



Carbon Credits 101: An Introduction to a Growing Global Market

As the science around climate change becomes more indisputable, and the need to act more urgent, many governments and companies are committing to net-zero greenhouse gas (GHG) emissions targets. According to the United Nations, 1,541 companies—and 23 percent of the Fortune 500—with a combined revenue of over \$11.4 trillion, have adopted net zero targets. Many are meeting these commitments in part by purchasing and retiring carbon credits.

As of December 31, 2021, there were 25 national and sub-national carbon credit programs operating, with another six in development. This does not include existing transnational schemes, such as the UN's Clean Development Mechanism (CDM) and voluntary programs, such as Verra's Verified Carbon Standard.

As a result of these considerations, there is a lot of excitement around carbon credits. There is also a lot of uncertainty and confusion about them. This article will attempt to shed some light on this complex but important topic. It will discuss:

- What carbon credits are
- The functions that credits serve
- How credits ensure real GHG reductions
- The carbon credit process
- Prospects for future demand

What are Carbon Credits?

Carbon credits represent a tonne of CO₂ emissions that has been removed, reduced or avoided. Carbon credits can be used to negate, or offset, emissions of an equivalent amount of CO₂ that have occurred elsewhere. They may be purchased by an organization that has mandatory or voluntary obligations to reduce its GHG emissions. The buyer will then “retire” the credit in order to meet those reduction requirements. Buyers may also choose to hold onto the credits for use against future reduction requirements or as an investment asset for sale on carbon markets.

A Credit by any other name

You may hear carbon credits referred to as “carbon offsets” and “greenhouse gas offsets.” They all refer to the same thing; however, there are different types of carbon credits. Those that are used to meet regulatory requirements to reduce GHG emissions are referred to as “compliance” credits and are typically listed in government-sponsored third-party registries. They are usually submitted to meet reductions that a company is required to make under regulations. They may also be retained by the company to meet future GHG reductions obligations.

Credits that are used to meet voluntary reductions—such as when companies make voluntary net zero pledges—are referred to as “voluntary” credits. The latter may be listed on voluntary carbon registries and bought and sold through project developers or brokers. These credits are often referred to as “offsets” and are always the result of voluntary—as opposed to mandatory—activities and are typically “surplus” to regulations (that is, not mandated by law) and are not the result of business-as-usual practices in the sector. In most cases, projects would also not occur if it were not for the presence of carbon finance (that is, revenue from the sale of credits), a concept called financial additionality.

Why Carbon Credits?

Carbon credits are intended to serve as a market mechanism to support the attainment of GHG reduction targets set out by governments and companies. They are often instituted in conjunction with regulatory measures, such as performance standards, and provide both a financial incentive for voluntary GHG reductions, as well as flexibility in mandatory reductions. By obtaining and retiring the credits, organizations with compliance or voluntary GHG reduction commitments can do so in a cost- and process-effective manner. Carbon credits can serve a number of valuable functions in helping governments to meet their GHG reduction targets. These are outlined in the sections that follow.

1) Compliance flexibility

Companies may use carbon credits to meet their reduction commitments for a variety of reasons. First, they may be unable to make the reductions themselves due to limitations in existing processes, technologies and/or inputs (such as fossil fuels). Second, making such reductions may not be cost effective and

carbon credits may be a more cost-effective means than making technology or process changes.

For these reasons, carbon credits are often referred to as flexibility mechanisms for GHG reductions. Providing this flexibility not only increases the chances that the reductions targets of the companies and governments will be met, it allows the opportunity to do so in the most cost-effective manner. This is important for political acceptance of GHG reduction schemes.

For instance, recognizing the GHG emissions associated with aviation, the International Civil Aviation Organization (ICAO) undertook a voluntary industry-wide net zero commitment. Because there is currently no effective replacement for fossil fuels for aviation, the industry established the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), an initiative to offset emissions associated with international flight. CORSIA members will purchase and retire credits to meet their reduction commitments in near and middle term until commercially viable sustainable fuels are available to replace fossil-based fuels.

2) Reward early action

When governments institute GHG-reduction regulations, they will often provide a period of time to allow for the industry to make the changes necessary to meet those requirements. If companies are able to make those reductions prior to the policy start date, those reductions may be eligible for credits, as the reductions would be considered both voluntary and beyond business-as-usual practices. This can provide a strong incentive for early emission reductions, which increase the chances of attaining the emissions reduction targets. It also increases industry support for the incoming regulations.

A good example of this occurred in the oil and gas sector in Alberta. In 2016, the government signalled that high-bleed pneumatic devices—a source of significant methane emissions—would be required to be upgraded by 2025. Any replacements made before that date would be eligible for early action offsets.

Approximately 60,000 of these devices—each emitting about 50-60 tonnes CO₂e per year—were replaced, removed or retrofitted. The early action window allowed operators to cover the costs of the mandatory upgrades while generating revenues for a period of time. On the regulator's side, this not only helped to meet its GHG reduction targets, it also made it much more politically feasible to implement the policy.

Most importantly, it created a sense of urgency and an immediate call to action to reduce emissions. From a climate perspective, emission reductions that occur now are more important than emission reductions that occur later. Offsets help us deliver immediate action, generating real emissions reductions

while we develop, de-risk and scale the technologies that will get us to net zero.

3) Finance emerging technologies

Carbon credits, particularly offsets, are also intended to provide financing for deployment of early-stage technologies. Because they are new, emerging technologies or processes necessarily meet the additionality requirement of being beyond business-as-usual practices (see the [Making of a Credit: What is Required](#) in this paper for more detail). Due to economies of scale, early-stage technologies are often more expensive than established practices. Further, they are more subject to performance risk. The potential value of the carbon credits can help to overcome the financial and risk barriers, thus facilitating a pathway to demonstration and commercialization for emerging technologies.

4) Finance GHG-reduction projects

Project developers can use the projected value of carbon credits to secure financing for the project. This type of financing is often referred to as “carbon financing” because it is predicated on the value of the carbon credits. In some projects, the sale of offsets is the only revenue stream, meaning the project wouldn't be feasible without it. In other projects, offsets may provide secondary revenue streams that provide financial resilience for the project if the primary revenue stream is lower than expected.

5) Generate new revenue streams

Carbon credits represent new revenue streams and business models for companies. For companies in traditionally high-emitting sectors, such as oil and gas or power, this may be crucial to long-term viability.

As more governments and companies take on GHG reduction commitments, those will be met in significant part by the purchase and retirement of carbon credits. As such, carbon is rapidly emerging as a commodity of tremendous interest to investors and financial institutions. A number of carbon-centred investment funds have emerged, such as KFA Global Carbon ETF, an exchange-traded fund (ETF) that was launched in July 2020 and had grown to over \$380 million in May 2021. As the urgency to reduce GHG emissions intensifies, investors' interest in carbon as a commodity will only grow.

Carbon Tax or Carbon Credit: Which is Better?

A carbon tax is a tax payable to some level of government as a result of purchasing goods or services that result in emission reductions, such as gasoline for your car or natural gas for heating your home. Many groups argue that taxes are superior

to credits or other market-based approaches; however, this is not always the case.

A carbon tax is intended to make GHG-emitting activities more expensive and, thus, make lower-carbon activities more attractive. However, for many consumers, product substitution is not currently possible (for instance, not everyone can afford an electric car). Further, there is no guarantee that the government will deliver equivalent reductions with the tax revenue. Ideally, revenue from carbon taxes should fund the development of technologies and infrastructure that will help reduce the cost of substitution over time. However, with a tax there is very little measuring, monitoring and tracking of actual reductions. On the other hand, a carbon credit is only created if an activity has resulted in a reduction and the process to create a credit is rigorous, data-driven and transparent.

This is not an “either/or” situation. To effectively and immediately bend the curve of GHG emissions downward, we need both the policy stick of a carbon tax and the carrot that carbon credits represent.

The Making of a Credit: What is Required?

Carbon credits are intended to address climate change by reducing GHGs. It is crucial, therefore, that all credits represent real reductions. Further, credits that are purchased not only represent significant financial investment by the buyer but, because they are being applied against regulatory requirements, they must represent legitimate reductions. If not, they create significant legal risk for the purchaser. It is therefore crucial that the credits represent real, measurable and permanent reductions, not only from the standpoint of the claimed environmental gain but also for the credibility and effective functioning of carbon markets.

In order to ensure that they meet all the requirements of environmental and commercial integrity, the credits must be:

- **Unique:** The reduction must only be counted and credited once, and the credit must only be retired against a reduction obligation once. If an emission is credited or retired more than once, it is known as double-counting. To prevent this, when a carbon credit is created, it is registered on one of a number of registries and is assigned a unique identifying serial number. If the credit is sold, the transaction will be noted on the registry and the owner information updated. When the credit is retired, the registry will remove it from circulation, so it cannot be used again.
- **Additional:** In the case of GHG offsets, the reduction represented by the credit must be additional to those that would have taken place in the absence of the reduction project. It cannot be the result of actions undertaken due to

regulations or as a result of normal, business-as-usual or industry-standard practices. Some offset systems, such as the Clean Development Mechanism, require that the reduction project not be financially viable without the revenues generated from the credits. This is referred to as “financial additionality.”

- **Quantifiable:** To ensure that the claimed reductions are real, they must be measurable, or quantifiable, against a pre-project emissions baseline. The number of credits generated are calculated by comparing emissions in the project condition against those of the baseline condition, with the difference representing the number of credits generated (in tonnes of CO₂e or CO₂ equivalent). Both the baseline level of emissions and the reduced level of emissions must be quantified.
- **Permanent:** When a credit is retired, the obligation for that reduction is considered to be fulfilled. As such, the reduction represented by the credit must be permanent. In some project types—particularly forestry and agriculture—the emissions reduction may be subject to a reversal, such as through a forest fire. This could create legal and reputation risk for the company that retired the credit. To protect against this, the crediting system will establish a process that accounts for such reversals. For instance, a percentage of emissions reductions may be allocated to a buffer pool. In such a case, a forestry project developer may only receive credit for 90 percent of emissions, with the remaining 10 percent being allocated to a buffer pool.
- **Verified:** For credits to serve their environmental purpose, it is crucial to ensure that the reductions the offsets represent are real and permanent. They must also meet the requirements of the governing crediting body, which are defined in GHG reduction quantification methodologies or protocols. Third-party auditors must verify that the reduction meets the requirements established in the protocol. In some cases, such as the CDM, the project will be validated as meeting the protocol requirements prior to project commencement. This can help secure project financing, particularly if it is predicated on the value of the expected credits, and can also reduce project risk.

The Carbon Credit Process

There are a number of voluntary and compliance offset systems currently operating, each of which has its own particular requirements and processes. However, credit creation in each follows similar steps. These are in place to ensure that any reductions being claimed are real, permanent and additional. Generally speaking, the offset development process is as follows:

1. Quantify pre-project (baseline) emissions;
2. Identify existing GHG reduction quantification methodology (or protocol) or work with registry to develop an approved methodology;
3. Assess project for offset eligibility and projected volume against protocol or methodology;
4. Conduct GHG removal, reduction or avoidance activity;
5. Quantify the GHG emissions that were removed, reduced or avoided as a result of the project activity;
6. Document the reductions according to the governing body's requirements;
7. Verify emissions against the requirements of the protocol using third-party verifier;
8. Register offset on registry and receive certification, including unique identifying serial number; and,
9. Manage offset according to strategic objectives, such as retiring the offset against a GHG-reduction commitment, selling the offset, or holding the offset for future retirement or sale.

Creating Credits: The Importance of Data

Two of the key criteria required to ensure the environmental integrity of the carbon credit are quantification and verification. Both of these criteria rely on high-quality data. Prior to commencing a carbon credit project, it is useful to ensure that strong data management systems and practices are in place. Digital solutions are emerging that can drastically streamline the quantification, documentation and verification processes. Doing so, also facilitates buyer due diligence processes, thereby reducing transaction costs and risk for both buyer and seller.

Carbon Credits: Rapidly Growing Markets

Carbon market analysts Refinitiv reported that the total value of global carbon markets grew by nearly 20 percent in 2020, reaching €229 billion, the fourth consecutive year of record growth and more than five times the value in 2017.^[1] This was driven, in part, by the widespread adoption of voluntary net zero targets by companies, which is expected to continue for the foreseeable future.

The Taskforce on Scaling Voluntary Carbon Markets (TSVCM) estimates that demand for carbon credits could increase 15 times or more from 2020 levels by 2030 and by 100 times by 2050.^[2] It predicts that voluntary markets alone will be worth \$50 billion by 2030.^[3] Timothy Adams, chief executive of the IIF, believes there is “huge upside potential” for voluntary carbon credits. He

predicts the market could be worth as much as \$100 billion a year by 2050.^[4]

Methane: Low-Hanging Carbon Credit Fruit

Carbon credits can be generated by a wide variety of GHG-reduction, removal or avoidance activities. One rapidly emerging global opportunity is through the capture and use of methane emissions that are produced through oil and gas extraction, processing and transport activities.

When it comes to global warming, methane is 34 times more potent than CO₂ over a 100-year period but 86 times more potent over a 20-year period. As a result, reducing methane emissions in the short-term is an important step in reducing the effects of climate change in the short term.

Methane is therefore considered low-hanging fruit in terms of GHG reductions. The tools and technologies to reduce methane emissions at low-cost are already commercially available. However, until now, producers have had little incentive to reduce methane emissions. The rapid growth of both compliance and voluntary markets presents producers with excellent opportunities to reduce those emissions, thereby generating new revenue streams from the production and sale of carbon credits. Reducing methane emissions also greatly reduces the GHG-intensity of their hydrocarbon products, which can have significant benefits in terms of gaining access to market and attracting GHG-conscious investors.

^[1] Refinitiv (Feb 2021) [Carbon Market Year in Review 2020](#)

^[2] Taskforce on Scaling Voluntary Carbon Markets (January 2021) [Phase 1 – Final Report](#)

^[3] McKinsey (Jan 2021) [A blueprint for scaling voluntary carbon markets to meet the climate challenge](#)

^[4] CNBC (Jul 8, 2021) [IIF sees huge potential for voluntary carbon credits, predicts \\$100 billion a year market by 2050](#)



Supporting the Quantification, Verification and Monetization of Carbon Credits

Headquartered in Calgary Canada, with

representative offices in the United Arab Emirates, CarbonAi is engaged in accelerating and automating emissions reductions. CarbonAi is focused on turning the global challenge of climate change and associated emission reduction obligations into strategic opportunities. CarbonAi supports target partners and sectors with visualizing emissions, understanding complex regulations, implementing effective solutions, and managing ongoing inspections, data requirements, and audits. In addition to our suite of technology solutions, CarbonAi is also actively engaged in large-scale, international emission reduction projects.

CarbonAi's leadership team has extensive experience and expertise in:

- Carbon markets and carbon credit monetization
- Methane reductions management
- Project management of carbon emission reduction projects
- Project engineering, procurement and construction
- Project financing
- Emissions data management

For more information, please visit CarbonAi.ca or email at info@CarbonAi.ca