TEAM WORK GLOBAL

DETERMINING THE GLOBAL MARKET SIZE FOR CARBON SAVINGS AS A SERVICE

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PAPER OVERVIEW

This investigation had the task of determining the global market size for the emissions saved/removed by Sabien. Our approach focused on the market for carbon, but the concepts can be extended to other greenhouse gases.

To begin with, it is useful to first understand the carbon market so we explore this in detail. We differentiated between the voluntary and regulatory markets. Here we argued that the Voluntary market is the most appropriate market for Sabien to enter as it covers the industries which Sabien typically invest in, moreover the voluntary market is less fragmented which makes it more accessible, especially in a global context.

Once the market for carbon emissions has been understood then the factors that would affect the value of Sabien's carbon savings are explained The UK, EU and North American markets were studied by this team and their particularities will be highlighted in the main body of the report, including the risks and opportunities of investing in each unique market.

Finally, we conclude with a solution to entering the voluntary market by proposing that each carbon credit is tokenised using blockchain technology into a new Sabien token.

GLOSSARY

Blockchain – A specific type of database that stores data in blocks which are then chained together. Each block in the chain is timestamped and tampering with the chain is extremely difficult.

Carbon credit - A carbon credit is a digital certificate certifying that *one ton* of CO2, or CO2 equivalent of other greenhouse gases, has been verifiably avoided in the past.

Emissions Trading Scheme (ETS) - A cap is set on certain sectors covered by the scheme; emitters are then given permits that allow a set level of emissions, and these permits can be traded so that companies met their emissions targets.

Regulatory Carbon Market - Regulatory markets are created and regulated by mandatory national, regional or international carbon reduction schemes. They are mainly implemented using a 'cap and trade' or 'baseline and credit' system.

Voluntary Carbon Market (VCM)- The voluntary carbon market covers all transactions of carbon credits that are purchased with no intended use for compliance purposes.

HOW THE GLOBAL CARBON MARKET WORKS- CARBON CREDITS AND CARBON PRICING MECHANISMS:

Climate change is the defining challenge of this generation affecting everyone around the globe, and we're not doing enough to stop it. Carbon credits, and the concept of carbon pricing, is one attempt to resolve this issue.

Emitting carbon and other greenhouse gasses into the atmosphere is a 'negative externality. In other words, the emission of carbon is a damaging by-product of economic activity. The market does not internalize the costs of these emissions, resulting in too much carbon being emitted and creating a market failure. Therefore, collective action is required to achieve the socially desirable objective of limiting temperature rises as much as possible. By assigning a monetary value to carbon emissions, policymakers help to internalize the environmental and social costs of carbon pollution and incentivise the development of low carbon alternatives. On a general level, there are two broad policies instruments available to achieve this: (1) Carbon taxes, and (2) carbon markets.

1.Carbon taxes

The first, carbon taxes, are typically utilised by countries with a history of social democracy, and a custom of governmental intervention in the economy, such as France and the Scandinavian countries, although the predominant carbon pricing mechanism adopted by most countries is carbon markets. However, it is worth noting that carbon taxes can be utilised on their own, they can (and often are) used in combination with other approaches such as carbon markets as is common in many EU policies. The biggest benefit of using carbon taxes is their stability; this can provide longer-term certainty regarding the cost of carbon, which can help in facilitating investment in lower carbon investment. As research on climate policy instrument choice under uncertainty suggests, this can have higher than expected benefits when compared to carbon markets, where carbon prices commonly fluctuate due to a variety of unpredictable factors, such as political commitment to GHG reduction and economic cycles (Pizer, 2002; Newell, Pizer and Raimi, 2013).

2.carbon markets

Under a carbon market, spare carbon offsets – also known as carbon credits - are exchanged through a marketplace for a price, allowing one entity to offset any pollution caused, whilst simultaneously rewarding the other for its environmentally friendly practices. An overwhelming amount of carbon credits are audited by trustworthy international institutions and certified with global registries which follow strict protocols. To both protect the value of carbon credits, and to protect against the threat of carbon reversibility, registries establish "buffers" that act to guarantee the ledger and permanence of credits. Once certified, carbon credits can be either accumulated, and perhaps, therefore, speculated upon, or consumed to offset a pollution output. A key aspect of carbon credits are their persistence; they will last until they are consumed (or, in the very long term, eventually cancelled for pollution compensation).

However, some believe that carbon taxes are a suboptimal method of lowering emissions because under a tax system, the price of carbon is arbitrarily determined by the government or regulator and can therefore be established at too high or too low a level. Consequently, it can cause excessive economic harm by disproportionately burdening some carbon-intensive industries, or conversely, be set too low to provide an incentive to reduce emissions. A similar, but distinct issue is that the revenue generated may be distributed inefficiently, and not used to further curb GHG emissions. A carbon market avoids these problems by having the market dictate the price, thereby encouraging consumers to purchase lower-priced, efficient carbon offsets, and thus rewarding innovators who develop new methods of cleaner production. And scaled-up voluntary carbon markets could facilitate the mobilization of capital to the Global South, where there is the most potential for economical nature-based emissions-reduction projects (McKinsey, 2021).
There are two broad types of carbon markets: (1) regulatory 'cap and trade' markets and (2) voluntary markets.

1.Regulatory Markets:

To deal with the first, large companies participate in regulatory government markets, also known as 'cap and trade' markets. In these, the government, via a regulator, typically establish a minimum price for carbon credits (called allowances) and set a mandatory cap on Greenhouse Gas (GHG) emissions for a predefined set of emission resources - something typically done sector by sector. Companies that pollute within these markets are ranked on how much pollution they generate. Any that pollute beyond the annual "cap" on emissions will have to offset any excess pollution by purchasing government-issued carbon credits on organised exchanges (therefore providing a 'fine' – or financial cost – for polluting). Meanwhile, companies that pollute the least certify their allowances, or permits to pollute, and therefore benefit from their environmentally responsible activities.

2.Voluntary markets:

Voluntary carbon markets, on the other hand, apply to GHG emission reductions outside the scope of regulated emissions and are typically self-regulated by a global foundation or institution such as Verra. Importantly, voluntary markets differ from regulatory markets as they are not regulated by any government agency and unlike the regulatory market, do not operate at a minimum price. There are four main types of credits in the voluntary market: forestry, clean energy, landfill and biomass, although other types of credit also exist (Forest Trends, 2020). Demand for voluntary credits arise from two sources; corporations and environmentally conscious people looking to offset their carbon emissions over and above any legal requirements.

SIGNIFICANCE OF THE VOLUNTARY MARKET

The voluntary market is rather small when compared to regulatory markets – being valued at $282.3 million USD (US Dollars) in 2019 - and the balance between supply and demand has been difficult (Forest Trends, 2020). This raises an important question in assessing the viability of investing in this market: is there a significant future at all for voluntary carbon markets?
The voluntary carbon market has remained relatively static since its inception. Analysis by Forest Trends demonstrates that volumes have remained relatively unaltered in the past two decades. Meanwhile, global emission output has more than doubled in this same period and out of the 55 billion tonnes of carbon emitted each year, just 11 billion is compensated for (either through voluntary or regulatory markets). If all CO2 emissions in the world were compensated, the potential annual market would be $1.3 trillion USD (World Bank Group, 2019) Nonetheless, recent developments have changed the perception, and the long-term outlook of this market for the better. McKinsey (2021) estimates now suggest that by 2030, the voluntary Carbon Market could be worth between $5 billion and $30 billion at the low end and more than $50 billion at the high end, depending on different price scenarios and their underlying drivers demonstrating the potential in this area.

The voluntary market is poised to dramatically expand from 2021 onwards, driven by a rapid acceleration of net-zero commitments from corporations and reflected in bold new initiatives such as the Taskforce on Scaling Voluntary Carbon Markets, headed by Mark Carney (addressed in the following section) which is set to address key market maturity issues as well as increase the transparency, quality and integrity of offsets.

The significance of the voluntary carbon credit market and its potential for growth is also illustrated by attitudes towards carbon; 90% of millennials cite impact investing as their top strategy choice in the Bank of America Securities Survey, with climate change becoming the #1 investment theme within the survey itself (Domm, 2019). This number for people between 40 and 50 years old is 55% and for the generation between 70 and 80 years old is around 28%. In other words, the aging and growth of the key millennial and gen Z demographic (which already correspond to 25% of the combined populations of Europe, US (United States) and Brazil, or 256 million) should result in increased investor and consumer pressure to compensate for their carbon output.

This is something that is already beginning to bear fruit; 84% of companies with a long-term emissions target plan to use carbon credits as part of their climate strategy, and a further 11% would if given a more favourable policy environment (IETA, 2020). Meanwhile, several corporate giants, such as Amazon and Microsoft, who alone account for 60 million tonnes of annual voluntary carbon credit demand (which for perspective represents 12x the current supply of Brazilian Amazon Forest credits (Moss, 2020), have recently announced neutralization pledges, and more companies are to follow. As noted in the Taskforce Report (Institute of International Finance, 2021).

"Many large asset owners have called on companies to commit to achieving net-zero emissions: for example, BlackRock CEO Larry Fink wrote to chief executives saying his company would now avoid investments in companies that "present a high sustainability-related risk". In September 2020, the Climate Action Steering Committee, involving more than 500 global investors with over $47 trillion in assets, sent a letter to CEOs and chairs of the board at 161 global companies calling on firms to commit to net-zero business strategies. Signals like these have prompted companies to focus on addressing their GHG footprints— a shift that is visible across several sectors."
Moreover, the regulatory market is much more fragmented; whilst a single global market would be economically desirable as one ton of greenhouse gas has the same consequences for climate change regardless of where its emitted, this vision seems impossible. Instead, on the regulatory side of things, we see a multiplicity of regional, national, and even subnational markets emerging, most notably the Emissions Trading System set up by the European Union in 2005 and the Regional Greenhouse Gas Initiative in the North-eastern United States.

MARKET MATURITY ISSUES

Despite these promising signs, there remain significant hurdles to be overcome before voluntary carbon markets can achieve similar maturity to other advanced markets, such as corn, metals, and power. Given the demand and potential demand for both voluntary and regulatory carbon credits that could ensue from global reductions in GHG, a large, transparent and verifiable voluntary carbon market is needed. Today's market, however, is fragmented and complex, and key issues around verifiability and transparency need to be resolved (McKinsey, 2021). Limited pricing data makes it challenging for buyers to know whether they are paying a fair price, and for suppliers to manage the risk they take on by financing and working on carbon-reduction projects. It is crucial that the issues to be discussed are resolved for the market to fulfil its potential. In this regard, initiatives such as the Taskforce demonstrate that the market is heading in the right direction, and the COP21 summit should be crucial.
In this section, we shall outline some of the key market maturity issues facing both the voluntary and regulatory markets and the steps needed to address these issues.

Volume Of Supply:

One of the key issues affecting the voluntary markets revolves around the volume of carbon credit supplies. A mismatch between issuance and retirement of credits has resulted in more supply than demand of credits for nearly every year on record. And whilst the forecasted increase in demand for carbon credits is significant, McKinsey analysis suggests that only in 2030 could demand be matched by the potential annual supply of carbon credits. This oversupply of credits has contributed to average carbon credit prices falling almost every year from 2008 onwards reducing from $7.3 per ton of CO2 in 2008 to approximately $2.7 in 2019 (World Bank, 2020).
This, however, may be misleading as prices significantly differ depending on the category of carbon credits.

Analysis by Rabo Research (Poolen and Ryszka, 2021) demonstrates that the lowest average prices are paid for renewable energy projects (USD 1.4 /ton CO2e), whereas projects in forestry and land use see the highest average prices (USD 4.3 /ton CO2e). In 2019, prices for offsets from renewable energy decreased by 16 percent while their volume surged by 78 percent (Ecosystems Marketplace, 2020). These credits are cheap because their additionality is contested. Additionally, an expected acceleration in demand toward 2030 will make it difficult for the supply of high-quality carbon credits to keep up.

Quality Assurance Issues :

The quality of carbon credits remains an issue of concern. As mentioned above, whilst supplies of voluntary credits are high, buyers are concerned about the quality of credits being supplied, and there is a dearth of high quality, verifiable carbon credits in the market. Accounting and verification methodologies vary, with buyers being especially concerned about permanence – whether projects maintain GHG reductions or removals on a permanent basis. The issues currently posed in this regard can be reflected in comments made by Microsoft employees; "There are not enough verified – verified is the keyword – carbon offset credits in the world today just to satisfy Microsoft's needs for this year," (Allison, 2020).

Meanwhile, on the supply side, suppliers endure long lead times when seeking to get credits verified. Additionally, when selling those credits, suppliers face unpredictable demand and can seldom fetch economical prices due to limited pricing data (Payiatakis, 2021).

Price volatility increases risk::

Given the long lead time of low carbon investments, volatility makes it difficult for project sponsors to secure financing. In the medium-long term, the value of some existing credits may be questioned as they become "legacy" projects which may be older than a decade. Regulators, seeking to accelerate the transition to net-zero, may withdraw acceptance of these credits, rendering them worthless at a particular point. This is something that is beginning to happen to carbon credits released under the Kyoto Protocol's Clean Development Mechanism.

Meanwhile, on the regulatory side of things, ETSs are vulnerable to political lobbying which can delay implementation/tightening of the cap (and hence delay emission reductions) and a lack of long-term commitment can cause prices to fall, as was the case with the EU ETS in 2016. Nonetheless, this is perhaps less of an issue than feared. The market is now much more resilient and responsive than previously, as demonstrated by allowance prices during the Pandemic. Although allowance prices in regulated carbon markets fell during the start of the pandemic, as governments initiated lockdowns to contain the virus, by June most markets began to recover. By the end of the year, in America's Regional Greenhouse Gas Initiative, prices closed 43% higher than at the start of the year, and allowance prices in the EU had risen by 45% (Kardish, 2021). This resilience is in part a result of two factors.

Firstly, carbon markets now have more widespread mechanisms and tools to create more stable and predictable conditions than previously. For instance, the EU's Market Stability Reserve was introduced in 2019 to address allowance surpluses by adjusting the supply based on certain criteria and made an impact even before the pandemic. Secondly, there are now increased commitments from major governments towards a net-zero future which have boosted investor confidence and long term prospects for higher prices.

Whilst these issues are significant, the Taskforce on Scaling Voluntary Carbon Markets seeks to address these issues and has identified key areas for action.

Core carbon principles (CCPs) :

To increase the efficiency of transactions and address the lack of a centralised market infrastructure, the Taskforce produced a set of Core carbon Principles for the market to align to. These principles set out guidelines and quality criteria to which a carbon credit, and supporting methodologies. This will help to resolve the issue of transparency and fears over low quality carbon credits in the market.

Core Carbon Reference Contracts :

To address the issue of carbon credit fragmentation and transaction inefficiencies, the Taskforce lays out plans for Reference contracts that will allow for more efficient matching of buyers and suppliers. This helps both by creating less hassle for buyers, and also giving suppliers clearer price signals to inform their investment decisions.

Infrastructure and data :

The Taskforce sets out a blueprint to create a core set of infrastructure components capable of scaling up the voluntary markets as well as increasing standardisation. Amongst other things, it recommends further exchanges and clearinghouses, as well as the development of meta-registries to provide a custodian-like service for buyers and suppliers.

Demand Signals :

Clearer demand signals could be one of the most important factors in driving the development of the voluntary market and increasing liquidity according to the Taskforce. In this regard, it proposes four recommendations:
(I) creation of mechanisms for demand signalling; (II) increased collaboration and commitments across industries; (III) more consistent guidance on offsetting; and (iv) enhanced consumer product offerings.

HOW ARE CARBON CREDITS VALUED?

A framework for valuing carbon was proposed in a report by the EDF (Environmental Defence Fund, 2020). According to this report, six main factors determine the quality of a carbon credit. The criteria start with how the project impacts emissions. This factor is split into additionality, vulnerability and how the quantity of emission reduced by the project is measured. Additionality and vulnerability are linked to whether the emission removal project I.e., would Sabien's technology continue to be used if carbon credits were not issued alongside them. Essentially credits from a vulnerable project are valued highly by this criterion because without the payoffs from the credits the project would cease. For instance, the MC02 token by Moss is a project associated with limiting deforestation in the Amazon. Without the proceeds from the carbon token, deforestation in the Amazon would almost certainly continue. Therefore, credits are crucial to the survival of that project and so would be valued highly. On the other hand, Sabien's process differs from this because energy savings are the priority and carbon savings are a by-product so carbon credits from Sabien technology would not be valued highly. Sabien's technology is linked to the cloud and the energy savings are tracked so the quantification of emissions removed will be fully accurate and this would also increase the value of a Sabien carbon credit.

The second factor for valuing an emission reduction process is how well the project avoids double counting of emissions. Double counting can happen in several ways: more than one carbon credit can be issued for the same emission removal, the same carbon credit can be counted twice towards a climate goal and overlapping of Emission Trading Schemes could also lead to double counting. All the issues associated with double counting can be avoided with proper tracking of emissions which blockchain technology facilitates.
The next factor according to the EDF is what happens in the case of non-performance. A high-quality emission removal project must establish who is liable in the case of unfulfilled carbon removals. The potential damage done by non-performance is also considered in the valuation and the actions that have been taken to mitigate this.

Another factor to consider is if the technology facilitates a move towards net-zero emissions. The host company must show a commitment to the Paris Agreement's goal to limit the increase in global average temperatures to 1.5 degrees. Carbon credits from programs that show that they are genuinely concerned with climate change are sought after because buyers can be assured of the host's commitment to reduce emission and therefore supplying credits. The strength of the emission crediting program that the credit is issued under also affects the value of the carbon credit. High-quality credits require transparent projects, and this could be achieved with monthly reports of emissions and credits associated with Sabien's cloud technology.

The auditing process is crucial for an emission removal process before credits are issued. An accredited auditor must first approve the project and then confirm that the expected quantity of emissions is being removed. These two processes are referred to as validation and verification, respectively. In the validation period, the amount of carbon that will be saved by the project each year is quantified. Once the project has been validated, the project manager requests the registration certificates of these carbon savings. These certificates are the carbon credits.

The final factor that determines the value of an emission credit is the societal and environmental impact of the project therefore projects that improve the surrounding community beyond just removing emissions are highly valued by this criterion. For instance, a project that acquires credits through afforestation in regions that are frequently undergoing droughts has the added effect of improving the climate thus reducing the severity of droughts in the area. In this case, potential buyers would consider the added positive effect of the emissions project and choose this credit over one that just removes emissions such as a credit from a carbon sequestration project

ANALYSIS OF THE EUROPEAN UNION (EU)

1.The EU shows its strong ambition on Climate Change

The EU is one of the most ambitious leaders in fighting climate change. The EU ETS is the cornerstone of the European Union's strategy to reducing Greenhouse gas emissions. It's the world's first major carbon trading market and remains the biggest one. It operates in all EU countries plus Iceland, Liechtenstein and Norway (EEA-EFTA states), and in 2017, the EU and Switzerland signed an agreement to link their emissions trading systems. The agreement entered into force on 1 January 2020, and the link became operational in September that year. (European Commission, 2021)

On 14 July 2021, the European Commission adopted a series of legislative proposals setting out how it intends to achieve climate neutrality in the EU by 2050 and at least 55% net reduction in greenhouse gas emissions by 2030(European Commission, 2021).

Besides, the numerous social movements engaging in climate change in the EU could also be favourable for Sabien to enter the EU carbon market.

2.Risks of Entering the EU Market

2.1 The Regulatory Carbon Market

The EU ETS doesn’t cover all the sectors that Sabien invests

The EU ETS limits emissions from around 10,000 installations in the power sector and manufacturing industry, as well as airlines operating between these countries, and covers around 40% of the EU's greenhouse gas emissions. But it doesn’t cover all the sectors that Sabien invests currently, except heating.

Sectors and gases covered by the EU ETS (European Commission, 2021):

The EU ETS covers the following sectors and gases, focusing on emissions that can be measured, reported and verified with a high level of accuracy:

- carbon dioxide (CO2) from:

- electricity and heat generation,

- energy-intensive industry sectors including oil refineries, steelworks, and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals,

- commercial aviation within the European Economic Area;

- nitrous oxide (N2O) from the production of nitric, adipic and glyoxylic acids and glyoxal;
- perfluorocarbons (PFCs) from the production of aluminium.

Participation in the EU ETS is mandatory for companies in these sectors, but:

- In some sectors, only installations above a certain size are included,
- Certain small installations can be excluded if governments put in place fiscal or other measures that will cut their emissions by an equivalent amount,
- In the aviation sector, until 31 December 2023, the EU ETS will apply only to flights between airports located in the European Economic Area.

2.2 The Voluntary Market

2.2.1 Risk of issuing energy efficiency carbon credit :

Among all the carbon offset project types, the market volume of energy efficiency offsets project is relatively small, only 283 KtCO2e in 2015 with a value of €3.1M, while the reforestation project had a volume of 1.9 MtCO2e with a value of €14.0M (Hamrick, Brotto, 2017). The four most popular carbon offset project types are forestry and conservation, renewable energy, landfill, and biomass (MO.SS, 2021). Those are not the areas that Sabien focus on currently. Moreover, in the EU, only Swiss and Italian buyers are interested in energy efficiency projects.

2.2.2 EU offsets projects might be less attractive for the EU buyers :

The bulk of offsets sold by European organizations in 2015 came from projects located in non-EU countries, mainly in Asia (Hamrick, Brotto, 2017). In addition, the EU offsets were the most expensive one among all the regions in 2015 (Hamrick, Brotto, 2017). This could be a risk if Sabien wants to cooperate with the EU local companies and issue carbon credits.

2.2.3 Carbon taxes across the EU countries :

The carbon tax is one of the most effective approaches to put a price on GHG emissions. This section is divided into two parts: the analysis of countries requiring high carbon tax and countries with the biggest GHG emitters to provide an overview of how carbon taxes are different across the EU countries.

(1) Countries requiring high carbon tax

Sweden, Finland, Norway

Sweden, Finland and Norway are the countries that have the highest carbon taxes in the world. Sweden levies the highest carbon tax rate at €116.33 per ton of carbon emissions. Finland (€62) and Norway (€58.59), ranking #4 and #5 in the EU. The tax policies are similar among these three countries, the carbon tax targets fossil fuels—such as petrol, oil, and coal—used for heating purposes as well as motor fuels. there are also exemptions for fuel depending on its use. For example, fuel used for purposes other than motors or heating is not subject to the tax (OECD, 2019).

France

Same as Sweden, Finland and Norway, France puts a price on carbon both through a national carbon tax system and through a common cap and trade system of the European Union. The national carbon tax (la taxe carbone) was launched in 2014. The tax, taking the form of an excise duty, is imposed on carbon, natural gas, and energy products according to their CO2 content (Ministère de la transition écologique, 2021). The current carbon tax is France is around €45 per ton of carbon emissions, ranking #6 in Europe (World Bank, 2021).

In 2018, President Émmanuel Macron planned to further raise the carbon tax, up to €86.20/CO2-tonne by 2022. However, the proposal met with violent popular protests by the yellow vest's movement, who perceived the measure as socially unjust. The raise was eventually discarded, and the tax has since been frozen at €44.60 (Climate Scorecard, 2020).
Another problem with the French carbon tax is that it allows exemptions for various economic sectors. Domestic air and water transport remain completely exempt, while road transports have their taxes partly reimbursed (Climate Scorecard, 2020).

(2) Countries with the biggest GHG emitters

Poland

Poland is the one we don't recommend Sabien to invest. It has one of the lowest carbon taxes in the EU, only €0.07 per ton of carbon emissions (World Bank, 2021). And Poland was the only member state not to commit to climate neutrality by 2050 when the bloc set the target in 2019. The government has long courted political support from interests in coal (Reuters, 2021).

Germany

The German government has decided to put a price on greenhouse gas emissions in the transport and building sectors from 2021 as a key instrument to help reach its climate targets. The 'carbon consciousness' in Germany is growing. However, at the same time Germany allows carbon tax exemptions on the greenhouse gas emissions of suppliers or consumers of German heating and transport fuel (Journalism for the energy transition, 2021).

3.Conclusion

In a nutshell, the EU might not be the ideal place for Sabien to launch energy efficiency carbon credit. But there could be a potential short-term market for carbon savings in Sweden, Finland, Norway, France and Germany.

ANALYSIS OF THE UNITED KINGDOM (UK)

The UK is a leading country in the race to zero-emission, being the first major economy to commit to ending its Greenhouse gas emissions, the UK shows promising prospects for investment. Like the EU, the UK has ambitious goals and legal requirements to reach net-zero by 2050 (Department for Business, Energy & Industrial Strategy, 2019). Thus, the current political and legal environments could be encouraging factors for Sabien to enter the UK carbon savings market.

Many of the UK's guidelines for the terms to meet the emission goals have been conducted by the Climate change committee (CCC). Under their sixths carbon budget, the UK has been recommended to slash emissions by 78% by 2035 compared to 1990s levels, thus bringing the UK's target earlier by nearly 15 years (Climate Change Committee, 2020). Below, figure 1 gives an idea of how the CCS (Carbon Capture and Storage) rollout to net-zero will affect Sabien. In less than 10 years of publishing this report, the boiler and transport industries aim to go "low carbon". This does pose the question of whether this is enough time for Sabien to implement and roll out its own trading platform or whether it is more profitable and efficient to use existing platforms for trading. Nonetheless, this provides opportunities for Sabien to expand its service from energy-saving on GHG emissions to energy saving on the new sustainable fuel types.

1. **Low carbon solutions- 2030: cars, vans, boilers are low carbon, mainly electric.**
2. **2040- new trucks are low carbon, renewable energy shift and CCS technologies**
3. **2035- UK electricity production is zero carbon with a focus on Wind energy**
4. **2050-hydrogen replaces gas for heating**

Figure 1: How the Climate change committee's guidelines will affect Sabien.

Since the beginning of 2021, the UK has transitioned to its very own Emissions Trading Scheme (ETS) following its departure from the EU. This scheme's first phase runs from 2021 to 2030 and it follows similar standards to the EU with a cap-and-trade system, however arguably with more ambitious goals as the cap is 5% lower than the UK's share in the EU. At present, the ETS covers activities involving combustions of fuels in installation with a total thermal input that exceeds 20MW, this applies to energy-intensive industries, the power generation sector and aviation routes. The routes include "UK domestic flights between the UK and Gibraltar, and flights departing the UK to European Economic Area states conducted by all included aircraft operators, regardless of nationality." (Department for Business, Energy & Industrial Strategy, 2021). Although the legal environment opens doors for investment, these are not the sectors that Sabien currently invests in.

Nonetheless, voluntary carbon offsetting has spiked interest in those companies who are no longer waiting around for governments to take the lead, they have decided to take matters into their own hand as a response to ESG risk management and as part of their corporate social responsibility.

In a domestic survey that conducted proposals for the future of UK carbon pricing, 130 stakeholders responded with 61% agreeing that the scope of sectors should be increased under the ETS with suggestions to include transport and commercial and residential heating. The government have responded with aims to achieve this in time for their next review which will be held no later than 2026 (Department for Business, Energy & Industrial Strategy, 2019).

Moreover, UK companies make up almost one-third of the companies who have signed up to the United Nations global race to zero campaign that encourages companies to make voluntary commitments to meet the 2050 goal and these UK companies represent a total market capitalization of £630 billion pounds. Hence in this region, the voluntary market appears to be more feasible than the compliance market. (GOV.UK,2021) .

What is the Carbon price in the UK?

The UK ETS intends to cover 155 megatonnes of CO2e in its first year (edie, 2021) and since very first the opening of the UK's carbon market on Wednesday 19th May, prices reached £49.09 per tonnes of carbon emissions which was £5 higher than EU prices (Department for Business, Energy & Industrial Strategy, 2021) Although profitable, for large polluters this can be a hefty price to pay and it could also cause a loss to competitors, this could lead to carbon leakages. The government have aimed to reduce this risk through various methods. Firstly, by allocating heavy polluters free allowances to prevent carbon leakages. Secondly, implementing an intervention known as a cost containment mechanism (CCM). This tool allows the UK ETS authorities to intervene if prices are elevated for a sustained period for instance in August the average carbon price was calculated from the 2-year reference period from 1 May 2019 to 30 April 2021 to give a value of £44.74. Hence for the CCM to be triggered, the monthly carbon average price will need to exceed this value for a sustained period.
The ETS also has an auction reserve price (ARP) of £22 which means carbon cannot be auctioned below this price thus ensuring the stability of the market.
Although many risks have been considered, the UK ETS is still mostly under review with plans to open a trading link with the EU- following a similar approach to Switzerland. However, this depends if the conditions are favourable to the UK, if not these decisions can determine whether the UK is a stand-alone market or not which may then affect Sabien's choice to invest in this market This may be the downside to investing in this market in the UK as the scheme has not been fully developed yet, none the less the scheme does aim to limit environmental risks by allocating free allowances to compensate business, also if there is a global link with the EU, this may prevent carbon leakage.

ANALYSIS OF NORTH AMERICA

North America is a key region in addressing climate change and carbon markets. America is home to one of the world's largest multi-sectoral ETS – the Californian 'cap and trade' system, and the US has vowed to cut its carbon emissions in half by the end of this decade. Unlike the regions previously discussed, however, America does not have a federal carbon market, instead of regulating emissions on a state-by-state basis. Whilst this permits each state to flexibly set their own targets, and be as ambitious as they like, it also creates much fragmentation in the regulatory market and acts as a barrier to standardization. In this sense, America is a good target for the voluntary market, as environmentally responsible companies may fall outside the scope of their state's regulated emissions market (if they have one at all) and therefore many companies must resort to buying voluntary credits if they wish to offset emissions.

This will not change for the near future; Democrats hold a slim majority, divided over the issue of climate change, with the newer faction opposing market-based emission reduction measures which they view as granting companies the ability to "purchase" their way out of emission controls. Furthermore, in a post Covid-era, policies like federal carbon trading schemes appear less attractive because they appear to favour a "Wall Street Crowd" and are hence viewed negatively when compared to efficiency or renewable power mandates that are tied to poverty alleviation and job creation.

Nonetheless, the Biden administration's climate pledges are much more aggressive and ambitious than any of his predecessors. The recent Covid-19 pandemic has spurred climate policies forward, with the Trump administrations Consolidated Appropriations Act and emergency stimulus funding including tax breaks for renewables and incentivising investment in low carbon technologies. Since then, the Biden administration has passed the $2tn "American Jobs Plan" which focuses on infrastructure and includes a national clean electricity standard as well as billions in subsidies for low-carbon energy and electric vehicles (Whitehouse, 2021).

These aggressive policies have been reflected in ambition amongst individual states. The Regional Greenhouse Gas Initiative (RGGI) is America's oldest cap-and-trade system, and covers power generation emissions from 11 North-Eastern states, with Pennsylvania considering membership and Virginia having joined at the start of the year. Some RGGI member states are also widening the coverage of their carbon markets to include transportation fuels from 2023 onwards (Latham & Watkins LLP, 2019). Meanwhile, efforts have continued in other states such as Washington and Oregon to introduce carbon markets, although both these states face stiff political and legal opposition in doing so. Similarly, oil-industry lobbyists have been implicated in holding back state initiatives to try and introduce carbon pricing.

Nonetheless, as the RGGI demonstrates, there have been successful examples of regional cap-and-trade systems in the US. The Californian Cap and Trade system is America's biggest, covering 85% of the state's emissions and is part of a goal to reach economy-wide carbon neutrality by 2045. However, whilst currently significant, schemes such as the Californian cap-and=-trade scheme are set to play smaller roles in America's long term climate strategy; instead, more emphasis will be placed on emission reductions through additional policies such as increased energy efficiency. Indeed, historically, regulations rather than carbon caps have been the main driver of carbon reductions. Despite housing one of the world's largest regulatory markets, California doesn't itself rely just on carbon markets to reduce emissions - enacting an array of standard regulatory rules to reduce carbon emissions as well. For instance, before the introduction of the Californian market, the official plan was for such regulatory steps to account for 80% of the reduction in carbon emissions, and the carbon market for only 20% (Taylor, 2016). Thus, currently, less emphasis is placed on regulatory markets than in other comparable regions, such as the EU.

In regard to upcoming developments and industries, the transport sector is one area to watch. Traditionally, the transportation sector has placed relatively little emphasis on voluntarily offsetting emissions. However, this is quickly changing due to the aviation industry. Last year, all major US airlines signed up to the CORSIA scheme, in which they agreed to voluntarily offset all their emissions from flights by purchasing voluntary credits. This market will bring a predicted additional annual demand of 180 million tons of carbon per year from 2021 onwards (Forest Trends, 2020), and will bring additional demands once the scheme becomes mandatory in 2027.

Another relevant sector is construction and buildings. In 2018, direct greenhouse gas emissions from buildings accounted for 12 percent of total U.S. emissions, with 6.6% from commercial buildings and 5.6% from residential (Climateactiontracker.org, 2021) Political efforts there have been efforts have particularly focused on initiatives to make buildings more energy-efficient such as installing smart meters to monitor energy usage. However, these emission reduction efforts have been mixed. For example, there are marked differences in smart meter penetration across the region, ranging from just 6.4% in Hawaii to 92.8% in the Texas reliability region (Federal Energy Regulatory Commission, 2020). Furthermore, North America's building stock is considerably less efficient than other comparable wealthy nations due to growing housing stock and continued use of fossil fuels (Goldstein, Gounaridis and Newell, 2020), with around 50% of properties being heated with natural gas, with a third being heated by electricity (Statista, 2021). This, combined with a predicted increase in the use of appliances and electronics is expected to result in a net increase in greenhouse gas emissions by 2050. There are plans to decarbonise the electricity industry by 2035, but the US will need to do more if it wishes to meet its Paris Agreement emission targets. By this point, the market should have shifted from avoidance/reduction offsets that are common today, towards carbon sequestration and removal.

SOLUTION: BLOCKCHAIN IN CARBON MARKET

Although carbon credits are certificates in themselves, an added layer of protection makes carbon credits more secure to potential buyers. Blockchain offers several advantages in this respect. Blockchain networks are immutable, encrypted end-to-end and the information held by blockchain tokens would be stored on several computers. This makes it difficult for hackers to tamper with and because of the distributed ledger blockchain uses, transactions that are underpinned by blockchain are more transparent. Leading on from this, blockchain naturally creates an audit trail and coupled with the fact that the records are immutable, blockchain technology is well suited to tracking a credit from issuance, ongoing verification, and monitoring. Finally, blockchain is extremely useful because of how “smart contracts” can be implemented in a project. These contracts refer to automated processes where more data is added to the blockchain once a criterion has been met or an event has occurred.
We propose that each carbon credit be tokenised using blockchain technology into a new Sabien token. Furthermore, this tokenisation represents a building block that other financial instruments can be added onto. The company Moss has MC02, a carbon token that uses this very model that Sabien could incorporate (Moss, n.d.). The tokenised credit represents a simple secure crypto asset that is tied to a ton of carbon emissions that have been saved in the past. Aside from helping to stop double counting which counts towards a highly valued credit, creating a tokenised credit and platform would make it easier to incorporate savings from different Sabien technologies.

Conclusion

In summary, the voluntary market is the best approach for a supplier of carbon credits due to its accessibility and forecasted growth. Blockchain is touted as a crucial tool to improve the coordination and integrity of carbon markets. However, Sabien can only operate in energy efficiency carbon markets in the short-medium term. By 2050 the carbon market should have shifted to sequestration offsets, and away from reduction offsets that are common today. Finally, the Taskforce on Scaling Voluntary Carbon Markets, headed by Mark Carney will be crucial for growth and aims to establish the infrastructure required to support the scale-up of VCMs.

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