Morgan Stanley

INVESTMENT MANAGEMENT

Counterpoint Global Insights

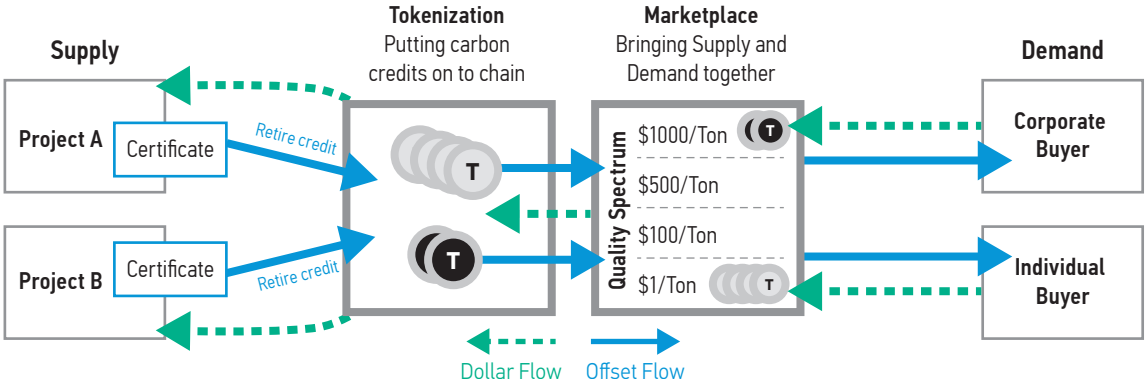
Crypto and Carbon

Global Interoperable Voluntary Offset Marketplace on Chain

CONVERGENCE | SUSTAINABILITY RESEARCH | JULY 2022

The intersection of Counterpoint Global's focus on disruptive technologies and Sustainability Research has resulted in the insight that recent Blockchain technologies have an opportunity to play a role in decarbonizing the global economy. While the market is currently focused on the near-term emissions from the energy intensive mining practices of cryptocurrencies like Bitcoin, our research helps us understand the potential energy efficiency improvements from emerging technologies like proof of stake (explained below). In addition to better contextualizing the risks, our research has highlighted how Blockchain technologies have unique capabilities that can enable an interoperable marketplace for voluntary carbon offsets. We believe the creation of a global marketplace to enable price discovery for varying offset quality is an essential tool to use market forces to decarbonize society.

Display 1: Can blockchain technology enable a global interoperable voluntary carbon offset trading marketplace?



Source: Morgan Stanley Investment Management. For illustrative purposes only. Information shown is to illustrate how blockchain technology could enable a global interoperable voluntary carbon offset trading marketplace.

The Market Opportunity

THE GLOBAL PROBLEM: The world emits roughly 51 billion tons of greenhouse gas emissions per year.[1] Most parts of our economy create emissions, including manufacturing (31%), energy production (27%), agriculture and land use (19%), and transportation (16%). Scientific experts from United Nations agencies estimate that even if all nations implement their pledges to reduce carbon emissions, this scale of output puts the world on track for a 1.8° Celsius (C) warming,[2] above the 1.5 °C target set by the Paris Agreement entered into force in 2016.

ADDRESSING THE PROBLEM: The global movement to decarbonize the economy is gaining momentum. Almost every country has endorsed the Paris Agreement and many for-profit companies have set targets to achieve net zero emissions. But a unified strategy on how to achieve these aspirational targets does not exist at either a country or a company level. Decarbonization will require a massive reduction in our emissions, and some segments of the economy have an existing strategy. For example, efforts are underway to replace electricity generation based on fossil fuels with alternatives such as solar and wind. By contrast, companies in some industries, including cement, steel, plastic production and aviation, will find it hard to reduce their carbon emissions substantially. They will require offsets to counteract their output. There are simply no alternative technologies available today that are low in carbon output and economically feasible.

THE OFFSET ECONOMY: Carbon offsets refer to the reduction or removal of greenhouse gas (GHG) emissions to compensate for emissions that occur elsewhere. Remarkably, there is no marketplace for global carbon where emitters can purchase offsets from those sequestering carbon. There is no centralized leadership to create a consensus global standard. As a result, the market is complex and chaotic. Some emerging verification standards exist, such as Verra who has certified over 1,800 Verified Carbon Standard projects, but none have achieved the scale to span isolated regional exchanges and create an interoperable global marketplace.[3]

OFFSET BUYERS: There are two primary types of buyers for offset credits. The first is the "compliance" market, where buyers have a legal mandate to offset their carbon emissions. The second is the "voluntary" market, a group that elects to pursue targets of net carbon reduction. The compliance market is more established. These buyers purchased roughly 11 billion tonnes of carbon dioxide equivalent (CO_2e) at a value of approximately $850 billion in 2021, representing an

[1] Source: Rhodium Group as of 2020, as referenced in How to Avoid a Climate Disaster, by Bill Gates, February 16, 2021.

[2] Source: International Energy Agency, November 6, 2021.

[3] Source: Verra.org, July 12, 2022.

increase of 164% from 2020 (European Union's Emissions Trading System accounted for 90% of global value, with €683 billion of transaction value in 2021).[4] The voluntary market today is much smaller, making purchases of 300 million tons CO_2e at a value of roughly $1 billion. While smaller than the compliance market, the voluntary market is growing significantly faster and is estimated to reach more than $100 billion of volume per year by 2030.[5] This trend is supported by likely regulations such as carbon taxation. These regulations seek to reduce the cost difference between high- and low-emissions alternatives, which is expected to lower green premiums.

OFFSET SELLERS: There is vast variability in cost and quality on the supply side. For example, the seller of a carbon credit can generate an offset by avoiding cutting down trees at a cost of a few dollars per credit or by spending up to $1,000 per credit to use 100% green energy to suck carbon from the air using solid sorbent direct air capture (DAC) systems and store it miles underground for centuries. The primary dimensions of quality are additionality, permanence, efficiency and verifiability.

- **ADDITIONALITY:** High-quality credits are said to have "additionality," which means that the sequestration happens only if incremental funding from selling credits is available. (A 2016 study released by the European Commission and carried out by the Oko-Institut estimates that 85% of offset projects were not additional. In other words, the sequestration would have occurred as a continuation of business as usual without the carbon marketplace.)
- **PERMANENCE:** Each sequestration method has a different estimated duration on how long the carbon is captured (Reforestation generally is expected to last for decades while captured and stored carbon can last centuries).
- **EFFICIENCY:** The amount of carbon that is released in the process of sequestering reduces net carbon removal efficiency. (Afforestation and Reforestation can be greater than 95% efficient, with the primary wastage being the forest management, while biochar is estimated to be 25% efficient, where each ton removed requires 0.75 tons to be emitted.)[6]
- **VERIFIABILITY:** Traceability and measurability vary between the different methods. (A captured and stored ton of carbon is relatively cheap to document while measuring soil-based sequestration of regenerative farming practices is labor intensive and estimated by lower precision survey work.)

While there are public sector groups like parties of the United Nations Climate Change Conference addressing Article 6 (the Paris Agreement's rulebook governing carbon markets), and private sector initiatives like Taskforce on Scaling Voluntary Carbon Markets and Carbon Meta-Registry focused on the issues, the scale and complexity of the task is immense. The lack of interoperability between marketplaces, as well as standards that vary, means a company that sequesters carbon is unable to add their credit to a liquid pool of global supply. As a consequence, carbon credits are not priced to reflect the proper underlying quality. There are currently 68 carbon pricing mechanisms around the world, including 36 carbon taxes and 32 emissions trading schemes.[7] In the compliance market prices range from below $5 to above $100 per ton depending on the country and region.[8] In the voluntary market, prices can range from less than $1 per ton to above $50 per ton.[9]

OPPORTUNITY SCALE: The market opportunity has the potential to be significant. If 85% of the global emissions of 51 billion tons are reduced through decarbonization strategies, more than 7 billion tons will need to be offset. Assuming a cost of $100 per ton to sequester emissions suggests a $765 billion market. This is larger than the software sector today. While we expect a market will eventually be created to meet this demand and hence capture the opportunity, further development through existing systems is anticipated to be slow.

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[4] Source: Refinitiv and Reuters, January 31, 2022.

[5] Source: Ecosystem Marketplace, November 10, 2021.

[6] Source: National Academies of Sciences, Engineering, and Medicine. *Negative Emissions Technologies and Reliable Sequestration: A Research Agenda*. 2018.

[7] Source: The World Bank, Carbon Pricing Dashboard, 2022.

[8] Source: The World Bank, Carbon Pricing Dashboard, 2021.

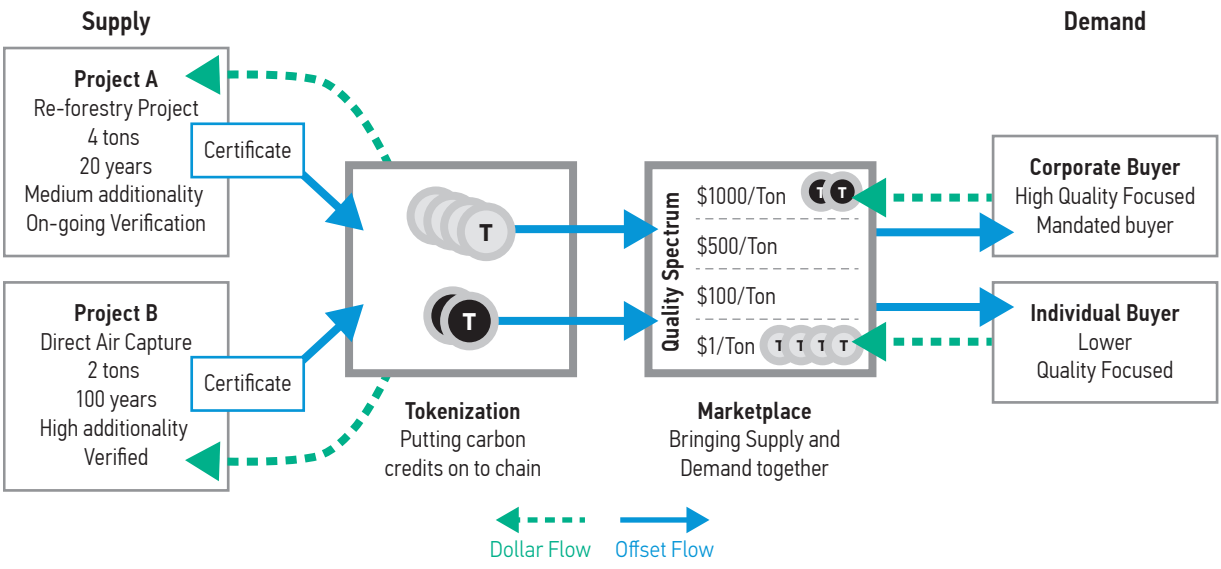
[9] Source: Ecosystem Marketplace, Global Carbon Markets Data Intelligence and Analytics Dashboard, 2021.

Game-Changing Technology

Blockchain is in effect a decentralized database. Four innovative applications built on foundational blockchain technology are relevant to the opportunity in the market for carbon offsets:

1. **CRYPTOCURRENCY:** Cryptocurrencies such as Bitcoin use blockchain as an enabling technology, but cryptocurrencies and blockchain are distinct. Bitcoin and other cryptocurrencies are an application of blockchain that enables a digital store of value in a transaction system that does not rely on trust. Cryptocurrencies create incentives for members to participate in the management of the ecosystem. For instance, the entities that provide the computing power to process the transactions in the Bitcoin network are compensated with new Bitcoins. This creates a self-sustaining ecosystem.
2. **NON-FUNGIBLE TOKENS (NFTS):** Most cryptocurrencies are fungible assets. For instance, all Bitcoins are the same and owners can use them interchangeably for transactions. Some blockchains enable the creation of tokens that have individually unique properties and traits. These are called non-fungible tokens (NFTs). NFTs are now best known as a way to collect and speculate on the value of unique pixelated images, but this enabling technology can add any type of unique asset to a distributed database. For example, one of the leading cryptocurrency decentralized exchanges, Uniswap V3, uses NFTs to represent positions in its liquidity pools.
3. **DECENTRALIZED AUTONOMOUS ORGANIZATIONS (DAOS):** A traditional company is a centralized entity where decisions are made through the use of governance structures. The management team runs the business, the board of directors is responsible for oversight and strategy, and shareholders elect the board. A decentralized autonomous organization (DAO) is managed through transparent rules run on a computer program and controlled by the crowdsourced voting of DAO members. The holders of DAO governance tokens cast votes to determine the actions of the DAO. Unlike traditional corporations, governance token holders may not have any formal ownership of the DAO or rights to its assets. DAOs can sell governance tokens or give them to people or entities that are strategic to the success of the enterprise. This enables community ownership and incentivizes participation.
4. **PROOF OF STAKE:** The first version of cryptocurrencies were applications based on proof of work (PoW), where the prover was incentivized with rewards to generate specific computational output that others could verify. This

Display 2: How carbon trading on chain could work:



1) Pricing quality serves as a demand pull to create more high-quality projects (currently demand outstrips supply)
2) Overtime the quality floor is expected to be raised by regulations as corporate buyers specifically buying low quality will likely be seen as greenwashing their net-zero commitment

Source: Morgan Stanley Investment Management. Information shown is for illustrative purposes only.

output required substantial computer processing and was thus energy intensive. Beyond extensive energy needs, these early PoW applications were too slow and could not meet the performance demands of newer applications. Rather than earning from PoW, the next generation of network participants in cryptocurrencies earn through proof of stake (PoS). This process allows owners to earn additional cryptocurrency by staking their assets in exchange for the privilege of validating network transactions. PoS is faster and much more energy efficient than PoW. It also disincentivizes bad behavior.

Technology Colliding With an Opportunity

The thesis is that blockchain-enabled applications of NFTs, DAOs and PoS have the potential to enable the creation of a global carbon offset marketplace that can decarbonize the economy through market forces.

1. **NFTS ADDRESS QUALITY VARIANCE:** A ton of carbon removed is currently a commodity. But there is a massive difference in quality between verifiable, long-duration and net-efficient activities such as direct air capture using green energy and harder-to-verify activities in forestry conservation. A carbon removal credit that is put on chain and made into an NFT can be priced to reflect the underlying quality of the sequestration. Matching price and quality can unleash the necessary market forces to incentivize the generation of high-quality credits. Over time, the market can demand different quality minimums.

2. **NFTS ADDRESS TRACEABILITY:** When a company buys a carbon credit today it has to trust that the ton sequestered was sold only once and not counted twice. In certain cases, there also has to be trust that the company that purchased the offset will retire the credit and not resell it. Since NFTs are programmable, they can be coded to be retired, or "burn," after consumption. This verifies sole sale. This burning allows purchasers of offsets to see the amount of carbon credits consumed, allowing them to compare prices and compete effectively. This also allows market participants to speculate more easily on the pricing of varying quality. For example, they can lock in current pricing by forward buying credits and not burning them.

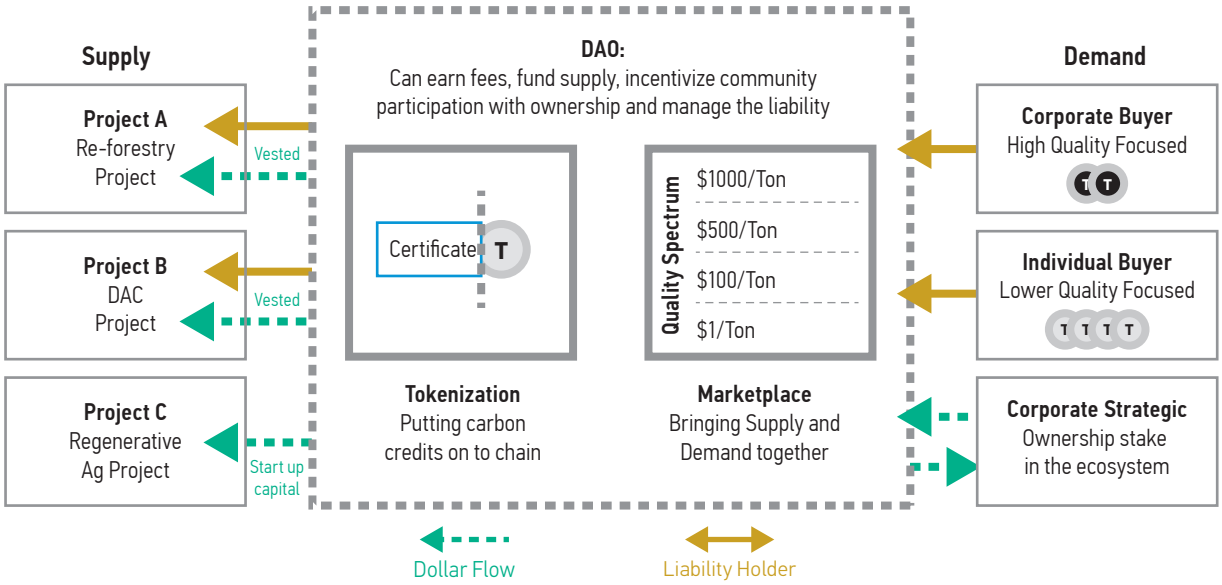
3. **DAOS CAN HELP FACILITATE A GLOBAL MARKETPLACE TO BRING TOGETHER SUPPLY AND DEMAND:** DAOs create an incentive for community participation and ownership. DAOs can issue tokens that they can sell to participants on the supply and demand side. Marketplaces that scale successfully follow common patterns. Liquidity attracts incremental liquidity, which can create positive feedback that could result in a leader taking-most market. DAOs have an advantage over traditional marketplaces owned by centralized organizations because they can enable participation, hence driving incremental demand and supply.

4. **DAOS CAN HELP ADDRESS THE PROBLEM OF FUNDING OFFSETS:** One of the primary constraints on the offset economy is the upfront cost to start sequestration projects and the ongoing costs to verify carbon credits. For instance, regenerative farmers already sequester carbon but generally are not compensated for it because the cost of verification is too high. DAOs can use funds from treasury to pay for farmers to adopt regenerative agriculture practices and the on-going verification costs. The credits created through that project can then be sold on the owned exchange by mandate, allowing for the initial upfront investment to be recovered. This new source of revenue for regenerative farmers would attract the incremental farmer to adopt regenerative practices.

5. **DAOS AND NFTS CAN HELP PROVIDE PROGRAMMATIC LIABILITY MANAGEMENT:** Offset sellers can receive payment over time utilizing verification vesting coded into the NFT, incentivizing continued land maintenance, for instance. The DAOs that issue the NFTs can serve as the liable entity should an offset seller change their practices or if the sequestration is proven impermanent. The DAO can hold a reserve of NFTs or US Dollar-linked coins in treasury as insurance to compensate buyers should the initial sale prove impermanent. Having the liability transferred to a DAO lowers the risk of corporate buyers who fear reputational harm from mistakenly buying low-quality credits.

6. **CRYPTOCURRENCY ALLOWS PARTICIPANTS TO CASH IN AND CASH OUT:** The global cryptocurrency infrastructure and service providers enable buyers to put cash into the system to acquire carbon offset NFTs while carbon sequesters can take cash out of the ecosystem after linking their verified carbon offsets to NFTs.

Display 3: How DAOs can help facilitate the scaling of on-chain carbon offset marketplaces



1) Entity will earn fees for tokenization and marketplace transactions
2) Overtime marketplace and tokenization fees can help fund projects to bring more supply on to chain
3) Entity can manage liability to insure purchases with a carbon or dollar reserve, and pay out to supply providers with vesting as their permanence obligations are met
4) Community participation can be incentivized with ownership of the DAO via utility-like tokens

Source: Morgan Stanley Investment Management. Information shown is for illustrative purposes only.

The Impact

The average price of a carbon offset in the voluntary market was estimated to be $3.37 per ton in 2021, up from $2.50 in 2020, this low price reflects the perceived quality and disaggregated demand pools.[10] The academic consensus is that the price per ton needs to be $100 or greater to sizably incentivize the scalable decarbonization projects to transform the global economy to net-zero emissions. We believe the creation of a global interoperable marketplace with price discovery and variance to reflect quality is a systemic way to use market forces to incentivize decarbonization on a mass scale.

While it is certainly possible that a global marketplace will be controlled by a centralized set of exchanges (similar to how equities or bonds are traded) we believe the complexity, scale and variance of this market makes these emergent technologies particularly useful. Blockchain technologies can also help address missing capabilities to enable mass adoption such as programmatic verification, liability management and a funding mechanism for offset creation. In our view, building a marketplace now that factors in quality variance enables society to be ready to scale if the will and budgets materialize to act, and a liquid marketplace appropriately pricing qualitative factors such as permanence is likely to result in carbon credits over time that have both quality scores issued by third-party rating agencies and the integration of standard time scales (ton sequestered for 10 years, for example).

The thesis is that the path to disruption will start at a niche segment of the high-end market. Specifically, buyers that demand the highest quality will purchase the best-quality carbon credits. We are seeing that some sophisticated large technology corporate buyers that want to meet their net-zero commitments in an authentic way are helping to jumpstart this market. Such activity particularly at the high end of the market will likely create an incentive to bring more supply into the market and help emergent technologies like DAC get to scale. Buyers, in turn, will establish price differences between highest- and lowest-quality credits. Over time, we expect quality will rise either as the result of regulations or by carbon sequesters moving up the quality spectrum in response to incentives.

[10] Source: Ecosystem Marketplace, Global Carbon Markets Data Intelligence and Analytics Dashboard.

If the trading volume over these marketplaces grows to meet the increasing demands of buyers looking to meet net-zero targets, it is likely that the service layers of tokenization and the marketplace itself will likely become valuable entities. Counterpoint Global will be looking for potential investments that could capture some of this value, derivatively we believe there should be investment opportunities that get created as a result of having a liquid marketplace, such as companies that create high quality offsets cost efficiently.

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JASON YEUNG	Health Care	27	22	20
ARMISTEAD NASH	Business Services, Software	24	22	20
DAVID COHEN	Consumer	36	31	25
ALEX NORTON	Consumer, Industrials, Technology (ex Software)	29	24	24
MANAS GAUTAM	Head of Global Endurance, Generalist	12	9	9
ANNE EDELSTEIN	Co-Head of Vitality, Health Care	13	6	6
JENNY LEEDS	Co-Head of Vitality, Health Care	8	5	5
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RUOBING CHANG	Internet	12	8	4
ALEKS SAMETS	Payments	4	4	4
BETH FIFER	Health Care	12	3	3
MUHAMMADRAZA PANJU	Internet	5	3	3
PETE STOVELL	Generalist	30	3	3
MICHAEL MORITZ	Generalist	6	2	2
GINO GRAZIADIO	Generalist	<1	<1	<1
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DAN CALLAHAN	Consilient Research	19	4	4
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SASHA COHEN	Big Ideas, Emerging Themes	7	7	7
JUSTIN AMEZQUITA	Big Ideas, Emerging Themes	4	4	4
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PRAJAKTA NADKARNI	Portfolio Specialist	20	17	13
MICK MORAN	Portfolio Specialist	10	10	2
MCKENZIE BURKHARDT	Portfolio Specialist	21	21	21
XAVIER SALAZAR	Portfolio Analyst	6	6	2
KATHRYNE DOWNS	Portfolio Specialist ~ Global Endurance	12	12	2
EARL PRYCE	Portfolio Administrator	24	24	17
CHAYSE MORGAN	Portfolio Administrator	4	4	4
ERICA CASARENO	Portfolio Administrator	2	2	2
AMBER YANG	Business Management	14	6	3

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DEFINITIONS

Blockchain: Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network.

Cryptocurrency: Cryptocurrency (notably, Bitcoin) operates as a decentralized, peer-to-peer financial exchange and value storage that is used like money. It is not backed by any government. Federal, state or foreign governments may restrict the use and exchange of cryptocurrency. Cryptocurrency may experience very high volatility.

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