

VCM Retirement Analysis and 2023 Forecast



Headline Findings

- The estimated **value of the market retirements** reached **\$1.35b** in 2022.
- **Prices** continued to fall to close out the year; the 'average' credit being retired is valued at **\$6.4/tCO2e**.
- **Retired credits** dropped slightly, from 208m to **205m**; we forecast 250m credits will be retired in 2023.
 - Excluding tokenized credits, the number of credits retired grew from 191m to 199m.
- **Issued credits** dropped from 366m to **290m** in 2022; we forecast 354m credits will be issued in 2023.
- Number of **projects** in VCM reached **25,000** in 2022.

Who We Are

AlliedOffsets is a London-based data and technology firm focused on providing transparency for the voluntary carbon market (VCM).

Purpose of Report

The purpose of this report is to showcase the state of the VCM: supply and demand drivers from 2022, retirement forecast for 2023, overview of the key emerging trends, and pricing data for over the counter VCM transactions.

The data in the report has been compiled or generated by AlliedOffsets. For more information, please visit [our website](#). To try out demo, click [here](#).

The report will be updated on a regular basis, to help provide actionable insights into VCM activity for market participants. If you have any questions, please contact hello@alliedoffsets.com.

The report was prepared by [Anton Root](#), Head of Research, and [Antonia Drummond](#), Carbon Market Data Analyst.

Key Data Points Analyzed

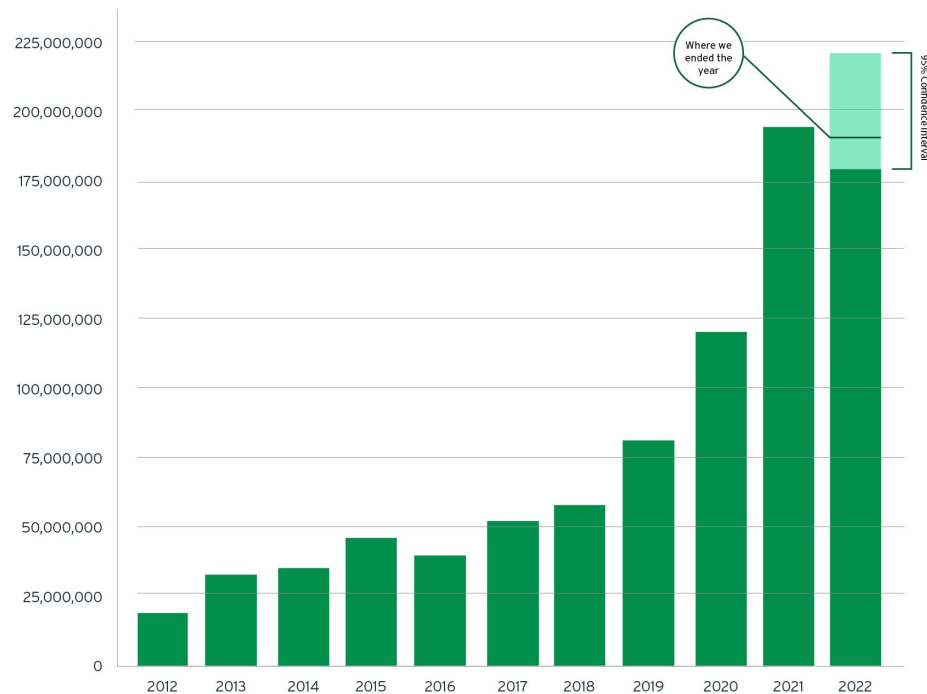
- Aggregated unique data points from leading carbon offset registries and over 150 carbon resellers and brokers
- 17 registries
- 25,000 voluntary carbon offset projects from 150+ countries
- Detailed OTC pricing information
- Credit-level data on offset buyers
- Data on validators and auditors of projects
- Data on ~500 emerging CDR projects
- Data from project design documents and other project documentation

Overall Retirement Activity and Forecast



In September 2022, AlliedOffsets predicted retirements to **reach 201m** (up from 196m) by the end of 2022, forecasting growth of 2%, with a 95% confidence interval of -6% growth (183m) to 11% growth (219m). This was forecast for the 11 registries we were tracking at the time. On those registries, the number of credits retired reached: **193m** tCO₂e, or a decline of 1.3% vs. 2021. This means the actual retirements differed from our model prediction by 4%.

2022 Retirement Forecast vs. Actual Retirements



Updated Figures

Since we put out the forecast in September, we started tracking 6 more registries. This gave us visibility on an additional 12m tCO₂e retired in 2022. Adding this data to the analysis gives a fuller picture of the market, particularly as it includes Colombian projects listed on Cercarbono. Taking these numbers into account, our updated figures for 2021 and 2022 are:

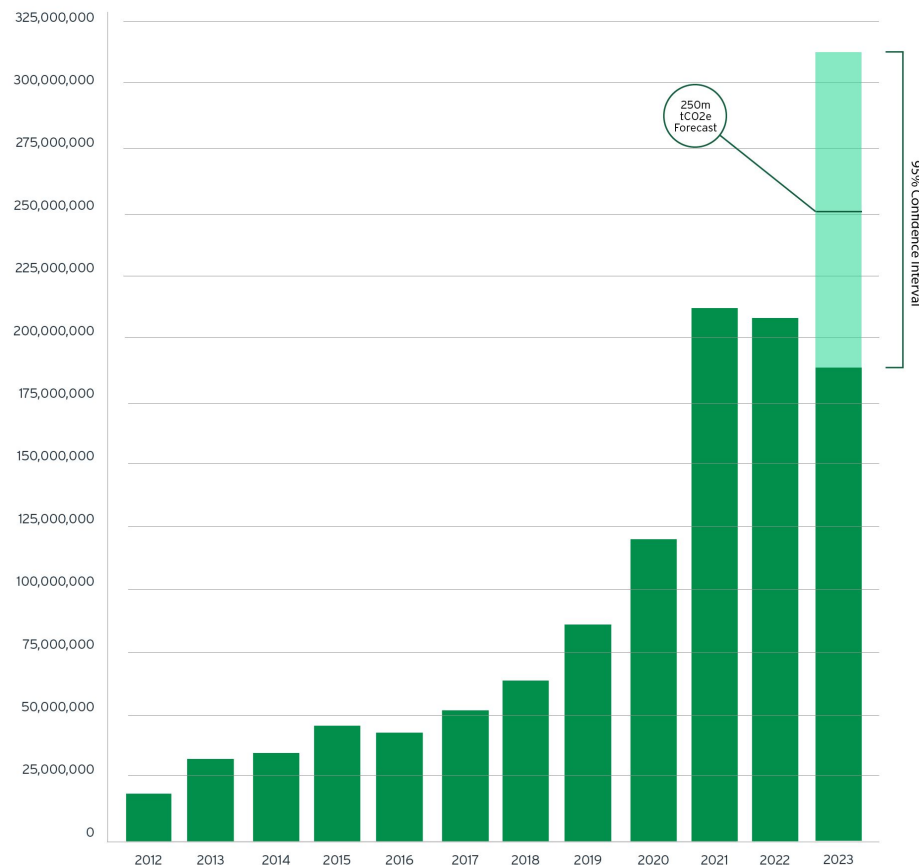
208m tCO₂e | 205m tCO₂e

retired in 2021 | retired in 2022

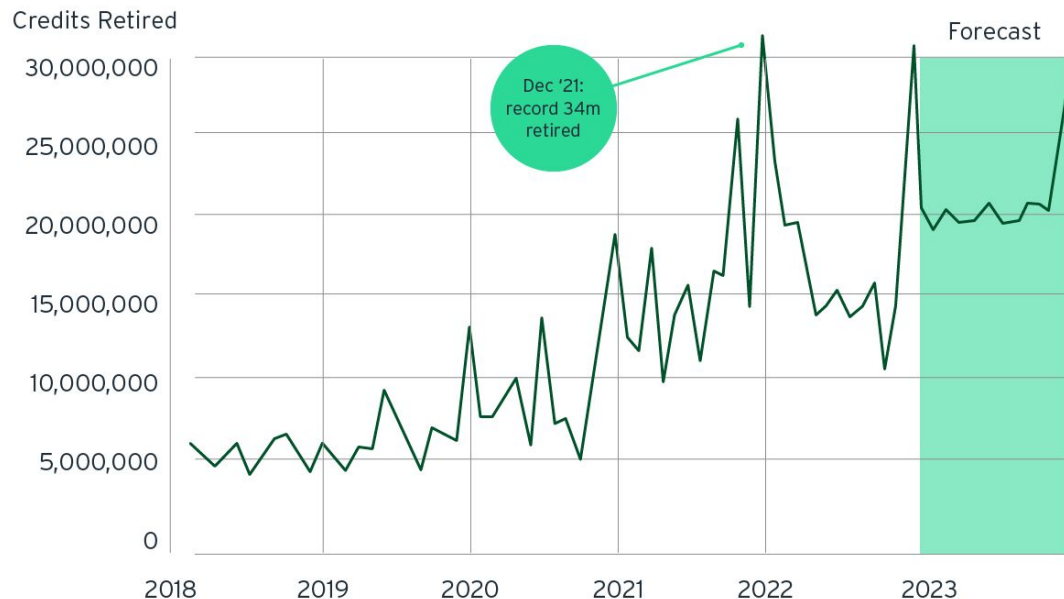
The aggregated value of retired credits reached **\$1.35 billion** in 2022.

- December saw the second-most credits retired in the market in a single month.
- Despite the 2022 slowdown, we forecast retirements to grow in 2023, reaching **250m**.
- This would mean a return to growth of 22% year on year.
- 95% confidence interval: 188m tCO₂e (-8%) to 313m tCO₂e (52%)

2023 Retirement Forecast



December Consistently Sees Highest Retirement Numbers



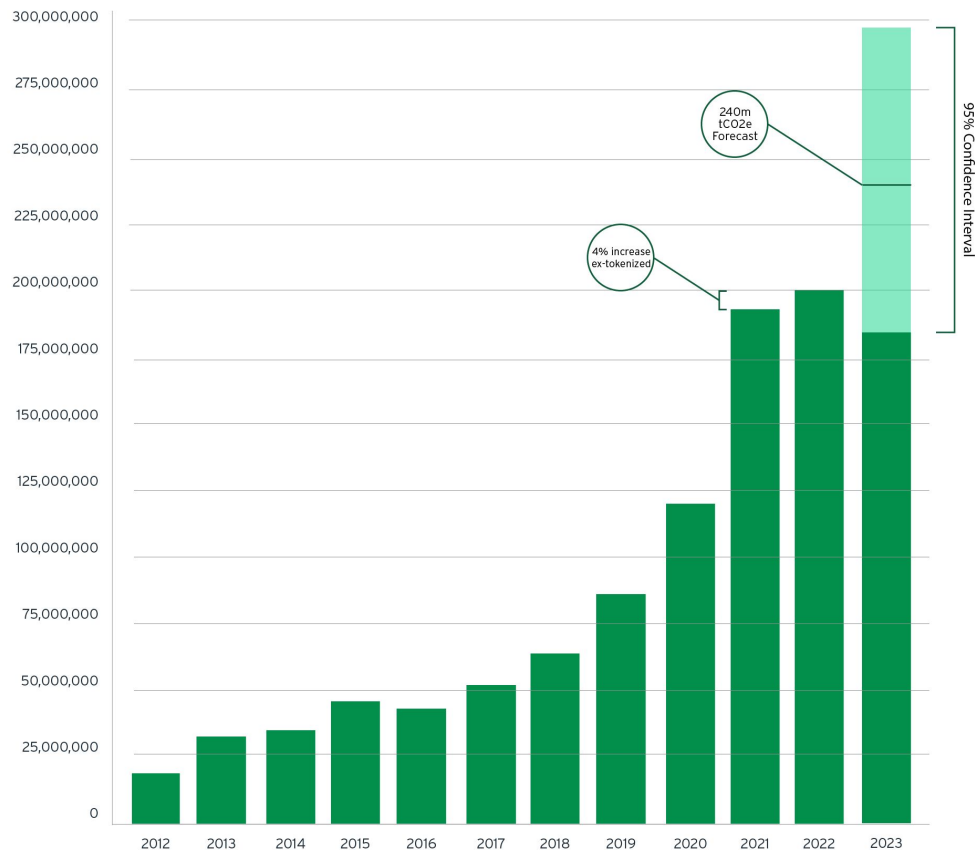
- As in our September report, we are using the Facebook Prophet Model to forecast the retirement activity due to its ability to model seasonal effects with additional regressors, its ability to handle outliers, and its performance on a test-train split of the data.
- The model creates an estimate for the number of credits retired for each day in the year, which are then aggregated to weekly and monthly data.
- The model does not take into account exogenous shocks (e.g., tokenizations), meaning it is best seen as a short-term forecast.
- It is especially useful in projecting the likely upper and lower bounds of retirement and issuance activity.

Potential Reasons for Slowdown

- There were obvious headwinds for the VCM in 2022, key among them being a looming recession in much of the world due to rising inflation, as well as a difficult year for public equity markets and alternative investments like crypto. Conflict in Ukraine, which contributed to the above by driving up the price of energy and food, also contributed to a general feeling of global economic malaise, knocking business confidence.
- Lack of tokenization activity after Q1 also contributed to the slowdown of activity; see next slide for more info.
- The big loser in 2022 VCM was the forestry sector: forestry retirements were down 30% on the year. This may be due to political uncertainty in the key market of Indonesia (retirements there declined by 51%); the price premium of forestry projects over others (~3x higher than renewable energy projects); and the emergence of sovereign carbon, among other factors.
- Cheaper renewable energy projects picked up the slack, growing from 90m tCO2e in 2021 to 105m tCO2e in 2022.

- Excluding tokenized credits from our analysis shows that 2022 saw more credits retired than 2021 (199m vs. 191m).
- We project the number of (ex-token) credits retired in 2023 to reach 240m tCO₂e.
- It's been nearly a year since major registries decided to pause bridging of credits on-chain. We expect registries to make clearer policy guidelines on what they will allow in terms of bridging activity in early 2023.

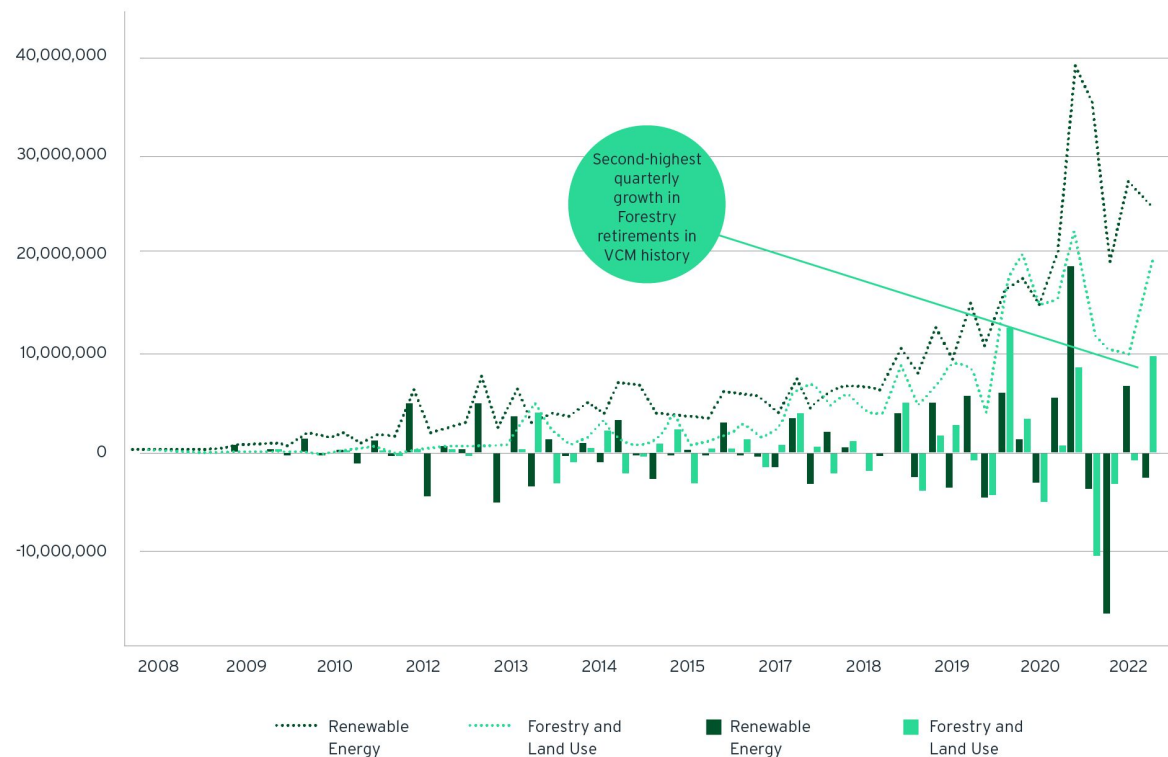
2023 Forecast Excluding Tokenized Credits



Demand Analysis

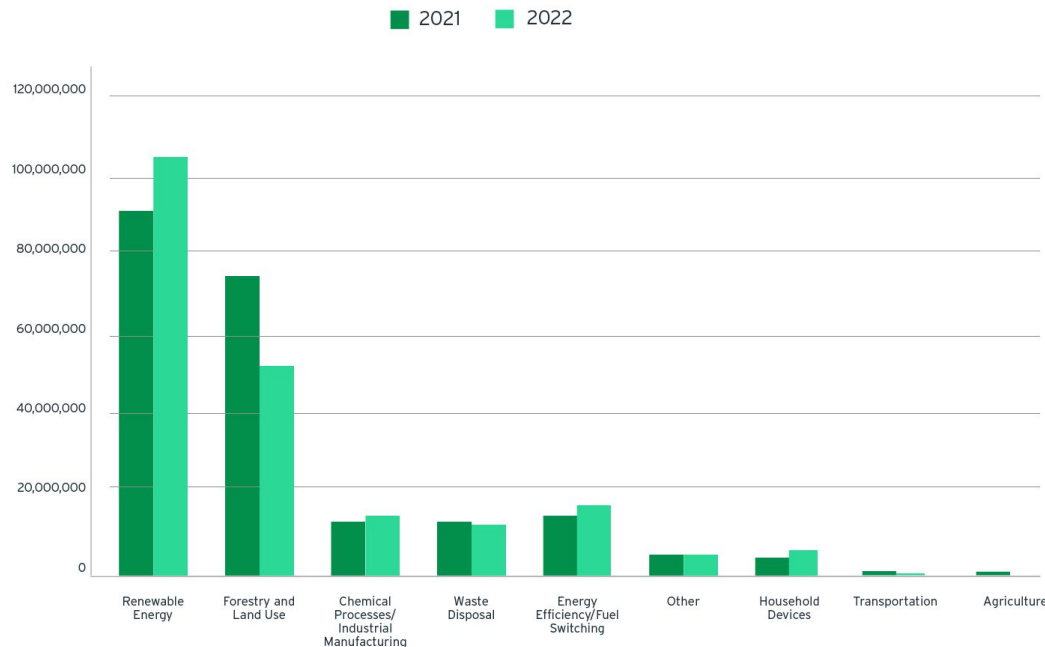


Quarterly Changes in Credits Retired, Renewable Energy and Forestry



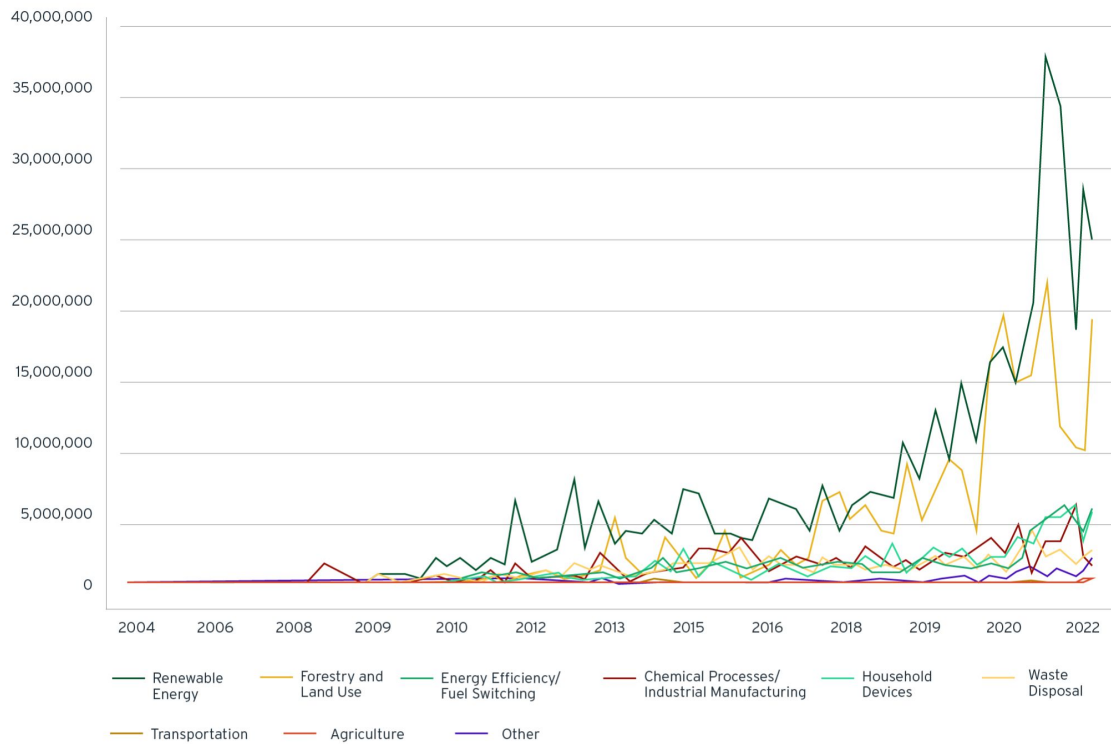
- While both forestry and renewable energy retirements dropped in Q1 2022, renewable energy bounced back much more quickly than forestry projects, which only saw growth in Q4.
- Forestry credits saw a big uptick in retirements in Q4, following three consecutive quarters of negative growth.

Sector Breakdown



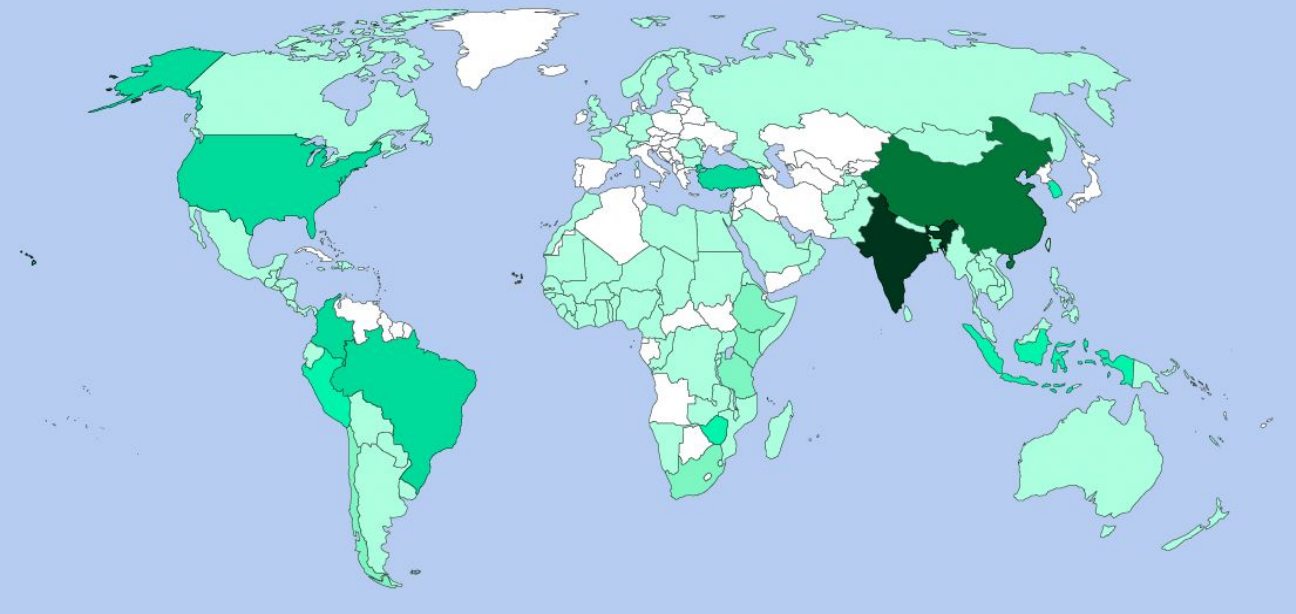
- The dip in overall retirements is driven largely by a drop in forestry projects retirements, which decreased by 30% between 2022 and 2021, despite an uptick at the end of Q4.
- Other sectors have made gains in 2022, most notably renewable energy with a 17% increase in retirements.

Sector Breakdown



- Renewable energy project retirements continued their growth in 2022, while forestry project retirements experienced a severe dip in the middle half of the year.
- Renewable energy and forestry make up ~80% of all credit retirements in 2021 and 2022.
- REDD credits were especially affected, halving from 50m tCO₂e retired in 2021 to 25.6m tCO₂e retired in 2022.

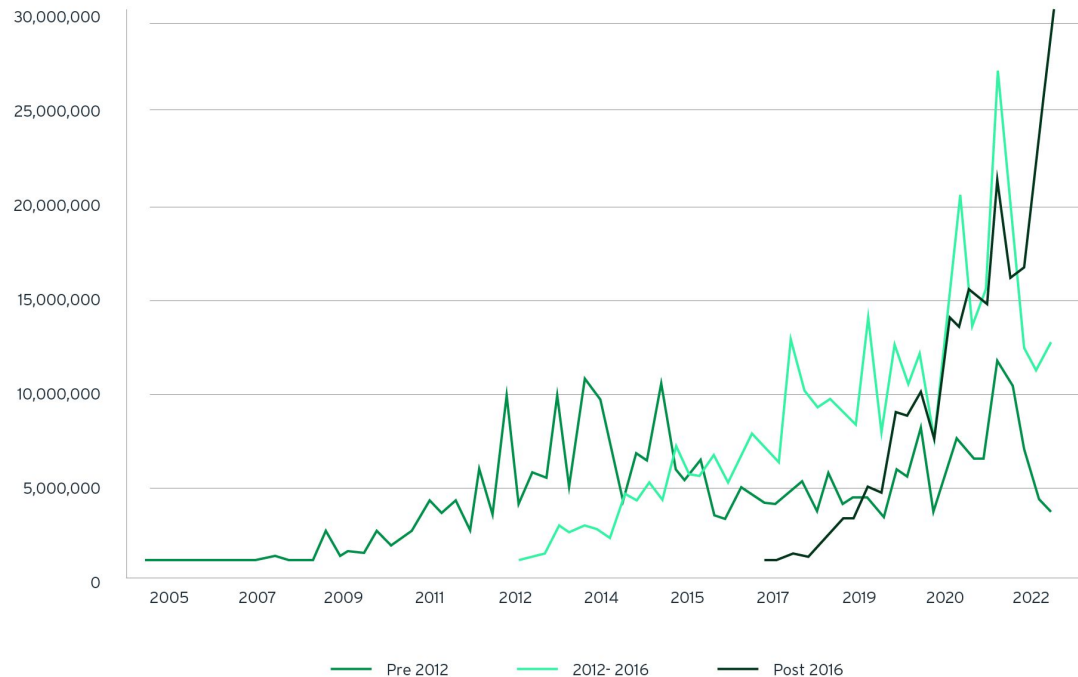
Retirements by Country



- The country with the most retired credits, India, had more than 10x the number of retired credits as the 10th country by retired credits, Zimbabwe. The top 10 countries accounted for 75% of all retirements in 2022. Of the top 10 countries by credits retired, five are in Asia and only one is in Africa:

India	48.8m
China	28.7m
Colombia	15.6m
Brazil	15.2m
United States	12.2m
Turkey	10.2m
Indonesia	8.9m
South Korea	7.6m
Peru	6.3m
Zimbabwe	4.8m

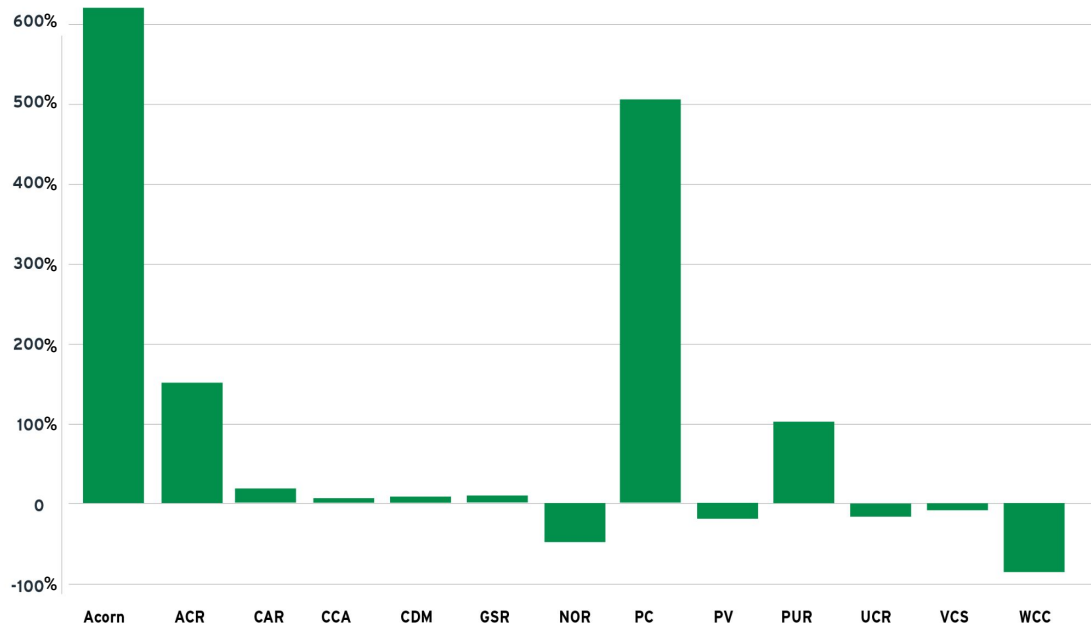
Credits Retired by Vintage



- In 2022, the number of newer (v2017 and above) credits retired grew to an all-time high, potentially signalling a preference among buyers to match emissions to retirements.
- This also reflects the fact that the majority of unretired credits are now in this vintage segment:
 - v96-v12: 103m tCO₂e remaining
 - v12-v16: 270m tCO₂e remaining
 - v17-v22: 540m tCO₂e remaining
- More on this on slide 27.

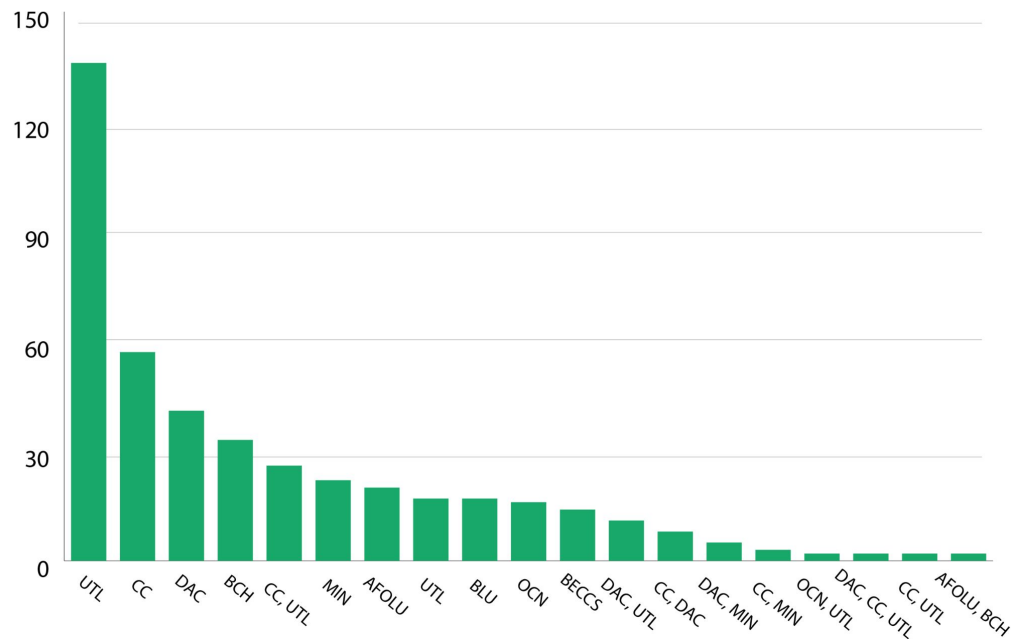
- While Verra continues to hold the largest market share of credits retired, it saw a decline in retirements in 2022.
- Projects listed on Verra make up 57% of credits retired in 2022.
- Peatland Code, American Carbon Registry, Puro.earth, and Acorn projects experienced the largest proportional increase in retirements / assignments in 2022, but only hold a combined 6% of market share.
- Cercarbono continues to increase market share, making up 6% of retirements in 2022.

Growth in Retirements and Assignments by Registry



- With prices for conventional VCM projects falling throughout the year, CDR activity was somewhat subdued in 2022.
- Our database of CDR projects and companies captures over 450 initiatives, which we've categorized into nine distinct methodologies.
- Projects looking to utilize carbon by injecting it into products lead the way with over 130 such projects in the database, followed by (point source) carbon capture, and direct air capture.

Number of CDR Projects by Methodology



Pricing and Transaction Analysis



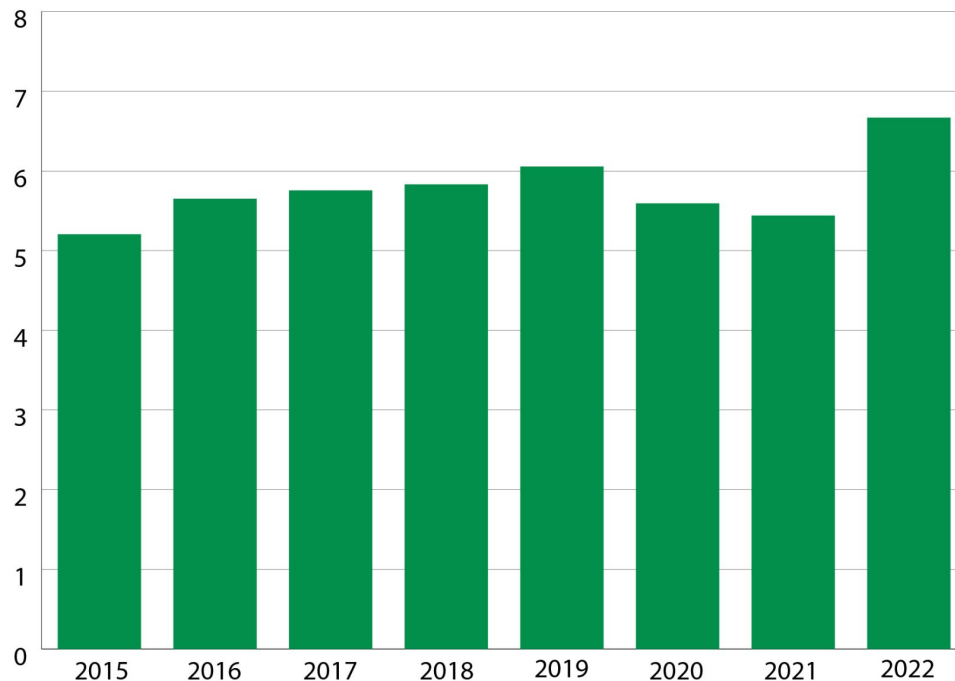
- The AlliedOffsets 500 price index dropped by \$2.50 in August 2022, followed by a tempered rise in the autumn and a slowdown at the end of the year. Since our September report, credit prices have continued to fall, though they have rebounded slightly in December.
- The index tracks the weighted average price for the top 500 projects by number of retirements in the last 3 years. These are dominated by renewables and forestry project retirements. The prices are adjusted by the volumes and vintages being retired, to make the data as representative of the market as possible.
- The index focuses on broker-led, over the counter prices, rather than tracking exchange-traded data.
- Nature-based and household device projects continue to trade at roughly double the price of projects in other sectors.
- Renewable energy projects tend to trade at low prices, and were estimated to be the cheapest credits in Q4 2022.

AlliedOffsets 500 Index



- The average age of credits retired grew in 2022 to just under 7 years old – this means that on average, the credits retired were from v2015.
- The transaction size grew slightly to 3,886 tCO₂e per retirement (up from 3,782 tCO₂e in 2021). There is a lot of variance among the registries in terms of the retirement size: some, like Nori and Peatland Code retired under 100 tCO₂e per transaction. Others, like Cercarbono (12,765) and CDM (28,435) retire well over 10,000 tCO₂e per transaction.
- There were 5 individual transactions with over 1m tCO₂e retired, led by a [CDM retirement](#) that saw Banco Votorantim retire nearly 3m tCO₂e in one go.

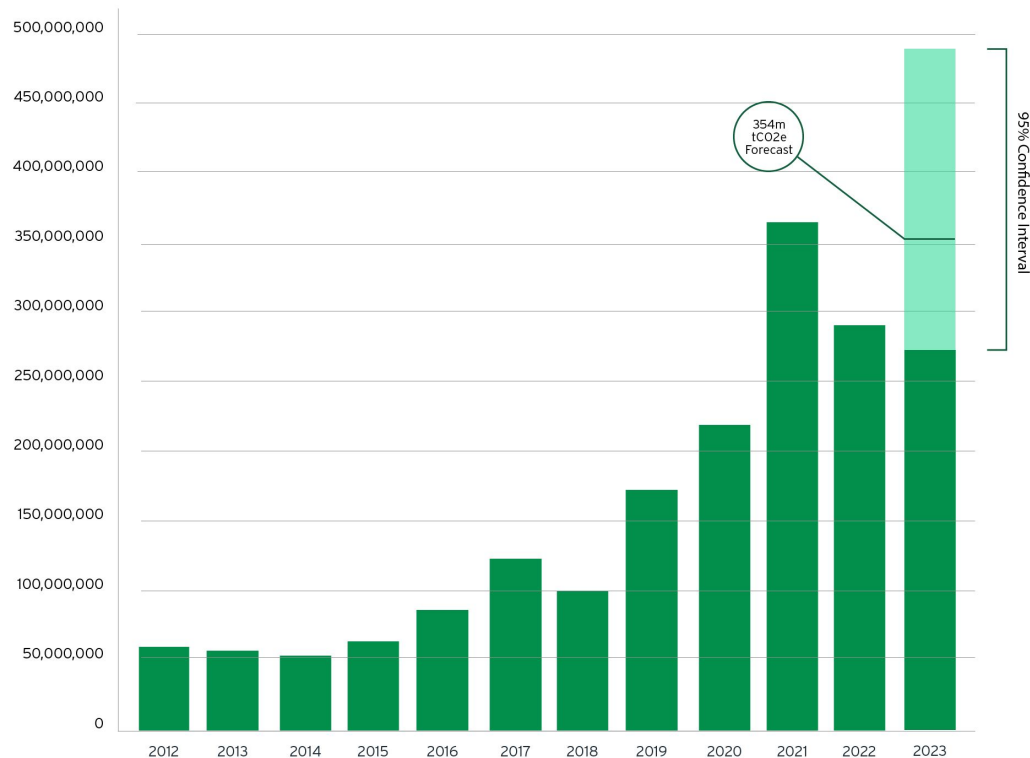
Average Age of Credits Retired



Supply Analysis

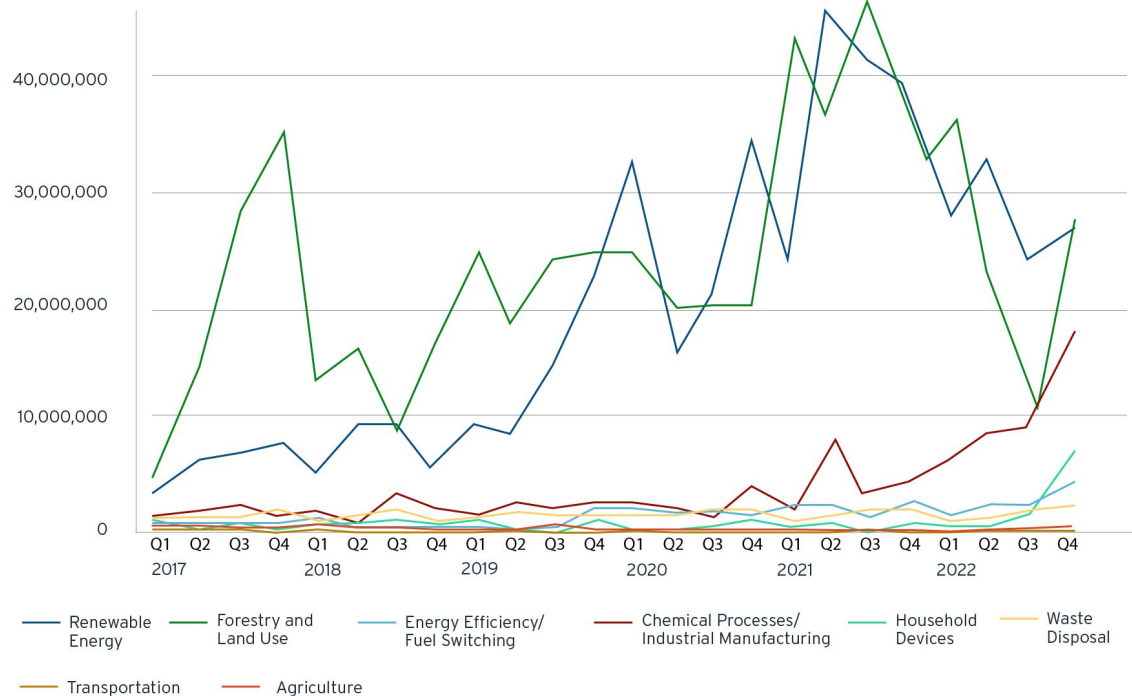


2023 Issuance Forecast



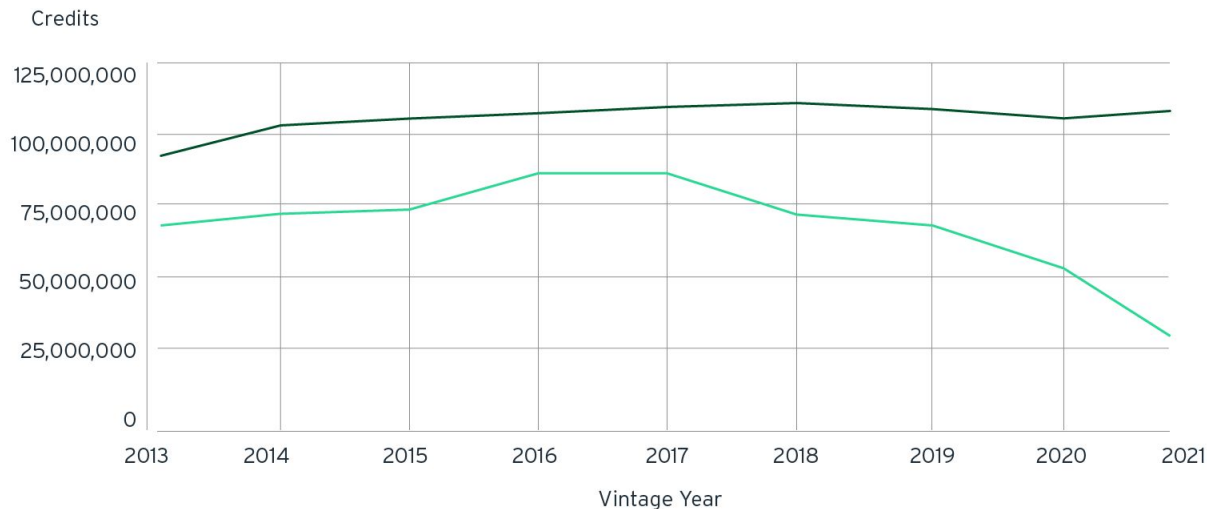
- Credit issuances are more variable year to year, making them more difficult to forecast.
- Issuances dropped 20% between 2021 and 2022, from 366m to 290m.
- December saw the most credits ever issued, with 46m tCO2e coming onto the market.
- We forecast 354m issuances for 2023: in spite of the slowdown compared to 2021, we predict the supply for credits will continue to outpace demand.

Credits Issued by Sector



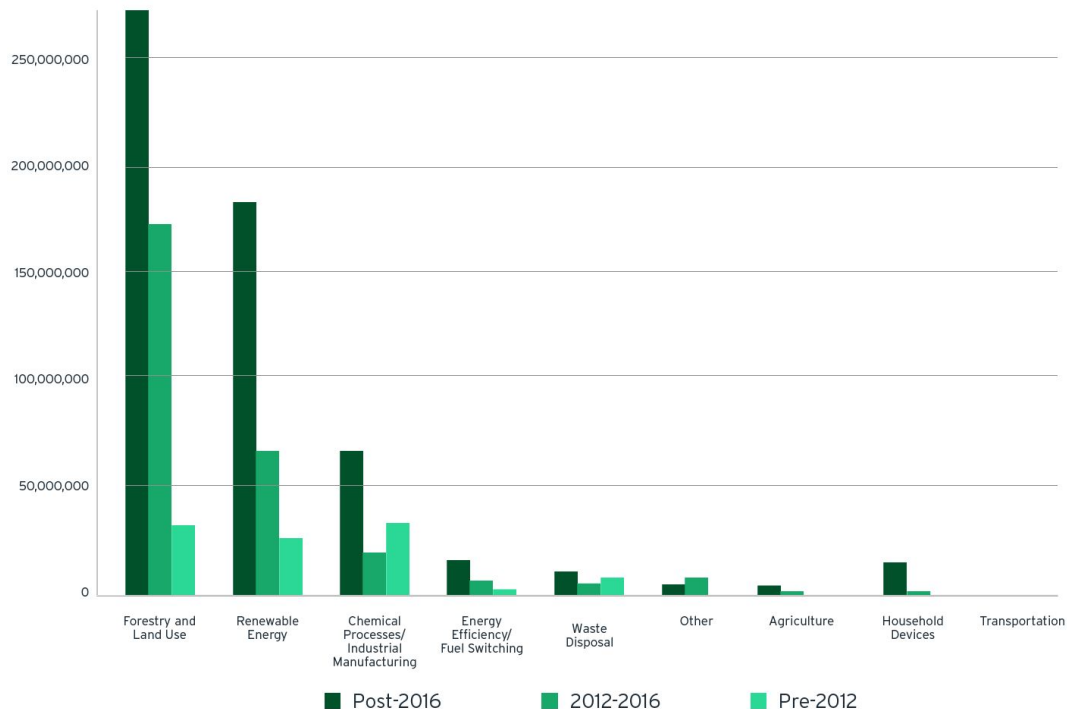
- While forestry project issuances dropped overall in 2022, so did renewable energy. Renewable energy retirements, however, grew vs. 2021.
- This indicates the dip in forestry retirements is not driven solely by decreased supply of credits.

Forecast vs. Actual Issuances for Top VCM Projects



- AlliedOffsets has extracted reported project forecast issuances from project design documents (PDDs) for ~450 projects with 500m total retirements to date (just over half of total market share by retirements).
- On average, projects issued 68% of the credits they forecast in their PDDs for vintages 2013-20. This suggests investors and buyers of credits should, on average, discount the number of credits a project will deliver over its stated ambition.

Remaining Credits by Vintage



- While post-2016 vintages retirements grew in the end of 2022, the largest non-retired volume of credits is amongst newer (v2017+) vintages.
- As some firms claim a coming credit crunch, we see the overall remaining number of credits continuing to grow. Simply stated, there are consistently more credits issued than retired in the market.
- If no new credits are ever issued again, there are enough credits to sustain current retirement activity for 4.5 years.

Buyer Analysis



Company-Retirement Matching

AlliedOffsets has matched data on hundreds of millions of retirements to retiring entities (companies and organizations retiring the credits). Overall, we have matched:

40%

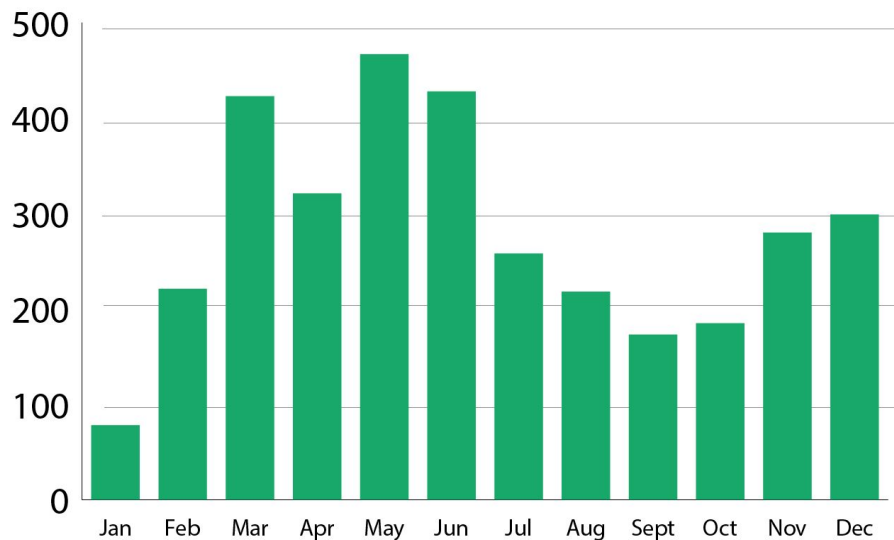
of all retirements

46%

of all retirements in the last 3 years

To put this into context, **40%** of transactions are completely anonymous, meaning we have matched over **70%** of all named credits ever retired to a company, organization, or broker making a claim on the retirement.

Number of Distinct Retiring Entities

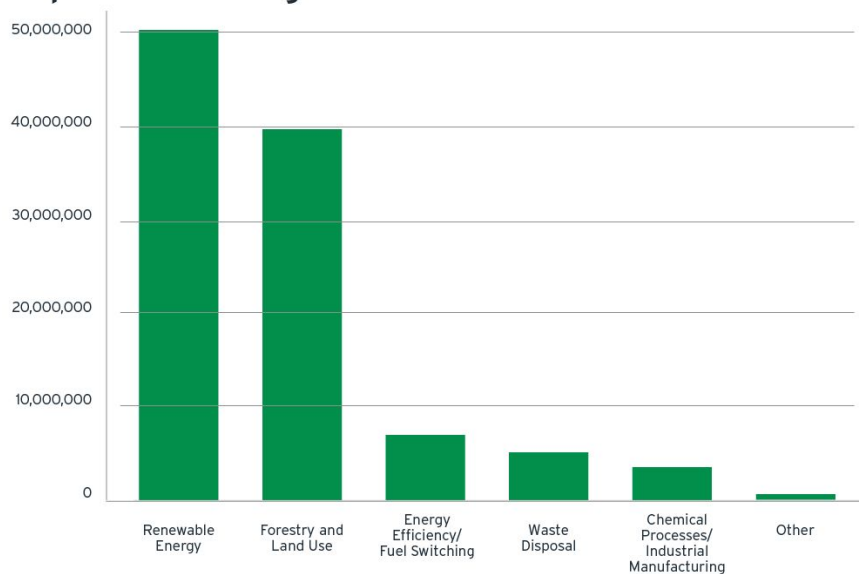


- The number of distinct retirement entities peaked in Q2 this year, with nearly 500 unique companies making retirements in May. This maps to the retirement activity over the year.
- The number of retiring entities saw an uptick in November and December (data through December 15th).

- The top 10 retiring entities are responsible for nearly 60% of retirements in the last 3 years. A full list of buyers is available to those interested.
- 83% of all retirements in the last 3 years by the top 10 companies have been for renewables and forestry projects.
- 51% of retirements have been from projects in Asia, primarily in China, India, and Indonesia. A further 40% were from projects in South America, primarily in Colombia, Brazil and Peru. 7% were from projects in Africa.

Retiring Entity	Credits Retired Last 3 Years
Delta	31.3m tCO2e
Toucan Token	22.1m tCO2e
Banco Votorantim	8.6m tCO2e
Shell	8.5m tCO2e
Primax Colombia	7.4m tCO2e
Volkswagen	6.8m tCO2e
Telstra	6.6m tCO2e
Takeda	6.0m tCO2e
easyJet	5.9m tCO2e
Biomax	5.6m tCO2e

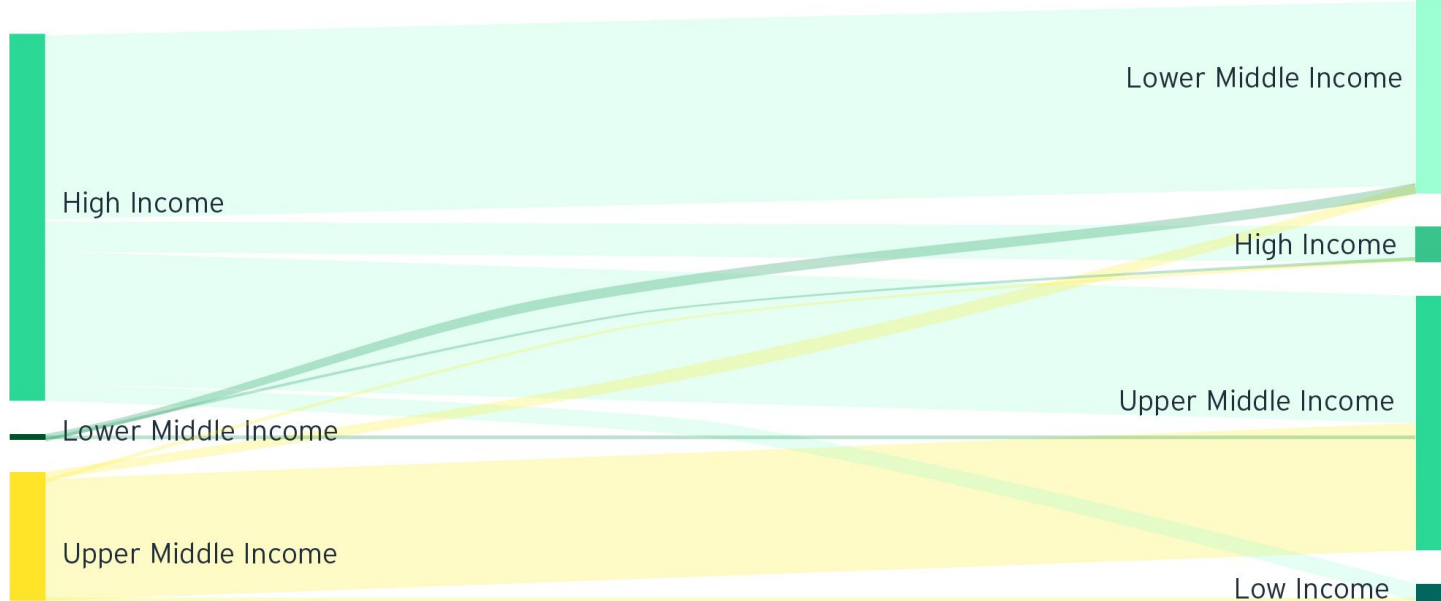
Top 10 Retiring Entities: Sector Breakdown



Country to Country Retirement Flows

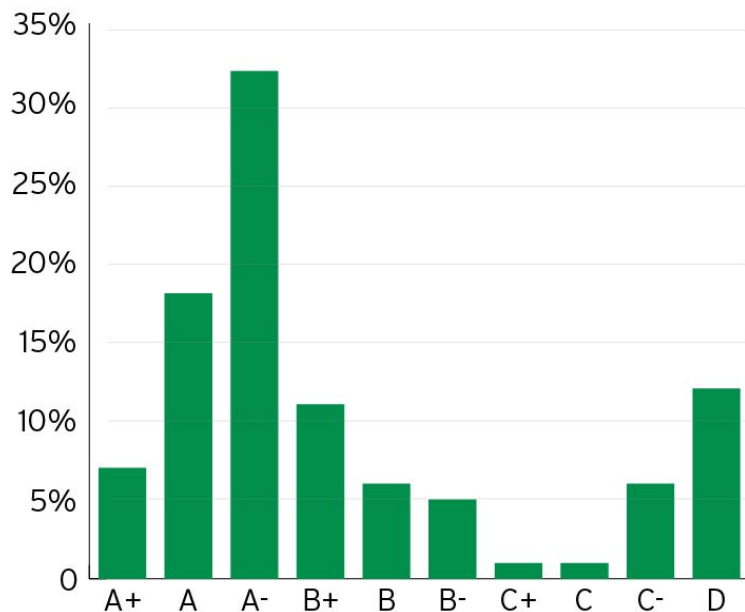
Retiring Entity Location

Project Location



- A large proportion of retirements have been contained within relatively high income countries.
- 99% of corporate retirements* have come from a company in a high or upper middle income country.
- Only 3% of retirements have gone towards projects in low income countries, and 38% to projects in lower middle income countries.
- There are no corporate buyers from low income countries represented.

Buyer Grade Distribution



- We have given each buyer a grade which reflects their commitment to offsetting as a complement to their emission reduction strategies.
- The average price per credit retired within the last 2 years has steadily decreased for all corporates who have retired carbon credits within the last 3 years (A+ to C+), with a relatively stable price for grades B to C+.
- In terms of retired credits, A- companies have retired the most (~68 million credits). The group includes relatively high polluters compared to A+ companies whose average credits retired are almost four times lower.
- The rating grade is based on corporate carbon credit retirements, their overall and recent value, average vintage year, the difference between vintage and year of retirement, as well as annual scope 1 and 2 emissions per retirements over the last 3 years (sample from 250 corporates).
- We will be launching a report in the coming weeks to track changes in the companies' grades as they offset more (or less) of their emissions.

Upcoming from AlliedOffsets



AlliedOffsets Alerts

- Our alert service will allow users to track activity for areas of interest, including new projects added to registries, retirements over 10,000, news, etc.
- Geographical mapping to track fires and vegetation loss in forestry project boundaries.

Beta Fire Alert Dashboard



AlliedOffsets Price Calculator

- Our online calculator that predicts price per credit based on project attributes.
- Users can estimate the price at which a project will trade based on its registry, country, sector, methodology, co-benefits, credit vintage, and transaction volume.

Specify the project characteristics here

No constraints are enforced make sure the selections are consistent

Select Registry
VCS

Select Country
Indonesia

Select Sector
Forestry and Land Use

Select Methodology
VM0007

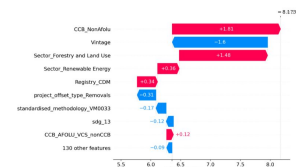
Select offset_type
Avoidance/Reduction

Select Corsia Eligibility
False

AlliedOffsets Carbon Credit Calculator

Shapely Values, for feature Interpretability

The interpretation is that each feature will contribute to a deviation from the global sample mean



AO Price
8.17
per tCO2e

Glossary

ACR - American Carbon Registry

CAR - Climate Action Reserve

CCA - Cercarbono

CDM - Clean Development Mechanism

CDR - Carbon Dioxide Removal

GSR - Gold Standard

NOR - Nori

OTC - Over the counter

PC - Peatland Code

PV - Plan Vivo

PDD - Project design document

PUR - Puro.earth

RE - Renewable energy

tCO2e - Ton of carbon dioxide equivalent

UCR - Universal Carbon Registry

VCM - Voluntary Carbon Market

VCS - Verra

WCC - Woodland Carbon Code

CDR Methodologies:

AFOLU - Agriculture, forestry, and other land use

BCH - Biochar

BLU - Blue carbon

BECCS - Bioenergy carbon capture and storage

CC - Carbon capture

DAC - Direct air capture

MIN - Enhanced weathering and mineralization

OCN - Ocean alkalization

UTL - Utilization

Thank you!

For more information and data, please visit our website or contact hello@alliedoffsets.com.