Analysis of Voluntary Carbon Market Stakeholders and Intermediaries

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1. Executive Summary

The carbon markets are increasingly being touted as a key part of the solution to climate change. In general, the carbon market can be broken down into two categories: first, the much larger compliance market; and second, the relatively small voluntary carbon market (VCM).

Both aim to put a price on an externality – namely, carbon emissions – with the compliance market typically taking some form of cap and trade or emissions trading programs, and the voluntary market taking the shape of offsetting emissions by funding emissions avoidance or reductions projects around the world.

The VCM, which has been around since the late 1980s in some form or another, has seen a major uptick in growth over the last several years: the number of credits retired has grown from 50m in 2017 to 200m in 2021. While 2022 looks to be a step back year for the VCM, the overall trends and predictions are that this market will grow. Growth has been fueled by increased consumer and corporate demand, a renewed (if not yet well-defined) emphasis on quality, and more prominent initiatives that are aiming to make the VCM into a mechanism that can help fund green projects around the world by tapping into polluters' coffers.

An expanding market, the VCM has seen a large number of new entrants and an increased number of stakeholders operate across all parts of the market. This report examines the stakeholders in the VCM, with a focus on intermediaries. This is an opaque part of the market, with few data points available on the intermediaries in this space, the volumes they are transacting, and who they deal with. This is in contrast to data available on projects and credit issuances, which are fairly well documented via registries; and claims on carbon credits, which are imperfect, but can be inferred via registries and companies' own annual reports.

In other words, while it's almost always possible to know who was involved in project creation and credit issuance, and data on end users of credits is fairly available (though far

from perfect), there exists almost no information about what happens between a credit issuance and retirement.

At AlliedOffsets, we have attempted to extrapolate as much of this information as possible, using the data available to us from public sources and elsewhere. We have focused on two key aspects of this part of the market: the connection between entities involved, and the pricing of credits that are being traded.

We end the report with some calls for increased transparency in the market. Due to the lack of trust in the VCM, going a step further in transparency would be a positive signal to those who are skeptical or are on the sidelines. Increased transparency would not solve all of the issues in the VCM, but it would make it much easier for stakeholders to understand the flows of money in the market, and where they may be best placed to participate in the market.

2. Introduction

This report aims to examine how carbon revenue is distributed in the voluntary carbon market. This includes gathering information on the general prevalence of the market activities in the voluntary carbon market, entities that are involved in generating credits, and some of the typical ways money flows among the stakeholders involved. We also examine the roles of intermediaries in the market, and examine the fees they charge for their services.

To provide the information described above, we have first done a high level analysis of the actors in the market and conducted desk research on the role of each in carbon credit pricing and the changes to pricing between credit issuance and retirement. The actors include project developers, owners and investors, numerous intermediaries, as well as project buyers. Later, we conducted interviews with members of each group, synthesized the findings and compared them with primary and secondary pricing data found on the AlliedOffsets dashboard and other sources such as reports or online sources.

The findings of the analysis are presented below. We start with a data overview, presenting the overall structure of the market for context: what are the volumes involved, and basic data

on the types of projects that are being used for offsetting, where they are located, etc. We move to describing how credits are generated, as well as stakeholder types and their roles in the market. Next, we discuss the credit pathways, including project development costs, across a number of project types; costs associated with registry validation and compare them to previously described development costs; and fees charged by intermediaries in the market. Later, we focus on buyers and examine specific cases of corporate offsetting. The last section concludes and offers recommendations.

3. Methodology and Data Collection

3.1. Data Synthesis

The report makes use of AlliedOffsets data to present an overview of the voluntary carbon market (VCM). The data comes from 16 of the world's biggest registries, though the key ones examined below are those from the American Carbon Registry (ACR), Climate Action Reserve (CAR), Gold Standard (GS), and Verra (VCS). Data on wholesale price estimates comes from AlliedOffsets's pricing model, which takes in data from brokers, project developers, and certain publicly-available information to create a price estimate for every project in the aggregated database. We supplement this information with data from resellers, which we track on a monthly basis, corporates' annual and / or sustainability reports, and more.

The data relating to the development costs of carbon credits came from interviews with project developers and intermediaries in the market. To find the fees intermediaries charge, we went through a sample of public websites of 125 resellers and brokers and, where available, reviewed the financial statements to find additional information on carbon credit sales. The average wholesale, reseller, and project type pricing were sourced from the AlliedOffsets database. The registry fees were found on the registry websites.

3.2. Desk Research

Desk research included a literature review of available secondary data on the VCM, especially project development and related costs, as well as the role of intermediaries in the market and their impact on carbon credit pricing in the secondary market.

3.3. Qualitative Interviews

We conducted interviews with dozens of project developers and brokers to gather qualitative and quantitative data and anecdotal evidence. Findings from these interviews are summarized in the sections below and have been anonymized. The interviewees were selected based on their role in the market.

4. Overall Structure of the Market

The VCM got its start in the mid-1990s, with early deals taking place as far back as 1996. Retirement data from ACR, CAR, GS, and VCS begins on December 31, 2004, with CoolClimate LLC offsetting 407 credits on behalf of Atmosclear Climate Club from the Des Plaines LFG to Energy project on ACR. Since then, there have been over 810m credits offset across ACR, CAR, GS, VCS, and CDM's voluntary retirements.

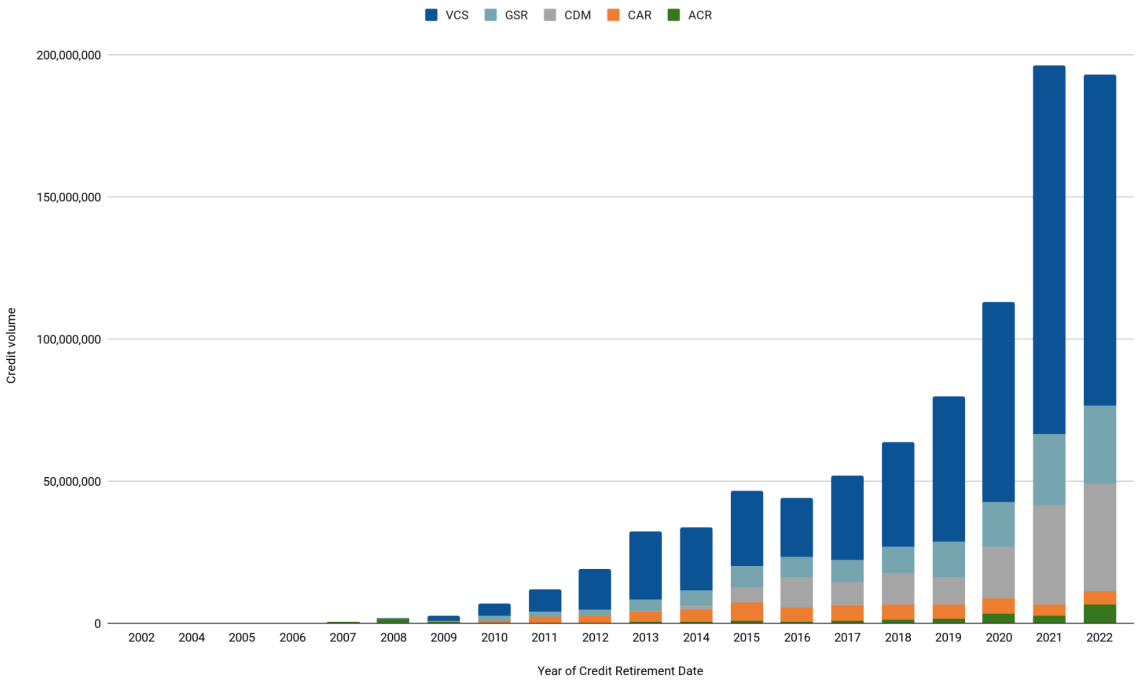


Figure 1: Credit retirements by registry over time

VCS projects have accounted for the majority of the retirements in the market, representing 66% of the market share. Since launching its registry, VCS has not held a less than 47% market share, and topped out at nearly 76% in 2012.

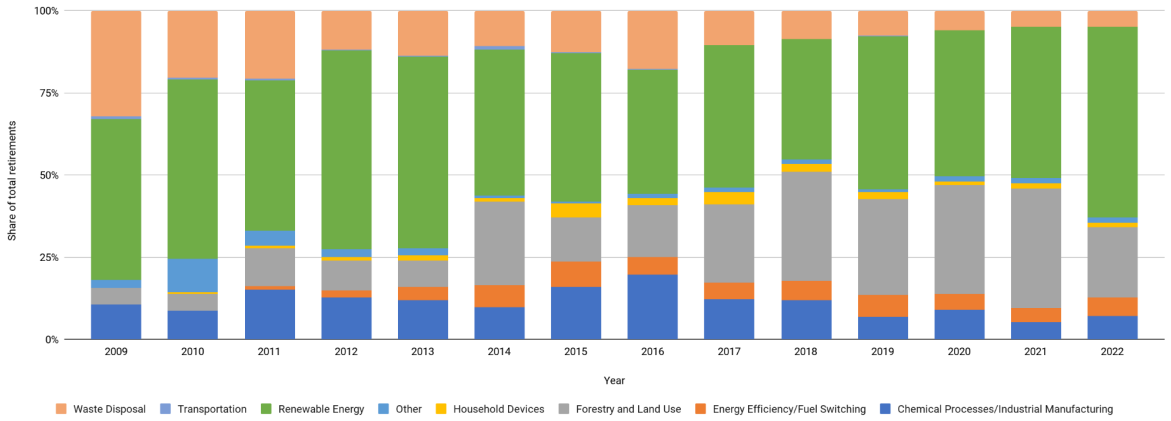


Figure 2: Share of issuances by project sector (source: AlliedOffsets, 2022)

Since 2009, the market has been dominated by Renewable Energy projects, with 40 to 60% of retirements in a given year going to projects from that sector. WIthin renewable energy, ACM2: Grid-connected electricity generation from renewable sources is the most prevalent methodology, when measured on the basis of credits retirement, accounting for 80% of retirements within the sector in 2021.

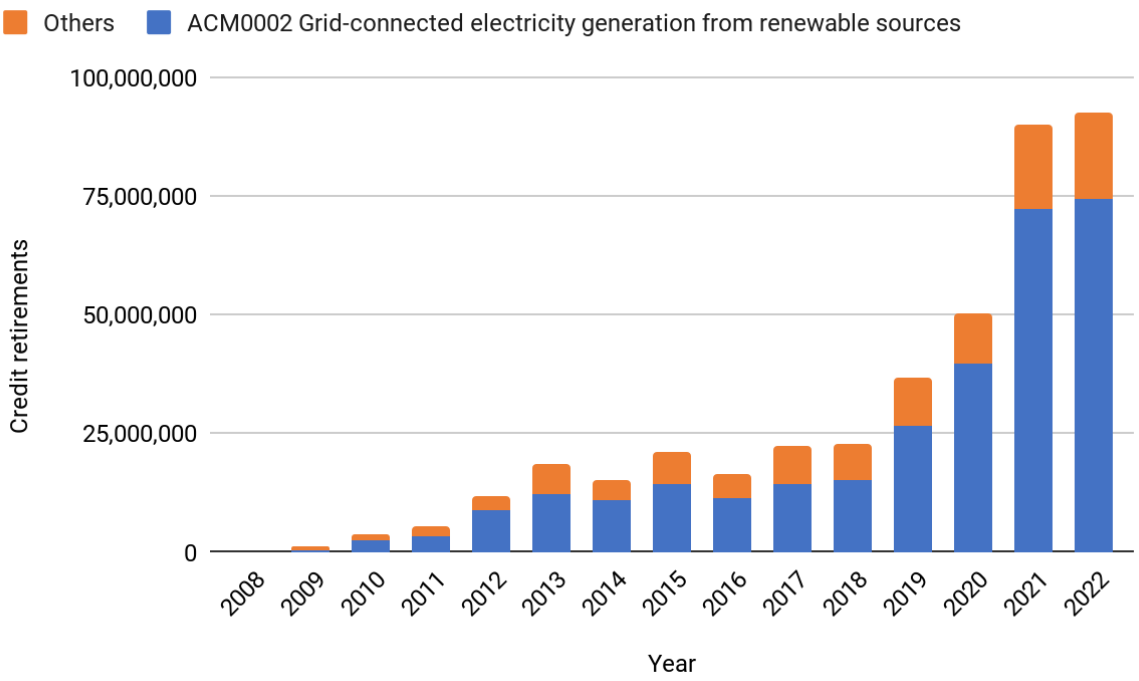


Figure 3: Renewable energy credit retirements over time (source: AlliedOffsets, 2022)

Since 2014, forestry and land use projects have also become a prominent part of the retirement ecosystem, accounting for roughly a quarter to a third of the overall retirements per year. Within forestry projects, four methodologies are the most prevalent: VM0015 Methodology for Avoided Unplanned Deforestation, VM0009 Methodology for Avoided Ecosystem Conversion, VM0007 REDD+ Methodology Framework (REDD+MF), and VM0004 Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests. In 2021, these methodologies combined for 82% of retirements within the forestry sector.

Geographically, the countries with over 50m credits retired since 2004 are India, China, US, and Brazil.

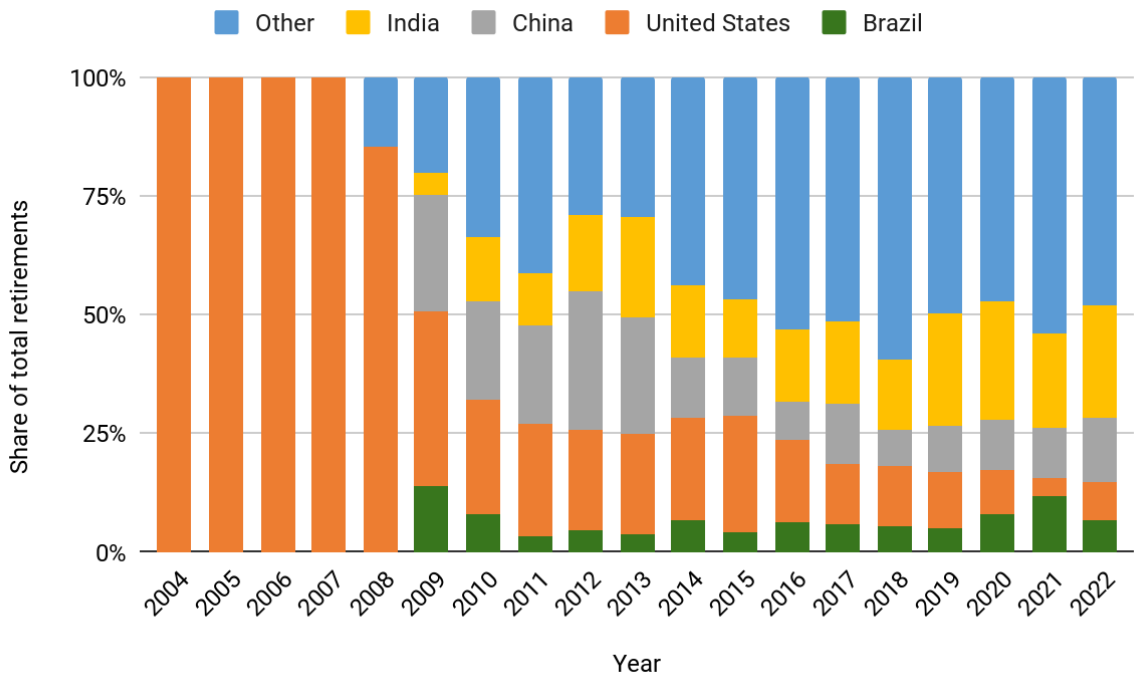


Figure 4: Share of credit retirements over 50m credits by country (source: AlliedOffsets, 2022)

The US has seen its market share fall in recent years, as international standards like GS and VCS have become more prominent. Other countries with 10m+ credits retired since 2004 are:

Table 1: Overview of the volume of retired credits by country (source: AlliedOffsets, 2022)

Country	Retired credits
India	176,790,595
China	108,304,546
United States	97,581,476
Brazil	65,233,088
Turkey	47,813,232
South Korea	43,835,140
Indonesia	43,713,585
Colombia	35,069,872
Peru	33,770,202
Kenya	25,123,397
Zimbabwe	20,047,856
Cambodia	15,179,119
South Africa	11,801,158
Uganda	11,468,073
Thailand	11,431,038

In some of these countries, like Turkey, the credits come from a large number of projects. In others, like Zimbabwe, the credits are generated by one major project (in the case of Zimbabwe, Kariba REDD+). The table below shows the top ten projects in terms of credits retired since 2004.

Table 2: Projects with most retired credits since 2004 (source: AlliedOffsets, 2022)

Project Name	Retired credits
Rimba Raya Biodiversity Reserve Project	21,497,877
KARIBA REDD+ PROJECT	19,981,890
REDD+ Project Resguardo Indigena Unificado Selva de Mataven (RIU SM)	18,720,429
Hydroelectric Project in Kinnaur District in Himachal Pradesh	12,367,118
Katingan Peatland Restoration and Conservation Project	11,403,297
Cordillera Azul National Park REDD Project	9,961,801
Hyundai Steel Waste Energy Cogeneration Project	9,903,477
Vishnuprayag Hydro-electric Project (VHEP) by Jaiprakash Power Ventures Ltd.(JPVL)	9,700,348
El Dorado Nitrogen, LP - Nitrous Oxide Abatement Project	8,417,135
Reduced Emissions from Deforestation and Degradation in Keo Seima Wildlife Sanctuary	8,083,477

As the market matures, an increasingly complex ecosystem of stakeholders has developed to support the funding, development, transaction, and retirement of carbon credits. Our report attempts to catalog this growing number of stakeholders, following the life cycle of a credit.

5. Carbon Credit Lifecycle

There are three broad categories of a project's lifecycle: creation of the credit, intermediation, and retirement. These three categories are laid out in more detail below, especially in figure 5, which examines the stakeholders that are present at each stage of the lifecycle. While we cover multiple scenarios in the sections below, each project is unique and makes use of structures and processes that make the most sense for it; therefore, the analysis below is meant to be illustrative, rather than instructional.

5.1. Credit Creation

In order for a credit to be created, a number of steps have to be completed, the first typically being to find the project and secure funding for it. The funding can come from various stakeholders and in various forms, from pre-purchase of credits, to a loan or equity investment. The earlier the investors come into the process, the riskier the funding activity is; however, that typically means the cost spent per credit tends to be lower than it is for those intermediaries or buyers that come into the process at a later stage, when the credits have been issued, and there is no uncertainty about the amount of credits that will be delivered. Next, projects must begin the project creation process.

Typically, standards setting bodies will ask project owners or developers to submit draft registration documents to ensure that the project meets minimum criteria. Verra, for example, asks projects to submit the draft project design document (PDD) and listing representation, which it reviews before allowing the project to be listed on the registry. On Gold Standard, once the project has been decided in principle, its proponents start formulating an Idea Note, which is a high level description of the project, its GHG reduction capabilities, as well as co-benefits and planned methodology. The project proponents also begin early stage preparations, which include a project plan, assessing the project's feasibility, and stakeholder consultation.

Then, preparation of the PDD begins. This document provides detailed and concrete information about the project such as expected emission reduction, scope of the project, quantifying and monitoring plans, and other social and environmental benefits of the endeavor. Next, a third-party auditor has to "validate" these plans and then after an initial project implementation period, the project is "verified" by an auditor who assesses the actual CO2 mitigation effectiveness of the project.

Once these steps have been successfully completed and the project has been certified by a standard and listed on a registry such as Gold Standard, project developers can start issuing and selling carbon credits. In the first half of 2022, over 160 million credits have been issued by Verra (under the VCS standard), American Carbon Registry (ACR), CAR (Climate

Action Reserve), and Gold Standard (GS) combined; more than 1.5 billion credits have been issued since 2004.

5.2. Intermediation

Issued credits can be bought by the end-buyers directly from project developers or transacted by intermediaries and sold again on the secondary market. The issued credits go into a stakeholder's registry account. On some standards setting bodies' registries, this information is publicly available, providing detailed data on which entities are holding onto which credits. On most registries, however, the data is not readily available, meaning there is no transparency around who has which projects' credits in their account.

In general, intermediaries help projects to find a stable source of demand for their credits. Many project owners do not have the expertise to put together marketing materials, identify potential buyers, and negotiate a worthwhile price – their expertise is limited to running the project's activities. Instead, they contract brokers or (sometimes) project developers to do this outreach on their behalf.

Brokers and resellers will typically highlight their projects' idiosyncrasies; exchanges, on the other hand, tend to offer standardized contracts that allow buyers to have the guarantee of a baseline criteria. This means that a buyer can purchase credits from a standardized contract and be sure that they will receive credits of a certain criteria, but not know which credits, specifically, they will receive. This has the benefit of promoting liquidity and increasing the number of transactions that take place in the VCM: if intermediaries have a guaranteed minimum standard they are working with, it gives them the confidence to transact with like-minded buyers. However, it also promotes a race to the bottom in that if a project developer has credits that are viewed as being higher quality than minimum criteria that the standardized contracts demand, they may perceive the standardized contract's pricing as the price floor for their credits.

Data on all transactions are not widely available, but some marketplaces and resellers publish data on transaction volumes. For example, a growing number of transactions are

done on exchanges. On CBL, an online exchange owned by Xpansiv, more than 121.5m credits were traded in 2021, which is a 288% increase compared to the previous year. Additionally, Carbon Trade eXchange (CTX) issued a press release stating that it had transacted almost 2 million credits combined in October and November 2021 (assuming this number was similar to previous months, it would add up to 12 million credits in total in 2021).

5.3. Retirement

Once a credit is bought by an end buyer, it can be retired upon purchase or at a later date. There have been 250,000+ retirement events since 2004, according to registry data, and the total number of credits retired over that period is 864m, with an average transaction size of ~3,200 credits.

Table 3: Average credit retirement size by project sector (source: AlliedOffsets, 2022)

Sector	Transaction Size
Chemical Processes/Industrial Manufacturing	12,261
Waste Disposal	9,681
Renewable Energy	4,169
Household Devices	2,952
Forestry and Land Use	2,310
Transportation	2,077
Energy Efficiency/Fuel Switching	1,722
Other	844
Agriculture	621

The table above shows the average number of credits retired in a transaction, broken down by sector. This can help indicate the types of buyers that purchase each project category. It shows that more industrial project types tend to be retired in larger amounts, indicating larger buyers that need a lot of credits; while projects with more co-benefits like agriculture

and energy efficiency (which include a number of clean cookstove projects) tend to be retired in smaller batches, appealing to smaller buyers.

Table 4: Average credits retired per project, by project type (source: AlliedOffsets, 2022)

Sector	Number of Projects	Retired Credits	Avg. Retired Credits
Renewable Energy	2,650	352,815,344	133,138
Forestry and Land Use	2,668	234,610,110	87,935
Chemical Processes/Industrial Manufacturing	586	55,168,662	94,144
Waste Disposal	631	50,611,253	80,208
Energy Efficiency/Fuel Switching	1,412	38,019,253	26,926
Household Devices	531	15,771,533	29,702
Other	119	13,981,782	117,494
Agriculture	693	2,006,778	2,896
Transportation	76	912,633	12,008

Forestry and Land Use credit retirements tend to be concentrated among a few large projects. There are 40 projects with over 1m credits retired, accounting for 192m credits: that's 82% of the total Forestry and Land Use credits.

Transactions also vary by registry, with novel players like Nori and Puro.earth registering smaller transactions (generally, at higher price):

Table 5: Average credit retirement by registry (source: AlliedOffsets, 2022)

Registry	Average of Retired Credits
NOR	23
PUR	307
GSR	1,319
VCS	3,315
ACORN	5,150
ACR	5,791
CAR	9,010
CDM	28,630

The numbers above help to put additional context around activity in the VCM. On Puro, a buyer is likely to be highly interested in the project's background, as the average volume is low – it will take a lot of these retirements to offset a firm's footprint, meaning Puro credits are more likely to form part of a larger company offset portfolio. On CDM, on the other hand, the buyers will likely care more about what volumes they're able to get, as the transaction sizes suggest bigger buyers.

To put these numbers into context, Exxon Mobil's scope 1, 2, and 3 emissions in 2021 amounted to 750 million tonnes of carbon dioxide emissions, which was significantly bigger than the size of the voluntary market that year. At the same time, some services-based companies are able to offset their entire carbon footprint with a few thousand credits.

Each of the three stages of carbon credit lifecycle is analyzed in more detail below, with a focus on the actors involved and their role in respective stages.

6. VCM Stakeholders and Their Involvement in the Credit Lifecycle

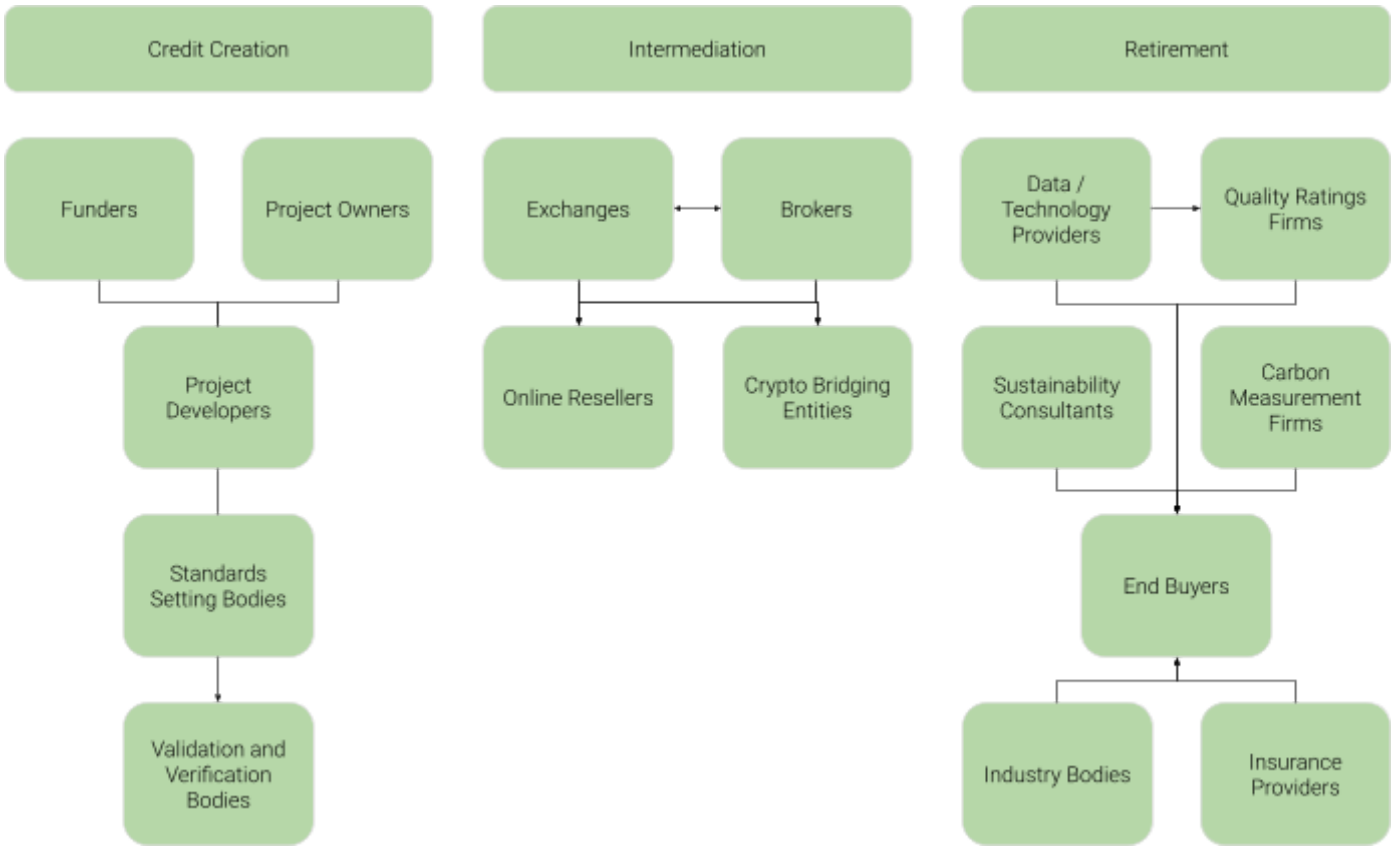


Figure 5: Overview of credit lifecycle and stakeholders involved

In this section, we describe actors in the VCM, with an explanation of how they operate with regards to credits creation and its lifespan until their retirement. It should be noted that some actors in the market take on multiple roles and hence function as hybrid entities.

This section provides a more in-depth description of the stages of a carbon project, based on aggregated data and conversations with actors in this space. Where possible, we have included data on costs and prices associated with each stage of the credit. It is important to

break down a credit's 'journey' in order to better understand how the costs and revenues are broken down at each stage of the process, culminating in a minimum credit price that is needed to make a project financially viable. In an efficient market with perfect competition, one would expect the marginal cost of credit production to also set its price. Given the current opaque nature of the VCM, prices are driven by more than just the cost of production; however, it is still important to examine costs in order to better understand what inputs go into creating a carbon credit, and attempt to establish a minimum price per tonne of CO2.

In dozens of conversations with project developers, brokers, and consultants, we were able to establish one constant: every project is different, and the cost and revenue structure for each one are different, too. However, there are some common themes and costs that can be presented as fairly standard to each project.

We examine some of these costs in more detail below, breaking down the analysis into three sections: household devices, forestry and other land use, and renewable energy.

6.1. Credit Creation

6.1.1. Funders

As the name suggests, project funders put money towards developing carbon credit projects. They are exposed to risk associated with project development and potential failure of the project to deliver the number of credits, and subsequently carbon revenue, estimated by PDDs. Their initial investment is usually recouped by revenue from carbon credit sales or other project activities. The funding can come in the form of equity, loans, or, in some cases, grants from national and international organizations. Another way projects get access to funding is via streaming, which allows funders to claim a share of future revenues from a project's carbon credit sales.

In general, developing a project takes a long time, and requires a lot of upfront investment. The specifics on the timing and the costs are project-specific, though there are some commonalities. Overall, the size of the project matters a lot in terms of setup and ongoing

costs, with larger projects costing more to set up initially, but cheaper per credit on an ongoing basis. Likewise, the investment behind a project will alter the project's financial viability and payback terms drastically. Projects that receive grant funding or are funded by the owners / developers will likely have more flexibility in paying back the money, whereas those who secured a loan or a revenue-sharing agreement with an investor will be more likely to sell the credits quickly.

Overall, costs related to the projects that are borne by the funders can be broken down into two cost structures: capital expenditures and operating costs. Capital expenditure involves everything that needs to be put into place in order for a project to be able to operate: purchasing land and assets, conducting feasibility studies, creating registry accounts, etc. Operating expenditure includes recurring costs that are incurred on an ongoing basis, in order to keep the project running. The costs include:

- Capital expenditure:
    - Land purchase
    - Purchase of equipment
    - Regulatory compliance costs
    - Stakeholder consultation meetings
    - Feasibility study
    - Registry fees
    - PDD development
- Operating expenditure:
    - Taxes (and other payments to government agencies)
    - Land lease
    - Labour
    - Sales and marketing
    - Energy and other inputs
    - Project monitoring
    - Credit issuance
    - Community benefit sharing costs (if applicable)

The costs listed above will further vary based on location, existing activities, ownership structure, similarity to other projects in the region, and staff expertise. For example, purchasing land may be a large upfront cost (thousands of dollars per hectare), or the land owner may already be part of the project. Likewise, a feasibility study may focus on the logistics of sourcing parts and assembling project equipment, if a project type is novel to the region. The stage of a project also matters for costs: renewable energy projects, for instance, begin generating credits more quickly than forestry ones, where the onus is on the project developer to prove that the project is having an impact, which can only be measured after a project has a track record of success.

6.1.2. Project Owners

Project owners operate and own the project implementation and assets. Often, they are land or renewable energy installers, or the organizations executing cookstove projects across emerging markets. Their focus is on running their project activities, not necessarily generating carbon credits, which is why they partner with developers in order to ascertain the potential for carbon crediting within their projects, and to guide them through the registration and validation/verification processes.

6.1.3. Project Developers

Project developers are a key component of the carbon credit value chain. They are essential to the VCM as they supply carbon credits to the market through project planning and implementation. Project developers can be for-profit or non-profit entities, and may be involved in numerous stages of the project; at the very least, they design the PDD that is submitted to standard setting bodies like Verra and Gold Standard. The PDD shows how a project adheres to its methodology, and calculates the amount of carbon credits that a project will receive if it is able to implement its activities.

Sometimes, the project developer and the project owner are the same entity; other times, they are distinct. For example, in the project GS7438, the project owner is listed as Potential

Energy, Inc., a Ugandan firm that is responsible for marketing, training, and distributing cookstoves; the project developer is listed in the PDD as Swiss Carbon Value Ltd., whose parent company is South Pole.

Likewise, in the project VCS1686, Agrocortex Madeiras do Acre Agroflorestal is listed as the project owner / proponent, and it is the owner of the land on which the project takes place; the project developer is listed as Ecológica Assessoria Ltda. in the PDD. Similarly, in the project VCS1654, Fazenda Nossa Senhora das Cachoeiras do Ituxi is listed as the proponent and landowner, while the organization Carbonext is the 'technical advisory in project development.' VCS832 follows a similar pattern, with CKBV Florestal Ltda being listed as the project proponent and owner, and TerraCarbon as the 'technical lead on development of VCS PD,' referring to the project documentation.

Project developers and owners overlap for a variety of reasons, but typically this is due to the expertise within the companies, as well as property ownership. Where the project developer has the ability to purchase the necessary equipment and land, and the expertise to run the project, they may choose to do so.

Project development includes fixed costs, such as registry fees, PDD preparation, and auditing, which tend to decrease per unit of credit generated as project size increases. However, sources (both research papers, as well as individuals we spoke with) define 'setup' or 'development' costs in several ways, which leads to reporting inconsistencies. This makes it difficult to compare not only values given but also cost groups and positions.The table below shows the costs associated with project development without the implementation costs.

The table below shows that project setup and ongoing costs are highly varied, and there is little consensus around what prices should be included in each stage.

The differences in costs, as stated before, can be explained by the heterogeneity of projects and subsequently of implementation costs. The section below describes examples of costs associated with project implementation and provides examples.

Table 6: Project costs breakdown overview

Cost	Definitions	Estimated value based on Pearson et al., 2013 ($)	Estimated value based on Carbon Co, 2018 ($)	Estimated value based on IBRD and WB, 2020 ($)	Estimated value based on UNEP, 2010 ($)	Estimated values based on FAO, 2010 ($)	Estimated values based on conversations with stakeholders
Search costs	Identification of project site and stakeholders	0 - 2,500	10,000	NA	NA	NA	NA
Feasibility study costs	Project feasibility study with GHG reduction assessments and idea note preparation	10,000 - 58,000	NA	NA	20,000 - 35,000	15,000 - 25,000	100,000 - 150,000
Registration costs	Project validation and verification fees, preparation of necessary documents, issuance fees	288,000 - 1,992,000	280,000 - 375,000 + issuance fees (assumed 0.19 per credit)	~200,000	115,000 - 220,000 + issuance fees	85,000 - 170,000 + issuance fees	50,000 - 1,000,000
Monitoring costs	Preparation of a monitoring plan and measuring and verification of the project's GHG reduction efficacy	240,000 - 840,000	25,000 - 55,000	114,000	20,000 - 60,000	3,500 - 25,000	10,000 - 35,000

6.1.3.1. Renewable Energy

The table below showcases a sample of eight renewable energy projects where the estimated price per credit is shown. The price per credit is important in that it helps a developer make a case for the credits being financially additional: if the renewable energy project's annual returns are lower than the benchmark rates in a country, the carbon credits are more likely to be justified as a way to provide additional financial support to make the project viable.

The variety in the numbers below (especially in the expected number of credits and the price) suggests that projects are using figures that have little precedent.

Upfront investment costs include insurance, design of the site, construction and construction permits, equipment purchase, as well as waste treatment. Operation expenses are driven by personnel costs, plant maintenance, fuel and energy consumption, and any overhead present. These cost types were consistent across PDDs examined, although their magnitude varied depending on the scale of the project.

Table 7: Overview of the costs and revenue of renewable energy projects (based on Project Design Documents)

Project name	Project ID	Crediting period (years)	Credits per MWh	Average annual credits	Total credits	Expected credit price (USD)	Investment cost (USD)	Operating cost (USD, total)	Total cost (USD)	IRR w/o credits	IRR w/ credits	Other revenue/Lifetime PPA revenue	Expected revenue from credits (USD)
Guizhou Qingshuihe Gelibridge Hydropower Project	VCS656	10	0.36	179,625	1,796,250	10.00	148,658,425	82,150,740	230,809,165	5.48%	6.88%	NA	17,962,500.00
CNOOC Pingyin Wind Farm Phase I project	GS11559	5	0.83	162,638	813,191	8.65	75,032,688	43,099,440	118,132,128	6.54%	8.08%	173,810,421	16,297,632.19
Inner Mongolia Tongliao Wind Farm Project Phase IV	VCS1313	7	1.224	121,480	850,360	13.00	58,016,908	21,008,454	79,025,362	6.38%	9.21%	NA	11,054,680.00
Saihanba East 45.05 MW Windfarm Project	VCS99	7	1.024	111,812	782,682	8.00	70,444,038	NA	70,444,038	6.81%	8.04%	9,951,991	6,261,456.00
Tire Biogas Power Plant	GS7781	5	0.57	110,953	554,763	3.00	15,048,200	48,709,354	63,757,554	10.60%	13.60%	76,903,331	1,664,288.10
Yantai Dongyuan Laizhou 48.5 MW Wind Farm Project Phase I	VCS588	7	1.075	94,845	663,915	12.00	66,352,748	14,511,541	80,864,289	6.60%	9.56%	187,302,662	7,966,980.00
Duzce Aksu Hydro Electricity Power Plant	VCS2095	10	0.53	75,832	753,820	4.00	75,994,712	6,112,546	82,107,258	10.02%	13.30%	NA	3,015,280.00
7.2 MW Nargund wind project for Grid system by Bhoruka Power Corporation Limited in Karnataka State, India.	VCS255	10	0.93	18,416	184,167	5.00	NA	NA	10 516 000	10.80%	11.86%	93,013,406	920,835.00

6.1.3.2. Household Devices

Cookstove projects make cooking more energy efficient, meaning users need to cut down fewer trees for fire burning. They are a popular type of carbon offsetting among companies, as they tend to feature co-benefits like improved healthcare for users. This makes the projects more marketable for their customers.

In many cases, there is no cash payment to the end users of the cookstoves; instead, the users are able to purchase the stoves at a subsidized price, or receive them for free. As part of the deal, the users sign away their rights to the carbon credits generated by the stoves, which are the property of the project owner or developer.

Costs associated with the development of household device projects are linked to the value of cookstoves used in the initiative. The price of an efficient cookstove ranges from $4 to $100 depending on its tier and emission reduction capabilities.

Table 8: Overview of credit issuance for cookstove projects

ID	Crediting period (years)	Average annual credits	Average cookstoves per year	Credits/stove per year
GS7438	4	171,495	15,100	11.4
GS7142	5	36,344	26,000	1.4
GS5780	7	4,252	343	12.4
GS1729	5	9,648	1,814	5.3
GS1247	21	9,014	2,080	4.3
GS7312	5	231,729	32,825	7.1

In addition to purchasing or building the cookstoves, other costs associated with cookstove project implementation are distribution and maintenance costs, monitoring of devices' efficacy, as well as costs of full time and temporary staff in operational and management roles. Often, a cookstove project is owned by a company whose mission is to distribute and maintain cookstoves to users, rather than distributing stoves on a one-off project basis,

meaning it incurs business costs like overhead, taxes, purchasing stoves and warehousing, etc.

In their investor presentations, Base Carbon and Carbon Streaming have laid out the investment sizes that go into funding a cookstove project, laid out below:

Table 9: Overview of investment costs related to cookstove projects

Investor	Investment	Credits	Stoves	Investment/ stove	Investment/ton
Base Carbon (Vietnam)	$20,800,000	26,600,000	1,210,000	$17	$1.28
Base Carbon (Rwanda)	$8,750,000	7,500,000	250,000	$35	$0.86
Carbon Streaming	$20,000,000	50,000,000	3,500,000	$6	$2.50

While this is a fairly simplistic way to examine the minimum price needed to cover an investment (as there may be other investments / revenue streams, the terms are not known, and the number of issued credits may differ from the projected), it does show general figures of how much it costs to get a large project off the ground. The differences among the projects may be attributed to a number of factors, including type of stove used, and the amount of biomass saved per stove.

6.1.3.3. Forestry

Depending on the methodology used, costs related to forestry projects can include reforestation related activities, or compensating for the opportunity cost (foregone earnings) of deforestation for local communities (assuming business as usual) and creating better local infrastructure, as well as land purchase or lease. These include permanent and temporary jobs in project-specific activities such as forest monitoring, building infrastructure, planting trees, and management.

The business model of a forestry project, and therefore the costs involved in setting up the project, vary by project methodology. When a project is protecting existing forest, the

operating costs involve purchasing monitoring equipment, hiring and training staff, and running any revenue-generating activities. When a project is involved in an afforestation/reforestation, costs will also include the purchase or lease of land and seeds for planting. When an afforestation project involves planting harvestable trees, there will be costs and revenues associated with cutting down and processing the timber, and planting new trees to replace those that have been harvested.

6.1.4. Standards Setting Bodies / Registries

These entities set the rules for the projects within their remit; they also operate the registries on which credits are issued, transferred, and retired. These entities approve methodologies for projects to adhere to, meaning that projects can only become part of a registry if the standards setting body offers the project methodology. These entities also determine which validation and verification bodies are allowed to audit projects.

The table below shows six of the top standards setting bodies with at least 100 projects listed in their registry, and the total number of projects listed (including pending and inactive projects). In order for a project to be approved by and listed by a registry, project proponents must pay registry fees.

Table 10: Number of projects per registry (source: AlliedOffsets, 2022)

Registry	Number of projects
VCS	3,178
LBC	308
GS	2,699
CDM	13,168
CAR	798
ACR	576

Below, we have aggregated registry certification fees for the biggest four voluntary registries. The registries distinguish between three types of registry fees, as explained below:

- *Account holder fees* - these include a one-off signup fee and / or annual fee that each account holder pays. This fee is payable by project developers, companies retiring credits under their own account, as well as various intermediaries.
- *Project registration fees* - project proponents are charged a number of one-off fixed fees during the project verification and registration process, in general independent of the volume of credits issued;
- *Ongoing credit issuance fees* - charged proportionally to the number of carbon credits issued by a project to project proponents.

Table 11: Registry fees summary

All fees in $	**Fixed Account Holder Fees**		**Fixed Project Flat Registration Fees**	**Variable Credit Fees per credit issued in the first year**	**Total Registration & First Year Issuance costs (issuance of 10,000 credits per year)**	**Total Registration & First Year Issuance costs (issuance of 100,000 credits per year)**	**Total Subsequent Issuance costs (issuance of 10,000 credits per year)**	**Total Subsequent Issuance costs (issuance of 100,000 credits per year)**
	Registration	Annual						
Verra	500	2,500	NA	0.10 + cumulative VCU issuance fee	1,000	13,100	500	13,100
GS	1,000	1,000	2,900	0.15	4,900	31,900	1,000	29,000
ACR	500	500	3,500	0.15	5,000	18,500	5,000	18,500
CAR	500	500	500	0.19	2,400	19,500	2,400	19,500

The table above shows different types of fees charged by registries during the registration process. Fixed registration fees include project design review, listing fees, or performance review (GS charges variable performance review fees as well) of the project depending on

the registry. The figures for GS represent averages across project types, as it charges different fees for different project types. A more detailed breakdown for all registries is available in the Appendix.

Based on this, project proponents wanting to issue 10,000 credits per year would face issuance costs between $500 (VCS) and $5,000 (ACR) which is equal to $0.15 and $0.50 per credit; a larger scale project targeting issuance of 100,000 units per year would be registered by a standard for anywhere between $13,100 (VCS) and $31,900 (GS), this translates into $0.19 and $0.32 per credit; this is the combined cost of issuance and registration of the project.

6.1.5. Validation and Verification Bodies

Validation and verification bodies (VVBs) ensure that the documents submitted by project proponents to registries are an accurate representation of the project's characteristics, carbon emissions reduction/removal capacity, and compliance with the standard's methodologies and other provisions.

Validation happens when a project has submitted its PDD, and is waiting for its activities to be recognized as being congruent with the project's methodology. Verification happens at regular stages on an ongoing basis over the project's lifetime, to ensure that the project continues to operate in the way it had set out to do at the start of the project.

Table 12: VVBs working with the most projects

Verifier	Projects Covered
Det Norske Veritas- CUK	2,892
TÜV SÜD South Asia Private Limited (TÜV SÜD)	1,498
RWTÜV GmbH	1,492
Bureau Veritas Certification Holding SAS (BVCH)	1,248
TÜV Rheinland (China) Ltd. (TÜV Rheinland)	1,074
SGS United Kingdom Limited (SGS)	1,062
Soil Association Certification Ltd	1036
Organic Farmers & Growers C.I.C.	453
RINA Services S.p.A. (RINA)	448
Tuev Nord Cert GmbH (Tuev Nord)	375
ERM Certification and Verification Services Limited (ERM CVS)	321
Lloyd's Register Quality Assurance Ltd. (LRQA)	313
Spanish Association for Standardisation and Certification (AENOR)	283
Japan Consulting Institute	281
LGAI Technological Center, S.A. (Applus+)	208
China Quality Certification Center (CQC)	205
Det Norske Veritas Climate Change Services AS (DNV)	203
China Environmental United Certification Center Co., Ltd. (CEC)	183
Bureau Veritas Certification Holding SAS (Bureau Veritas)	175
Perry Johnson Registrars Carbon Emissions Services (PJRCES)	170

VVBs are audited by the standards setting bodies, who are in charge of ensuring which methodologies a VVB is able to verify. Standards setting bodies with fewer projects in their registries tend to have a more concentrated distribution of VVBs. This is due to a number of factors, including more specialized project types, a smaller number of projects for VVBs to audit (making them comparatively less appealing), and fewer staff to oversee VVB activities on the part of the standards setting bodies. The table below shows the percentage of

projects audited by the top two most prominent auditors on the registry, highlighting the relative lack of choice project developers have when it comes to having their projects audited.

Table 13: Projects Audited by Top Two Verifiers on Registry

Registry	Share of Projects Audited by One of Top 2 Verifiers
PC	100%
WCC	89%
CCA	68%
PUR	57%
ACR	45%
CDM	33%
CAR	25%
VCS	22%

6.2. Intermediaries

These entities sit between project owners / developers and companies that ultimately retire the credits.

Based on the publicly available data on account holders sourced from American Carbon Registry and Climate Action Reserve, we found that there are 239 entities who identify as either a trader, broker, or a retailer. Some intermediaries operate under multiple legal entities and can use as many as 7 accounts, which were counted as unique entities here. Most (126) of the entities are registered in the United States, while the two next biggest countries are Australia and the United Kingdom -- each hosting 21 intermediaries. Gold Standard and Verra do not publicly disclose information on account holders, so we are limiting the analysis to these two registries only.

Table 14: Locations of intermediaries (source: ACR and CAR registry data, 2022)

Company Country	Number of intermediaries per country	Proportion of intermediaries per country
USA	126	52.72%
UK	21	8.79%
Australia	21	8.79%
Canada	14	5.86%
Switzerland	12	5.02%
Singapore	11	4.60%
France	6	2.51%
Netherlands	5	2.09%
Germany	5	2.09%
Spain	3	1.26%
Cayman Islands	2	0.84%
Taiwan	1	0.42%
Puerto Rico	1	0.42%
Panama	1	0.42%
Norway	1	0.42%
Mexico	1	0.42%
Jersey	1	0.42%
Japan	1	0.42%
India	1	0.42%
Hungary	1	0.42%
Hong Kong	1	0.42%
Estonia	1	0.42%
Denmark	1	0.42%
China	1	0.42%
Austria	1	0.42%
Grand Total	**239**	**100.00%**

While this data applies to ACR and CAR only, where the registries make the data publicly available, many of the entities operate across multiple registries, so there is likely to be overlap with other prominent registries.

6.2.1. Deal Structures

Based on the interviews conducted with project developers, we have identified several types of relationships that intermediaries have with project developers. These include:

- an annual fee paid to the intermediary for finding carbon credit buyers and negotiating a price on behalf of the project developer;
- direct sales to retail market through a marketplace, where the marketplace owner charges a fee on the credits sold through the platform (like the Gold Standard Marketplace)
- introductory fee, where an intermediary charges a fee to the developer for introducing him to potential buyers;
- intermediary buys the credits from a developer and hold them on his balance sheet to be sold later; the project developer may or may not know the prices charged by the reseller;
- floor and markup pricing, where a company commits to purchasing credits for a minimum price, and agrees on additional payments based on the final settlement price with the end buyer.

Given the increase in demand for carbon credits over the past three years, project developers have more choice in how they structure their deals. Some are able to dictate the end buyer of credits, or put in place clauses stipulating that a credit cannot be sold to another broker who will potentially pass the credit on indefinitely.

Typically, the price per credit (and potentially the margin) decrease with higher volumes, but the relationship is not linear. Given the opaque nature of the market, fees will further vary depending on the relationship between the broker and buyer/seller. The fee can be potentially higher if the intermediaries provide a level of quality control like in some forestry projects.

Unlike investors and project developers who are exposed to risk related to potential failure to deliver credits, traders have lower risk exposure, and may be expected to charge smaller fees

per credit. These fees are rarely publicly available and it is even rarer to provide information on how much money reaches the project developer; however, we identified 13 companies that provide transparency about their fee structure (see table 20).

When projects get higher prices per credit than it costs them to generate it, they can invest more into local communities (by building schools, setting up more workplace training programs, investing in health programs, hiring more staff, etc. which have positive spillover effects on the communities), keep the money as profit, or invest into creating more projects. The former lends itself more to nature-based projects, where community buy-in can be an important part of project success, while the latter is more common among household device projects, where the money goes into purchasing and distributing more cookstoves.

When projects are unable to sell enough credits, or at a price that is below their break-even mark, they may pursue grants or bridging loans, wait for prices to go up (thereby taking the risk that prices may fall further), cut certain benefits to communities, or end the project.

6.2.2. Online Resellers

Online resellers have established online marketplaces that cater, typically, to retail consumers. They buy credits from project developers or other intermediaries, and then sell the credits to the end buyers or other intermediaries at a markup. Because volumes are lower, prices tend to be higher on online marketplaces than elsewhere in the market.

Online resellers help facilitate a lot of retirement activity for projects in terms of the number of transactions, but not a lot of volume. The table below shows the characteristics of retirements that are under 100 credits, and those equal to and above 100 credits. While the smaller transactions account for over ⅔ of total retirement transactions in the market, they make up just 0.2% of the credits retired.

Table 15: Overview of retirements by transaction size (source: AlliedOffsets, 2022)

	Number of credits / transactions	**Percentage of overall credits / transactions**
Under 100 credits per transaction / Count of transactions for transaction volume	189,301	68%
Under 100 credits per transaction / Sum of credits retired	2,095,709	0.20%
Equal to and over 100 credit per transaction / Count of transactions	89,261	32%
Equal to and over 100 credit per transaction / Sum of credits retired	892,224,448	99.80%

6.2.3. Brokers

Brokers intermediate between project developers and buyers, sometimes without taking ownership of the credits, and other times by purchasing the credits and attempting to sell them off at a higher price. Brokers engage in the wholesale market and trade significantly higher volumes than online resellers.

Data on brokers is very sparse, with brokers or resellers reporting on just under 10% of credits retired in the VCM. Below are the brokers that have facilitated the largest number of retirements, in data publicly available via the registries going back to 2004. (Note that Gold Standard retirements represent the Gold Standard Marketplace.)

Table 16: Brokers with most credits publicly brokered (source: AlliedOffsets, 2022)

Broker / Reseller	Retired Credits Intermediated
GreenPrint	10,184,733
3Degrees	5,808,172
Natural Capital Partners	4,930,618
Bluesource	4,895,226
Greenchoice	4,763,751
Element Markets	4,604,768
Gold Standard	4,147,834
The Climate Trust	2,982,670
Carbonfund.org	2,820,712
Native	2,447,550

The transactions that involve brokers tend to be for large volumes of credits; the average brokered transaction size is just under 11,000 credits, rather than the overall retirement average of 2,700 credits per transaction. Below is a list of the top ten brokered transactions in terms of the number of credits retired. The table shows that there is no uniformity in how the data is presented: sometimes, the companies making use of the credits are named as the Account Holders, and sometimes it's the broker. In other cases, the Retirement Details contain both the name of the broker and the end user.

Table 17: Overview of biggest intermediated retirements (source: AlliedOffsets, 2022)

Broker	Company	Project Name	Retirement Date	Registry Account Holder	Registry Retirement Details	Retired Credits
Bluesource (now Anew)	TransAlta	Merit Energy Geo-Seq	2015	Blue Source	on behalf of TransAlta Corporation	376,274
Ecologi	AXA	Saint Nikola Wind Farm	2022	AXA Insurance DAC	Retired by Ecologi Action Ltd on behalf of AXA Insurance DAC	347,500
ecosecurities	Barclays	Waste Biomass Utilization at JSC Arkhangelsk Pulp and Paper Mill (APPM)	2009		Retired by EcoSecurities on behalf of Barclays to offset their 2009 carbon footprint	300,000
First Climate	AVIA	Zafarana KfW IV Wind Farm Project, Arab Republic of Egypt	2022		First Climate for AVIA AG	297,500
EcoFund	Brisbane City Council	Hyundai Steel Waste Energy Cogeneration Project	2013		Retirement of carbon offsets to cover Brisbane City Council's fleet, stationary energy & non GreenPowered streetlight emissions ... supplier: EcoFund QLD Pty Ltd	277,000
ClimateCare (now Climate Impact Partners)	Triton Partners	Solar Grouped project by ACME Group (EKIESL-VCS-Aug-16-01)	2020	Triton Partners	Retired by ClimateCare on behalf of Triton Partners to offset reported portfolio company 2019 Scope 1 & 2 emissions and Triton's direct 2019 Scope 2 and Scope 3 (business travel only) emissions.	269,155
Carbonfund.org	Netflix	The Envira Amazonia Project - A Tropical Forest Conservation Project in Acre, Brazil	2021	Carbonfund.org Foundation	Retired on Behalf of Netflix	214,500
ecosecurities	Banco BTG Pactual	Incomex Hydroelectric Project	2021		Voluntary offset retirement made by ecosecurities on behalf of Banco Bradesco S.A. to compensate 167.000 tCO2e corresponding to its operational GHG emissions from Scope 1, 2 and 3 generated in 2019.	167,000
3Degrees	Etsy	UPM Blandin Native American Hardwoods Conservation & Carbon Sequestration Project	2020	3Degrees Group, Inc.	Retired on behalf of Etsy, Inc.	151,356
3Degrees	Etsy	UPM Blandin Native American Hardwoods Conservation & Carbon Sequestration Project	2021	3Degrees Group, Inc.	Retired on behalf of Etsy, Inc.	151,355

Sometimes, project developers with an established business development team may themselves also broker the credits, while in other cases, the brokers are standalone entities that provide value to the market by helping project owners and developers find buyers for their credits, in exchange for a fee.

6.2.4. Exchanges

An exchange is a platform that allows holders of carbon credits to list them on their marketplace for a price, or to place an order for a credit that meets a certain criteria (VCS forestry project of 2018+ vintage, for example). Once listed, offsets can be purchased by any member of the exchange. Here, both sellers and buyers are charged a fee on the transaction, on top of the registration and annual membership fees.

Table 18: Overview of carbon credit exchange fees[1]

Exchange	Registration Fee	Annual Fee	Transaction fee BUYER (per credit)	Transaction fee SELLER (per credit)
CBL	NA	NA	$0.05	$0.05
AirCarbon	Not published	NA	NA	$5 per 1,000 credits
CTX (SME)	$1250	$595	5% - 10%	5% - 10%
CTX (Large/Listed Entities)	$1995	$995	5% - 10%	5% - 10%

AirCarbon and CBL have a minimum contract sizes of 1,000 credits, while CTX allows trades as low as 100 credits.

For example, for trades involving credits worth $10 per tonne, both the buyer and the seller of 10,000 credits would be charged between $50 and $10,000 (depending on the marketplace), whereas in a 100,000 credits trade the same agents would have to pay between $500 and $100,000 in fees.

[1] Sources for each exchange: CBL, AirCarbon, CTX (SME), CTX (Large/Listed Entities)

In addition to allowing projects to list their credits directly, exchanges also facilitate trade of standardized contracts. In this case, a project's credits must meet a certain criteria, which is then transferred to the buyer on the specified delivery date (often in the future). These contracts serve as a price guide for actors in the market, setting a price floor for certain projects, and providing liquidity for those looking to purchase large quantities of credits of a certain minimum criteria. However, project owners who feel they have a premium product may not want to list credits under a standard contract, as they will aim to fetch a higher price per credit via brokers, or by listing their project on the exchange.

This standardized contract structure is similar to what bridging entities and tokenized exchanges have done (see below).

Table 19: Trade volumes facilitated by exchanges[2]

Exchange	Traded volume
CBL	121.5m credits in 2021
AirCarbon	5.6m credits in first 8 months of 2021
CTX	0.85m credits in October 2021 and 1.1m credits in November 2021 (according to a newsletter)

Estimating 2021 volumes for AirCarbon and CTX to be ~10m credits each, the exchanges together would have facilitated ~140m worth of credit transactions in 2021. Ecosystem Marketplace, which collects survey data on the number and sizes of transactions within the market, found that its respondents had reported 493m credits transacted in 2021. Assuming that EM's survey captures ~80% of the market, the total amount of credits transacted may be at ~615m. This suggests that a credit is traded ~3.1 times before it is finally retired. Assuming these assumptions are reasonable, exchanges would represent about 23% of the VCM.

[2] AirCarbon data based on the following press release

6.2.5. Carbon Credit Bridging Entities

Carbon credit bridging entities bring carbon credits onto the blockchain. One carbon credit becomes a tokenized credit. This allows for a number of additional uses of the credits, including splitting credits up into amounts smaller than 1tCO2e (which is the typical theoretical value of a credit), and being able to better track how credits move among various users on the blockchain.

While the number of credits bridged has plummeted since the first weeks of launching in October 2021 (~9m of the ~22m bridged credits were tokenized in October), there is still ~$250,000 of daily trading activity taking place on the Base Carbon Tonne (BCT), the most prominent of the tokenized credits at the end of 2022. (This means that a credit selling for $5 that trades 10 times among a group of traders will generate $50 in trading activity, even though it's the same credit and its price doesn't change.) In sum, the market volumes for BCT have exceeded $3.1b, within 300 days of trading activity.

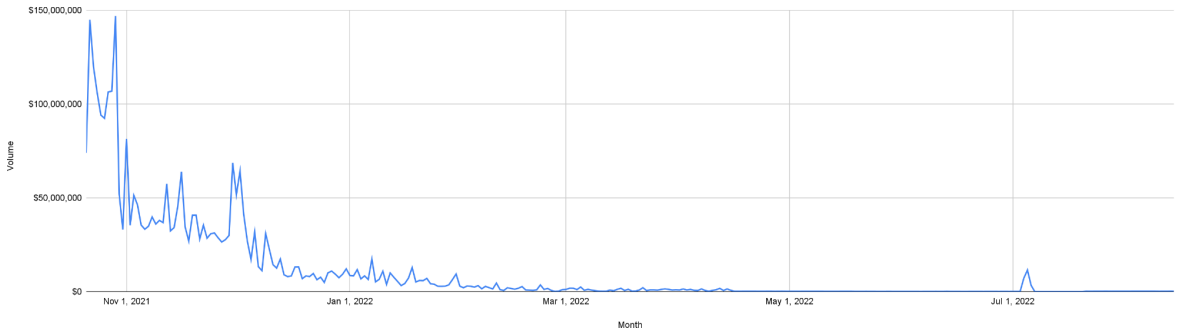


Figure 6: Volume of BCT traded over time

The most prominent bridging firm is Toucan, which has facilitated around 20m credits from Verra projects coming onto the blockchain.

6.2.6. Platform Fees

The sample of brokers examined includes 125 brokers and resellers, but only a fraction (13 of those in the sample) of the intermediaries state their markups on offset sales and another 9 disclose that the majority or revenue from credit sales goes towards projects. The average fee based on the sample of 13 intermediaries that publish their markups is 15.5%.

Table 20: Resellers' fees[3]

Name	Type	Fee
Carbon Credit Cart	Reseller	3.5% goes to the credit card processing, 11.5% goes to Carbon Credit Card fund to fund the ongoing development of the platform
Carbonfund.org	Reseller	5%-10%
Carbon Neutral Britain	Reseller	10% to administrative costs, 10% on fundraising and marketing
Carbon Removed	Reseller	30% of the price goes towards business development
Climate Wise	Reseller	10%
Greentripper	Reseller	18% (3% transfer costs and 15% commission)
HALO.eco	Reseller	15% goes to running costs, 3% to payment processing, 82% directly to HALO projects
Klima Ohne Grenzen	Reseller	Maximum 15% (transaction costs)
Klimat Kompensera	Reseller	20% - 30% fees
Offsetra	Reseller	18% of subscription (goes towards transaction and admin costs)
Persefoni	Reseller	10% Patch fee + 4.5% Persefoni fee
plannetzero	Reseller	Up to 15% fee
Ripple Africa	Reseller	10% towards administrative costs

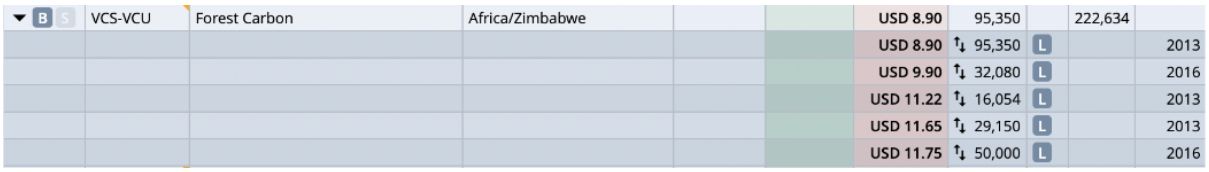
[3] The fees have been sourced from: Carbon Credit Cart, Carbonfund.org, Carbon Neutral Britain, Carbon Removed, Climate Wise, Greentripper, HALO.eco, Klima Ohne Grenzen, Klimat Kompensera, Offsetra, Persefoni, plannetzero, Ripple Africa

Out of the 125 analyzed, 20 intermediaries (16% of entities examined) are non-profit organizations (some, like Carbonfund.org disclose what percentage of money received is directed towards administrative expenses). Here, carbon credits purchase often takes the form of a donation to the organization (see here or here).

It is rare for companies to break down the fees into more detail of what the fees cover. For example, the reseller and offsetting subscription service Carbon Neutral Britain explains that 80% of the payment goes towards projects, while the remaining 20% is spent on administrative costs and fundraising and marketing expenses. However, the vast majority of intermediaries we examined are not as transparent in explaining what is included in transaction costs and what fraction of credit price reaches project developers and local communities. Many do not explicitly state what fees they charge but are open that a percentage of sales goes towards covering operating costs and others claim the majority of proceeds from carbon credit sales are reinvested in communities, presumably by the platforms purchasing more credits.

Platform fees, however, do not tell the whole story. The platforms may charge a processing fee of a certain percentage, but they may mark up the credit's price to whatever they think a consumer would be willing to pay.

As a case study, we examined Kariba REDD+, a forestry project in Zimbabwe. Only the Rimba Raya project in Indonesia (~21m) has retired more credits than Kariba REDD+ (~19m) in the voluntary carbon market. The project's credits were being offered on the CBL exchange with an Ask price of $8.90 to $11.75, in October, depending on vintage. (As it is the only Verra forestry project in Zimbabwe, these credits must come from Kariba.)



At the same time, three resellers were selling credits for the project: Persefoni ($17.65/credit[4]); South Pole Market ($19.99/credit); and Stand for Trees ($20/credit). None of the three resellers provide information on the vintage of the credits, meaning that, in theory, the credits being sold through their online marketplaces are Kariba's latest 2019 vintage, which would have fetched a higher price (around $13.50, depending on the size of the transaction, according to our pricing estimates at the time). However, it is also possible that the credits are 2012 vintage, where the price would have been even lower than the $8.90 on the platform (around $8.50/credit).

It's not possible to estimate the exact markup, as it's unclear when the credits were purchased, their vintage, and how many credits the resellers purchased in one go. For example, if any of these companies bought the credits in early 2021, when prices were considerably lower than they are today, they would have paid closer to $7/credit.

As seen in table 21, depending on the project type, intermediaries' can charge from around 22% (for forestry credits) to almost triple the wholesale price of a credit (renewable energy credits). However, this specifically refers to retail transactions, which are often for a small number of tons, and represent a small number of credits retired (but a majority of transactions).

[4] The price per ton is $15.35; the platform charges a 10% fee for Patch (its partner, which works with companies to list their credits on the platform) and an additional 4.5% Persefoni fee. South Pole Market and Stand for Trees do not charge a transaction fee.

Table 21: Comparison of wholesale and resale prices (source: AlliedOffsets, 2022)

Project Type	Avg. Resale Price	Avg. Estimated Wholesale Price	Difference	% Difference
Waste Disposal	$8.59	$7.08	1.5	21.19%
Transportation	$9.67	$7.08	2.59	36.51%
Renewable Energy	$16.44	$6.01	10.42	173.29%
Household Devices	$20.14	$11.30	8.84	78.23%
Forestry and Land Use	$19.30	$11.66	7.64	65.55%
Energy Efficiency	$17.84	$11.12	6.73	60.53%
Chemical/Industrial	$11.53	$6.39	5.14	80.34%
Agriculture	$20.32	$7.93	12.38	156.16%

6.3. End Buyers

This group purchases carbon offsets with the intention of retiring them, thereby offsetting their emissions. It includes corporations, individuals, NGOs, and public entities, among others. They purchase credits from projects directly, or via intermediaries. The retirements are completed on registries' websites, where each registry user has to have an account in order to transact and retire credits. The actors here include project proponents, intermediaries, and corporates. The actors must define their role when registering for an account so that it is clear what side of the transaction or retirement they are on.

With some standards, like Woodland Carbon Code, Plan Vivo, Peatland Code, and Acorn, the user of the credits is clearly stated in each retirement's details which makes the credits more traceable and enables one to verify corporate offsetting claims (Acorn only clearly identifies the buyer of the credits and not the seller). However, most registries do not make this mandatory; it is possible to offset retirements without attaching an account holder to the retirement. In some cases, users are able to input information on the Account Holder making the retirement – meaning anyone can claim to be retiring on behalf of any entity. Woodland Carbon Code and Peatland Code also require entities to list their credit holdings, making it

easy to understand who owns what credits. The Global Carbon Council also lists holdings, but it is unclear if all holdings are publicly available or only a subset. The biggest registries, however, do not require this level of information to be submitted when credits are traded between accounts, or when they are retired.

Just over 11% of total transactions were conducted on 'behalf' of another party, suggesting an intermediary was involved; these transactions account for ~138m credits, or roughly one sixth of the total credits retired.

Table 22: Corporate carbon credit retirements (source: AlliedOffsets, 2022)

Main Account	Total Retired Credits
Delta	31,014,153
Tokenised Credit	22,119,807
Shell	8,795,434
Hu-Chems Fine Corp	9,642,266
Banco Votorantim	7,982,665
LSB Industries	7,314,096
PRIMAX COLOMBIA	7,015,226
Telstra	6,563,192
Takeda	5,918,998
Interface	5,205,787

Among companies who have tagged transactions with identifiable information, Delta Airlines is currently the biggest retirer with over 30 million retired credits, which is almost 1.5 times the number of matched tokenized credits (all retirements on behalf of Toucan.Earth and Moss[5]) and triple what Shell and Hu-Chems Fine Corp have retired publicly. More than 50% of Delta's retirements are Renewable Energy credits, followed by credits from Forestry and Land Use, Chemical Processes, Energy Efficiency, Waste Disposal, Agriculture, and Household Devices project types.

[5] Although these are presented as retirements, tokenized credits are tradable on decentralized exchanges

Table 23: Availability of retirement data (source: AlliedOffsets, 2022)

Account holder details	Retirement details	Retired credits	Number of retirement events	Percentages transactions	Percentages credits
Empty	Empty	325,743,807	57,495	22.02%	39.12%
Empty	Entered	214,355,310	143,060	54.79%	25.74%
Entered	Empty	23,876,529	10,386	3.98%	2.87%
Entered	Entered	268,711,157	50,168	19.21%	32.27%
Total		**832,686,803**	**261,109**	**100.00%**	**100.00%**

On ACR, CAR, and VCS, each retirement allows users to input the account holder and the retirement details (ACR also requires its users to input a "Retirement Reason"); GS allows users only to input a retirement Note. (The registry recently added functionality to allocate credits retired to a specific entity, which will help to promote transparency.) Out of ~260,000 credit retirement transactions that have ever taken place in the VCM, 203,614 of credit retirement transactions have either an account holder or retirement details filled in (equal to almost 507M credits). Within these, 50,168 retirement events have both fields filled in, but in some cases, the same entity is listed in both. Furthermore, these details are often ambiguous or only state the purpose of the retirement (e.g., "For 2021 carbon emissions."), which makes it more difficult to identify the actual end-user of credits.

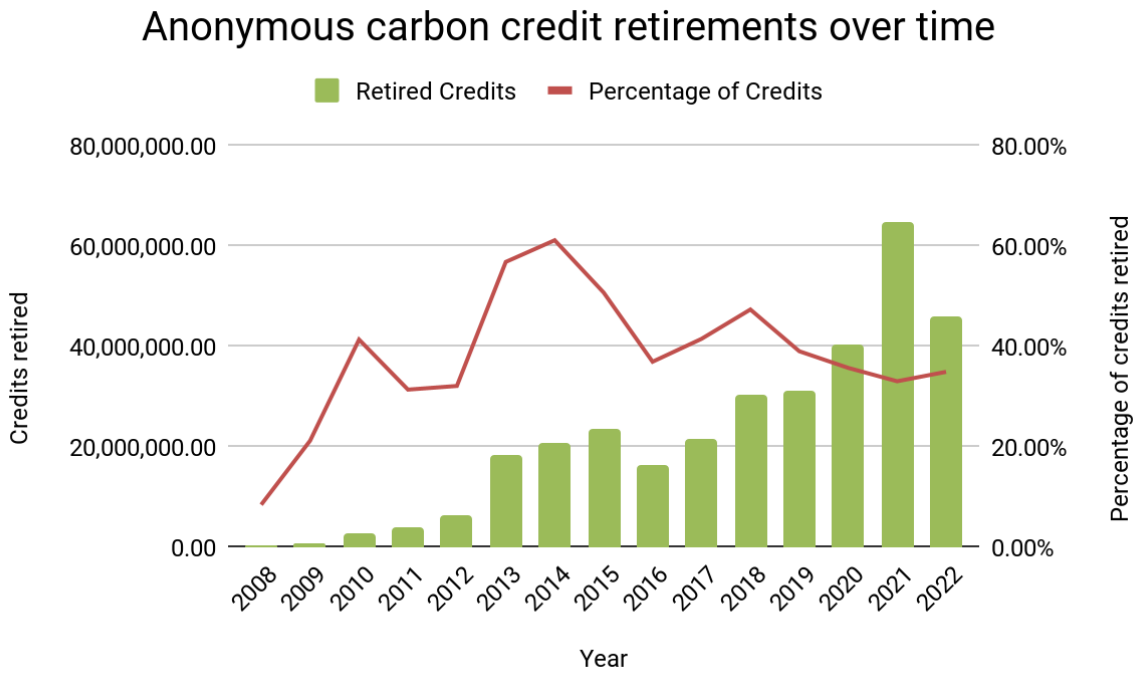


Figure 7: Anonymous carbon credit retirements over time (source: AlliedOffsets, 2022)

In other words, two fifths of all of the credits ever retired in the VCM are completely anonymous, with no public way to trace back a credit to the retiring company.

There are no guidelines regarding either and intermediaries can retire carbon credits on behalf of their clients but do not have to state who the end user is. Based on our analysis of retirement events' details and associated account holder details, we found that around 68,000 (26%) of all retirement transactions, equal to almost 132M (15.5%) retired credits, contains the phrases such as "on behalf of" or "retired for" (and their equivalents in other languages like Spanish or German), as well as transactions conducted through the Gold Standard Marketplace. While the Gold Standard Marketplace has contributed to almost a third of retirement events performed on behalf of another party, the volume of credits retired through these amounts to "only" around 341,000 (here, the average volume of retired credits per batch is 13.4; the relatively low number suggests that the marketplace caters to retail buyers).

However, oftentimes only one side of the transaction is listed in the retirement details or account holder fields (either the intermediary or the end user of credits), fewer times the relationship is explicit and identifiable. To examine this further, we analyzed a sample of 1000 random transactions and their details. Among these, 755 transactions had no account holder associated and 269 had an empty retirement details field. Within these, 81 retirement events contained clear information on both the buyer and the intermediary involved in the retirement, while 614 had information on either the buyer (356) or the seller (339 - the sample contained many retirements from the Gold Standard Marketplace) which allowed for identification of the entities.

6.3.1. Co-Benefits and Pricing

At the moment, buyers are making use of their carbon offsetting activities as part of their marketing efforts, meaning it is useful to buy credits from projects that have co-benefits additional to carbon emissions reductions or avoidance. There are two key ways for co-benefits to be measured: the United Nations-backed Sustainable Development Goals (SDGs), and Verra's Climate, Community, and Biodiversity (CCB) Standard, which applies to nature-based projects on the registry.

Overall, there are ~3,100 projects in the VCM claiming to be contributing to at least one Sustainable Development Goal. The majority of these projects are registered via Gold Standard, which requires projects to register certain SDGs as part of their mission.

Table 24: Sum of SDGs contribution by registry (source: AlliedOffsets, 2022)

Registry	**SDGs**
GS	2,555
ACR	507
VCS	55
CAR	20

The most common SDG is Goal 13: Climate Action, which is not surprising given the nature of the projects. The second most common is Goal 3: Good Health and Well-Being (which is common among energy efficiency, renewable energy, and household device projects), and the third most common is Goal 7: Affordable and Clean Energy.

In our analysis of pricing, we found that the number of SDGs registered was a bigger driver of price differentiation than the specific SDGs registered. A project with 2 SDGs, for instance, commands an estimated 7% price premium vs. one that has none or one SDG. A project with 5 or more SDGs fetches a 19% higher price than a similar project would, if it did not contribute to any SDGs. The pricing effect stops after 5 SDGs: we found no statistically significant link between higher price and more than 5 SDGs claimed by a project.

Table 25: Number of projects per CCB verification tier (source: AlliedOffsets, 2022)

CCB Verification	Projects
CCB-Gold	26
CCB-No Distinction	21
CCB-Biodiversity Gold; CCB-Climate Gold; CCB-Community Gold	18
CCB-Community Gold	10
CCB-Silver	9
CCB-Biodiversity Gold	8
CCB-Biodiversity Gold; CCB-Climate Gold	5
CCB-Community Gold; CCB-Gold	5
CCB-Biodiversity Gold; CCB-Community Gold	3
CCB-Biodiversity Gold; CCB-Climate Gold; CCB-Gold	2
CCB-Climate Gold	2
CCB-Biodiversity Gold	1
CCB-Biodiversity Gold; CCB-Climate Gold	1
CCB-Biodiversity Gold; CCB-Climate Gold; CCB-Community Gold	1
CCB-Biodiversity Gold; CCB-Climate Gold; CCB-Community Gold; CCB-Gold	1
CCB-Climate Gold; CCB-Community Gold	1

Our pricing model estimates have also found a connection between CCB verification and a higher price for Verra's nature-based projects.

6.4. Third Parties

In addition to the entities listed above, there is a growing number of support organizations that have entered the market in order to provide products and services to entities generating and retiring credits. Below is a non-exclusive list of these types of entities:

6.4.1. Carbon Quality Ratings Firms

Companies that rate the efficacy of carbon credits, attempting to provide an additional layer of quality assurance to the market. These companies include BeZero, Calyx, Renoster, Sustainacraft, and Sylvera.

6.4.2. Data Providers

Firms that provide data and analysis of the VCM, focusing on both individual transactions, as well as larger trends within the market. The firms include AlliedOffsets, Ecosystem Marketplace, and Viridios.ai.

6.4.3. Carbon Footprinting Firms

Carbon footprinting firms perform carbon footprint analyses for companies or individuals, in order to help them understand how much carbon they emit through their activities -- this can usually be done using online tools which constitute only a small part of the firms' value offer. This can be used as an indicator for the total quantity of carbon credits that a company would then want to buy on the market to offset residual carbon emissions. The providers of footprinting include Sweep, as well as NGOs like Carbon Trust.

6.4.4. Sustainability Consultants

Corporate entities that provide sustainability consulting to individuals, corporates, and NGOs, among others. They provide information on how firms can reduce their carbon footprint, as well as helping to source credits, and advising firms on their overall sustainability strategy. The firms include traditional consulting companies like BCG or McKinsey, as well as smaller actors in the market such as EcoAct or Climate Partner.

6.4.5. Insurance Providers

These firms, new to the market, provide insurance products for carbon offset projects, with an aim toward de-risking transactions within the VCM. Kita is one of the first actors in this space, though more traditional insurance providers have also shown an interest in the VCM.

6.4.6. Industry Bodies

Cross-sectoral initiatives working on establishing guidelines and by-laws for the VCM, which is not regulated by public bodies. These include the Integrity Council for the Voluntary Carbon Market, and the Voluntary Carbon Market Integrity Initiative.

6.4.7 Technology Providers

These firms build the registry platforms for the standards setting bodies, as well as tech platforms for others in this space. They include firms like APX and, increasingly, blockchain entities that enable more transparent transactions among stakeholders.

7. Conclusion

This report's aim was to provide information on the role of intermediaries in the voluntary market, as well as the prevalence of market activities in it and analyse the carbon credit development and money flows. In terms of project development, activities are highly dependent on the project's sector and the nature of the project developer (who can also act as a broker or project owner) which makes it difficult to compare projects and streamline the process. Furthermore, communication about costs related to project development is inconsistent and should be unified.

As part of the research, we have compiled a list of recommendations to make the activities in the VCM more transparent. These are:

1. For registries to require firms retiring credits to disclose on whose behalf the retirement is taking place (all retirements over 100 credits).
2. For registries to make public the accounts that are registered on their platforms.
3. For resellers and online marketplaces to make clear the vintage of the credits they are offering to the public, and the fees they charge.
4. For projects to include detailed geographical information about their project activity locations, as well as any baseline reference locations.
5. For registries to make clearer how they audit VVBs.
6. For companies making use of credits to put their carbon credit purchases in their annual or sustainability reports, and list the serial numbers of the credit transactions.

Intermediaries in the market operate according to a variety of business models and sometimes purchase credits for retirement for themselves as well. In terms of transparency of the market, only a small fraction of data on retirements and transactions is public. This makes corporate and non-profit offsetting efforts opaque and more difficult to examine. In order to mitigate this problem, retirers and intermediaries should be more transparent about their carbon credit purchases and ensure that the retirement and account details are tagged appropriately.