regional carbon markets, it is possible (and acceptable) for the Foundation to have a temporary negative cash flow.

► *Governance of the carbon basket*

If it is necessary at any time to amend the existing pegging methodology, either to accommodate the regulation of a new carbon registry or to introduce a transition mechanism to preserve value for existing Spark holders, then details of the required changes associated with the new target weighting will be proposed by the Advisory Board and only take effect if the proposal is accepted by the voting majority of Spark customers.

► *Reissuance of Spark*

If, as a result of any amendment approved by the Foundation, the value of the carbon basket changes, there will be a reissuance of Spark. The Foundation will change its holdings of allowances to match the new weighting, and use any profit to buy (or sell off to cover any losses of) the prerequisite number of allowances.

For example; a customer owns 100 Spark each worth \$20 creating a total investment of \$2000. If the carbon basket is amended and the new value of Spark is \$40, the customer is reissued with 50 Spark, preserving the value of their \$2000 investment.

9. Proof of Reserves

The integrity of the 1:1 pegging methodology is critical to the success of Spark as an investment and risk management tool, as well as to the broader objective of creating a transformational instrument in mitigating climate change.

For every Spark issued an equal number of physical carbon allowances are held in reserve by the Spark Change Foundation.

The Foundation operates a two layer mechanism to ensure the transparency and integrity of these reserves and their continual match to the number of Spark in circulation:

1. open-source access to the Spark registry reserves and trading system
2. auditing of the Spark reporting systems and reserve balances by a qualified third party auditor

Open-source access to reserves and trading system

In order to keep the value of Spark 1:1 pegged to the value of carbon allowances, the Spark Community must have confidence that 1:1 reserves are held against the total number of Spark in issuance. Reserves of carbon allowances can be either in the form of physical inventory that is held in Spark carbon registries or in the form of exchange traded purchases that have yet to be delivered physically.

Given the digital nature of carbon allowances their data can be drawn from the exchanges and carbon registries to automatically verify the 1:1 reserves within the blockchain against the total number of Spark in issuance using the formula:

Spark Issued	=	Carbon Allowance Reserves	=	Carbon Registry Inventory	+	To-be Delivered Exchange Purchases
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The Spark website provides real-time data showing:

- the number of carbon allowances held in each of the carbon registries associated with the relevant carbon market. In addition, where regulation permits, Spark provides 'read-only' access to the relevant carbon registries via the third party administrator of the exchange's website so that the data displayed on the Spark website can be validated by the community.
- the number of carbon allowances purchased via exchange that are yet to be delivered to the Spark carbon registries (in accordance with the terms and conditions of the relevant exchange). In jurisdictions where regulatory reporting on open positions on exchanges is required, the Spark Community is given access to the reports so that they can choose to validate the data published on the Spark website.

Spark website data is validated by a qualified third party auditor in scenarios where regional regulators do not:

- permit Spark to provide 'read-only' access to the general public
- require regulatory reporting
- permit the sharing of data with the general public

Qualified third party audit

To add an incremental trust layer to the Spark 1:1 reserves process, regular audits will be carried out by a third party auditor to prove that all the system calculations written to the blockchain and corresponding data pulled from the exchanges and carbon registries is operating in a true and accurate real-time manner.

Our audit partner will monitor the buying and selling of all carbon allowances to ensure that a) the reserve of carbon allowances is 1:1 pegged to the

Open-source access to the Spark registry reserves and trading system provides 24/7 validation, ensuring the transparency and integrity of the reserves and their continual match to the number of Spark in circulation.

On reaching sufficiently high trading volumes, the solution can switch to algorithmic carbon trading via an API linking to each exchange. Combined with smart contracts, this removes the need for a trusted third party auditor, and turns Spark into a fully decentralised digital currency.

Every Spark in circulation reduces industrial pollution fractionally, adding up to a global movement as the currency becomes more popular: Once Spark is a Top 20 cryptocurrency by market cap, the equivalent of the UK's entire annual CO₂ emissions will be prevented.

number of Spark in circulation and b) that Spark Change Group does not earn any undisclosed profit on the trading of carbon allowances.

The audit results will periodically be made public through a manually published report.

10. Go Live

On launch day, to ensure sufficient funds are in place to manage short term fluctuations in cashflow, the Foundation will be privately funded with \$100,000 and a minimum cash reserve of \$80,000. The minimum cash reserve will increase proportionally with Spark's market capitalisation. Any positive cashflow during the transaction cycle will also be added to the cash reserves. If the cash reserves fall below their minimum level then a spread is added to the bid-ask for issuance or retirement of Spark, until such point the minimum cash reserve level is reached. The size of this spread is exponentially larger than the shortfall between the actual funds and minimum cash reserve, to ensure the gap can be closed.

11. Additional Scope

For now, this initial implementation gets us on the right track to realize the vision of creating a currency for a cleaner world.

The short term goal is to issue a cryptocurrency that is 1:1 pegged to the value of carbon allowances, creating an uncorrelated, asset-backed currency with lower volatility than non-asset-backed cryptocurrencies. This will provide a risk management tool for cryptocurrency investors and a safe haven during bear markets, while accelerating the reduction in global pollution levels. At this stage the total target CO₂ emission cuts for the initiative is 25 million tons.

On completion of the primary stage we plan to integrate with a single leading online retailer (thereby minimising regulatory requirements) to allow their customer base to transact using Spark. This offers a unique selling proposition to organisations looking to improve customer loyalty or appeal to environmentally conscious customers. Target CO₂ emission cuts: 250 million tons.

When cryptocurrencies are better regulated, easier to understand and adopted by the mainstream our ultimate aim is to spark a global movement, integrating with hundreds of international retailers to become the de facto cryptocurrency of choice for consumers. Target CO₂ emission cuts: 6 billion tons.

Additionally, by reaching high enough trading volumes, we can trade carbon allowances algorithmically via an API that links to each exchange. Combined with the use of smart contracts, this removes the need for a trusted third party auditor, and turns Spark into a fully decentralised digital currency.

12. Conclusion

We have proposed a system for reducing global pollution at scale without adding any burden or complication to daily consumer life. Each Spark in circulation reduces industrial pollution fractionally, adding up to a global movement as the currency becomes more popular: Once Spark is a Top 20 cryptocurrency by market cap, the equivalent of the UK's entire annual CO₂ emissions will be prevented. Additionally, the system creates high quality uncorrelated collateral in the form of an asset-backed digital currency that helps cryptocurrency investors manage volatile markets. A trusted Foundation (governed by Spark customers and an Advisory Board) is responsible for buying and selling carbon allowances, ensuring no undisclosed profit and that

the process of peg maintenance remains visible. Additionally, the Foundation provides a marketplace of inventory so that customers can buy and sell relatively small quantities of Spark that do not meet the minimum buying requirements of the carbon exchanges. Open-source access to the Spark registry reserves and trading system, as well as periodic auditing of the Spark reporting systems and reserve balances by a qualified third party auditor, provides validation. The system uses a delegated Proof-of-Stake consensus protocol that minimises the energy consumption requirements to issue new tokens, that would otherwise undermine the currency's positive environmental impact. The initiative is privately funded and no capital is raised through any kind of crowdfunding or "initial coin offering". An initial issuance of \$500,000 of Spark is provided by the Spark Change Group to create Day 1 liquidity.

Our belief is that the currency of tomorrow can help to create a cleaner world, for everyone's benefit.

Authored by The Spark Change Group Inc.