Tradewater

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Evaluating Carbon Offset Credits:
Why Credits Generated through the Destruction of Harmful Refrigerant Gas are Among the Highest Quality Available

In evaluating the carbon offset credits available on the market, leading environmental organizations offer valuable guidance to indicate which approaches most effectively reduce greenhouse gas emissions around the world.

A scientific review of climate change strategies, *Project Drawdown*, finds the control and elimination of fluorinated refrigerant gases as a top approach to reduce global warming. To evaluate the offset credits generated by this and other approaches, widely accepted guides uniformly conclude that credits are of higher quality if the underlying project activities are truly "additional," if the emissions avoided are "permanent," and if the calculation of environmental benefit is "accurate" and transparent.

Tradewater is a project development company that collects and destroys old refrigerants creating carbon offset credits that meet and exceed these criteria. Tradewater offset credits are generated by permanently destroying some of the most potent greenhouse gases ever created under a process that is environmentally safe, easily quantified, and verified. Moreover, the refrigerant gases that Tradewater targets would never be destroyed in the absence of carbon offset projects.

This paper outlines the commonly accepted standards for high quality carbon offsets, describes why projects must follow strict criteria, and illustrates how Tradewater's projects meet the highest standards for greenhouse gas emission reductions.

Characterizing Carbon Offset Credits

Carbon offset credits may differ in project approach but share certain defining characteristics. Each carbon offset credit represents the reduction of the equivalent of one metric ton of carbon dioxide. All carbon offset credits represent greenhouse gas (GHG) emission reductions that occur above and beyond any regulatory requirements.[1] Project developers must follow strict protocols when reducing emissions and all project activities must be audited by independent third-party verifiers to confirm compliance with those protocols before any offset credits are issued. The carbon offset credits are ultimately issued by independent offset registries.

Despite these shared characteristics, the greenhouse gas reduction activities that different project developers undertake vary widely. Regarding long-term impact, for instance, forestry projects sequester carbon dioxide that has already been released and promise to maintain the carbon stock of the forest in trees and soil for 100 years. Refrigerant destruction projects, on the other hand, destroy harmful chemical gases before they are ever released into the atmosphere.

Focusing on Ozone Depleting Substances (ODS)

Carbon offset projects that focus on refrigerant destruction seek to identify, collect, and destroy Ozone Depleting Substances (ODS) around the globe. ODS destroy the earth's ozone layer, which protects the Earth's surface from harmful ultraviolet radiation.[2] ODS include a range of chemical gases, including refrigerants such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and halons that are used as fire suppressants.

Due to their impact on the ozone layer, ODS production was banned by the Montreal Protocol on Substances that Deplete the Ozone Layer (1987). Despite this production ban, however, ODS are still pervasive in old equipment such as cooling and refrigeration systems and in cylinders and cans filled with ODS that were manufactured and sold into commerce before the bans took effect but were never used.

The scale of ODS impact on the environment is staggering. CFC-12 refrigerant (chemical name dichlorodifluoromethane, commonly known as Freon), has 10,900 times the global warming potential as the same amount of carbon dioxide.[3] According to environmental scientists, CFCs leaked from discarded equipment, stockpiles, and foams could "add up to 10 Gt CO2-eq. of greenhouse gases to the atmosphere,"[4] which is greater than the annual emissions of the United States of 6.5 gigatons (Gt) carbon dioxide equivalent.[5]

Moreover, unlike carbon dioxide, ODS cannot be re-captured or sequestered once released into the atmosphere.[6] CFC-12, for example, remains in the atmosphere about 100 years before breaking down.[7] Because of this, preventing the release of ODS, along with other high-impact gases, will slow warming by 0.6° C by 2050.[8] It is also why *Project Drawdown* ranks increasing the control and elimination of fluorinated refrigerant gases as a top approach to reduce global warming.[9]

Tradewater's Carbon Offset Projects

Tradewater collects and destroys ODS around the world.[10] These gases are collected from cylinders and cans that can be found in garages, auto shops, HVAC stores, and in stockpiles owned by governments and businesses. Tradewater also recovers refrigerants from decommissioned cooling equipment such as building chillers. If not collected and destroyed, these gases would eventually leak into the atmosphere. The typical ODS container is not meant for long-term storage and will eventually rust. All ODS-containing equipment is at risk of leaking over time.

All the ODS that Tradewater collects is destroyed in highly regulated and permitted incinerators with continuous monitoring equipment to ensure that international, federal, and local environmental regulations are met. The most important of these regulations is a requirement that at least 99.99% of the ODS is destroyed.[11] All Tradewater projects follow offset protocols by the American Carbon Registry and California Air Resources Board for domestic ODS projects and Verra for international ODS projects.[12,13,14] These protocols lay out strict requirements for how the projects must be conducted and quantified to create carbon offsets. Each project is reviewed by third-party verifiers through a rigorous auditing process to confirm that these rules, and the appropriate offset protocol rules, were followed.[15,16]

A buyer of Tradewater offset credits can therefore have great confidence that nobody would be destroying refrigerant gases at scale in the absence of Tradewater's work, the refrigerant Tradewater destroys leads to permanent reductions, and the resulting offset credits reduce net CO_2 emissions by the amount Tradewater claims.

Establishing Criteria for High Quality Offset Credits

Four recently published guides offer sound examples of the criteria to use to evaluate and compare carbon offset project types: World Wildlife Fund/Environmental Defense Fund (EDF)/Oeko-Institut[17], Gold Standard[18], Vox Media[19], and GHG Management Institute (GHGMI)/Stockholm Environment Institute.[20]

While the guides have some differences between them, there are a set of key criteria common to most or all:

- All four guides stated that high quality carbon offset credits must be "**additional**."[21]
- Three of the four guides said that projects are of higher quality if the emission reductions are "**permanent**."[22]
- And three of the four guides state that high quality carbon offset credits come from projects in which the resulting credits are "**accurate**" or "**not overestimated**."[23]

On each of these criteria, Tradewater's carbon offset projects score very high.

Additionality

It is a basic requirement of all carbon offset projects that the underlying project activities are additional – that they would not happen in the absence of a carbon market.[24][25] But the degree of additionality depends on the project type.

For some projects, there can be a range of non-carbon factors that drive their development.[26] For example, some forests are already being conserved but may not have full formal protection in place to avoid deforestation in the future. Development of methane destruction programs related to landfill gas or animal methane digesters can be used to make electricity or compressed natural gas, which creates additional revenue streams to support the project.

In contrast, the case for ODS is simple: without the sale of carbon offset credits from ODS destruction projects, they would not take place and the gases would escape into the atmosphere. This is because there is no mandate to collect and destroy ODS gases.[27] Despite banning production of ODS, the Montreal Protocol did not require an end-of-life solution for existing ODS. It is still permissible to buy, sell, and use ODS that was produced before the ban.

Furthermore, there are no incentives or financial mechanisms to encourage ODS destruction.[28] According to the International Energy Agency and United Nations Environment Program, "there

is rarely funding nor incentive" to recover and destroy ODS in storages tanks and discarded equipment.[29] And collecting, transporting, and destroying ODS is time-intensive and expensive.[30] The burden to collect and destroy these gases therefore remains prohibitive outside of carbon offset markets – meaning that if organizations like Tradewater do not do this work, nobody else will.[31,32,33]

Additionally, countries are not focused on the need to collect and destroy ODS refrigerants. The Montreal Protocol has been celebrated as a success because of its production ban.[34] This success, however, ignores the legacy refrigerants produced before the ban and is a blind spot for government regulators. In the U.S., for example, the Environmental Protection Agency (EPA) developed a Vintaging Model in the 1990s to estimate the quantify of ODS left in circulation.[35] Based on the inputs and assumptions put into the model, the EPA predicted that no CFCs would be available for recovery beyond 2020 in the United States.[36] But this prediction did not prove accurate. Tradewater has collected and destroyed more than 1,100,000 pounds of CFCs in the United States in recent years and continues to identify thousands of pounds per week.

Similarly, international carbon accounting standards do not require corporations to measure or track emissions tied to ODS. ODS refrigerants are specifically excluded from Science Based Targets initiative (SBTi) commitments. These commitments derive from emissions reporting under the GHG Protocol, which requires companies to report on emissions only from new generation refrigerants, such as hydrofluorocarbons (HFCs), but does not establish any obligation to report inventories or emissions of ODS refrigerants still in use such as CFCs and HCFCs.[37]

All these factors combine to make Tradewater's carbon offset projects highly additional. As Giving Green, an initiative of IDinsight, concluded: "Tradewater would not exist without the offset market, so this element of additionality is clearly achieved."[38]

Permanent

Emission reductions are considered permanent if they are not reversible. In some projects, such as forestry or soil preservation, carbon offset credits are issued based upon the volume of CO_2 that will be sequestered over future decades – but human actions and natural processes such as forest fires, disease, and soil tillage can disrupt those projects. When that happens, the emission reductions claimed by the project are reversed.

The destruction of ODS does not carry this risk. All destruction activities in Tradewater's projects are conducted pursuant to the Montreal Protocol, which requires "a destruction process" that "results in the permanent transformation, or decomposition of all or a significant portion of such substances."[39] Specifically, the destruction facilities Tradewater uses must meet or exceed the recommendations of the UN Technology & Economic Assessment Panel, which approves certain technologies to destroy ODS,[40] including the requirement that the technology achieve a 99.99% or higher "destruction and removal efficiency." Simply put, this means that Tradewater's technologies ensures that over 99.99% of the chemicals are permanently destroyed. During the

destruction process, a continuous emission monitoring system is used to ensure full destruction of the ODS collected.[41]

Accurate and Not Overestimated

Carbon offsets can be "overestimated" if a project developer does not accurately account for the emission reductions achieved by a project, or if a project developer incorrectly estimates the emissions reduced by the project. This can be due to incorrect baseline or project assumptions, or complexities and uncertainties inherent to the project type.[42]

Tradewater avoids the issue of overestimation by consistently conducting extremely precise testing and measurement of the amount of ODS destroyed in each project.

First, every container of ODS that Tradewater destroys is weighed by a third-party using regularly calibrated scales. The ODS is then sampled by a third-party and analyzed by an accredited refrigerant laboratory to determine its species and purity. These two steps combine to ensure that credits are issued only for the precise volume and type of refrigerant destroyed.

Second, the destruction facilities that Tradewater uses continuously monitor the incineration process during destruction events to ensure that over 99.99% of the ODS is destroyed. This monitoring is mandated by regulatory protocols and is part of the verification process to which projects are subjected.

Third, Tradewater accounts for the project emissions created during the collection, transport, and destruction of ODS, and the number of offsets issued is reduced by a corresponding amount. The protocols that we use also build in other reductions to account for substitute chemicals that will be used to replace the destroyed refrigerants.[43,44]

Tradewater publishes this information in the documentation for all its ODS destruction projects. These documents outline how the material was obtained, the project emissions calculations, the test results, and the amount and type of ODS chemicals destroyed, among other information. [45]

Summary

The accurate appraisal of carbon offset credits may begin with criteria from leading environmental organizations and must also consider the long-term impact and accuracy of the projects considered.

Given these factors, Tradewater emerges as a leader in producing high quality carbon offset credits. Tradewater has developed 48 ODS projects that were successfully verified, resulting in the destruction of over 4,774,000 tons of carbon dioxide equivalent. These projects meet the most commonly accepted criteria for high quality carbon offset credits in the market – they are truly additional, the reductions achieved are permanent, and the emissions calculations are accurate and transparently presented.

[1] Carbon Market: Overview. 2015. Ecosystem Marketplace; [accessed 2021 May 4] https://www.ecosystemmarketplace.com/marketwatch/carbon/

[2] CFCs and their substitutes in stratospheric ozone depletion. NOAA Earth System Research Laboratory; [accessed 2021 May 4] https://www.esrl.noaa.gov/gmd/hats/about/cfc.html

[3] CFC-12, a popular refrigerant, has about 10,900 more global warming potential than carbon dioxide according to the fourth IPCC assessment global warming potentials that are used in the ODS protocols. Halons are between 1,640 and 7,1400 times more powerful than carbon dioxide. Source: Ozone-Depleting Substances. USEPA; [accessed 2021 May 4] https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances

[4] Solomon S, Alcamo J, Ravishankara AR. 2020. Unfinished business after five decades of ozone-layer science and policy. Nature Communications 11: 4272. https://doi.org/10.1038/s41467-020-18052-0

[5] Data Highlights: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019. USEPA; [accessed 2021 May 4] https://www.epa.gov/sites/production/files/2021-04/documents/us-ghg-inventory-1990-2019-data-highlights.pdf

[6] GIZ. 2017. Global roadmap on ODS bank management. Bonn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. https://www.giz.de/en/downloads/giz2017-en-global-roadmap.pdf

[7] Ozone-Depleting Substances. USEPA; [accessed 2021 May 4] https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances

[8] Why we need to act now. Climate & Clean Air Coalition; [accessed 2021 May 4] https://www.ccacoalition.org/en/content/why-we-need-act-now

[9] Refrigerant management. Project Drawdown; [accessed 2021 May 4] https://www.drawdown.org/solutions/refrigerant-management

[10] Tradewater has also completed verified projects for HFC reclamation (7,313 metric tons emissions reduced) and abandoned mine methane (2,236 metric tons emissions reduced, under the company name Wabashco). HFC project documents are available here: https://acr2.apx.com/mymodule/reg/prjView.asp?id1=564 and abandoned mine methane documents are available here: https://acr2.apx.com/mymodule/reg/prjView.asp?id1=342

[11] UNEP Technology and Economic Assessment Panel. 2018. Volume 2: Decision XXIX/4 TEAP Task Force report on destruction technologies for controlled substances. Nairobi: UNEP. https://ozone.unep.org/sites/default/files/2019-04/TEAP-DecXXIX4-TF-Report-April2018.pdf

[12] American Carbon Registry. 2017. Methodology for the Quantification, Monitoring, Reporting and Verification of Greenhouse Gas (GHG) Emissions Reductions from the Destruction of Ozone Depleting Substances (ODS) and High-Global Warming Potential (GWP) Foam, v1.1. Washington, DC: Winrock International. https://americancarbonregistry.org/carbon-accounting/standards-methodologies/destruction-of-ozone-depleting-substances-and-high-gwp-foam

[13] Verified Carbon Standard. 2017. VM0016 Recovery and Destruction of Ozone-Depleting Substances (ODS) from Products, v1.1. Vienna: Energy Changes Projekt Entwicklung GmbH and Wels: USG Umweltservice GmbH. https://verra.org/methodology/vm0016-recovery-and-destruction-of-ozone-depleting-substances-ods-from-products-v1-1/

[14] ARB Compliance Offset Protocols. California Air Resources Board; [accessed 2021 May 24] https://ww2.arb.ca.gov/our-workChicago/programs/compliance-offset-program

[15] TW Ghana ODS Project. Verra; [accessed 2021 May 4] https://registry.verra.org/app/projectDetail/VCS/1752

[16] To view Tradewater's verification documents from ACR, click on the link referenced here, click "Projects," filter for Tradewater as the project developer, click on a project name, then click on the Documents "View" link. Source: Project credits issued. American Carbon Registry; [accessed 2021 May 4] https://americancarbonregistry.org/how-it-works/registry-reports

[17] Schneider L, Healy S, Fallasch F, De León F, Rambharos M, Schallert B, Holler J, Kizzier K, Petsonk A, Hanafi A. What makes a high-quality carbon credit? Freiburg im Breisgau: Oekoinstitut. https://www.worldwildlife.org/publications/what-makes-a-high-quality-carbon-credit

[18] Carbon offsetting: What you need to know to take action against climate change. 2020. Gold Standard; [accessed 2021 May 4] https://www.goldstandard.org/our-story/gold-standard-offsetting-guide
[19] Ifran U. 2020 Feb 27. Can you really negate your carbon emissions? Carbon offsets, explained. Vox Media; [accessed 2021 May 4] https://www.vox.com/2020/2/27/20994118/carbon-offset-climate-change-net-zero-neutral-emissions
[20] Broekhoff D, Gillenwater M, Colbert-Sangree T, Cage P. 2019. Securing climate benefit: A guide to using carbon offsets. Stockholm Environment Institute & Greenhouse Gas Management Institute. http://www.offsetguide.org/pdf-download/
[21] All four guides had the criteria "not double counted," but this depends on the offset registration system, not the project type. Tradewater uses carbon registries to track how our carbon credits are issued and retired. Both ACR and Verra publicly list carbon credits and use a serial number system to ensure that each offset is only credited once. The less common criteria were: "Facilitating transition towards net zero emissions" and "Strong institutional arrangements and processes of the crediting program" (EDF/WWF/Oekoinstitut); and certified, verified and traceable (Gold Standard). Tradewater's ODS projects also meet these criteria. By destroying ODS, Tradewater is facilitating a transition to net zero emissions. Listing credits on the ACR and Verra registries, ensures that they are required to be certified, verified, and traceable. These organizations have legitimate institutional arrangements to prevent fraud or abuse in the voluntary carbon market.
[22] EDF/WWF/Oekoinstitut, Gold Standard, and SEI/GHGMI guides. See footnotes above for full references.
[23] EDF/WWF/Oekoinstitut, Gold Standard, and SEI/GHGMI guides. See footnotes above for full references.
[24] Verra defines a project as additional if "it can be demonstrated that the activity results in emission reductions or removals that are in excess of what would be achieved under a 'business as usual' scenario and the activity would not have occurred in the absence of the incentive provided by the carbon markets." Verra. 2019. VCS Standard, v4.0. Washington DC: Verra, p. 33. https://verra.org/wp-content/uploads/2019/09/VCS_Standard_v4.0.pdf
[25] ACR has a similar requirement: "ACR's additionality requirements are intended to ensure that credited offsets exceed the GHG reductions and removals that would have occurred under current laws and regulations, current industry practices, and without carbon market incentives. Project Proponents must demonstrate that the GHG emission reductions and removals from an offset project are above and beyond the 'business as usual' scenario." Source: American Carbon Registry. 2020. The American Carbon Registry standard, v7.0. Washington, DC: Winrock International, p. 29. https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard
[26] Forestry & Agriculture. Carbon Offset Guide; [accessed 2021 May 12] https://www.offsetguide.org/avoiding-low-quality-offsets/vetting-offset-projects/forestry-agriculture/
[27] In the United States, for example, the EPA allows parties to recover and reuse ODS gases. 'Venting' refrigerants (releasing them to the atmosphere) is illegal in the United States, but there is no mandate to destroy ODS gases. ODS gases may therefore leak from appliances and disposable containers, which are not meant for long-term storage. Source: Section 608 of the Clean Air Act: Stationary Refrigeration and Air Conditioning. 2018. USEPA; [accessed 2021 May 4] https://www.epa.gov/sites/production/files/2018-09/documents/section_608_of_the_clean_air_act.pdf
[28] Tradewater developed the method for determining project additionality for the Verra protocol. Countries with existing CFC recovery destruction programs are identified in this method. For projects to be validated as additional, "the project proponent must provide a description of any schemes or programs designed to incentivize ODS destruction in the country(ies) in which the CFC refrigerant is collected." Source: Brown T, Plotkin G, Caldwell I. 2017. VMD0048: Activity method for the determination of additionality for recovered and stockpiled ODS refrigerant projects. Washington, DC: VCS, p. 5. https://verra.org/wp-content/uploads/2018/03/VMD0048-Additionality-for-Recovered-and-Stockpiled-ODS-v1.0-30Nov2017-1.pdf
[29] United Nations Environment Programme and International Energy Agency. 2020. Cooling emissions and policy synthesis report. Nairobi: UNEP and Paris: IEA. https://wedocs.unep.org/bitstream/handle/20.500.11822/33094/CoolRep.pdf?sequence=1&isAllowed=y

[30] ICF. 2018. ODS destruction in the United States and abroad. Washington, DC: Prepared for the U.S. Environmental Protection Agency. https://www.epa.gov/sites/production/files/2018-03/documents/ods-destruction-in-the-us-and-abroad_feb2018.pdf

[31] One such project is conducted by the German international development organization, GIZ. See: https://www.giz.de/en/worldwide/30797.html

[32] The Environmental Investigation Agency found that, "To date, no comprehensive approach to manage ODS or HFC banks has been developed under the Montreal Protocol." Source: EIA. 2019. Search, Reuse, and Destroy: How States Can Take the Lead on a 100 Billion Ton Climate Problem. Washington, DC: EIA. https://eia-global.org/reports/20190214-search-reuse-destroy

[33] A recent presentation by GIZ highlighted the challenges of ODS bank management and destruction. These include regulatory, informational, financial, technological, and logistical barriers. Source: Schmittner, F. 2020. ODS Banks Management and Destruction: Challenges and Lessons Learnt. Presented at UNEP ECA Meeting "Recovery, recycling, reclaim (RRR) and disposal of refrigerants"; https://www.ozonactionmeetings.org/system/files/210414_ods_banks_management_and_destruction_franziska_schmittner.pdf

[34] Solomon S, Alcamo J, Ravishankara AR. 2020. Unfinished business after five decades of ozone-layer science and policy. Nature Communications 11: 4272. https://doi.org/10.1038/s41467-020-18052-0

[35] EPA's Vintaging Model of ODS Substitutes. USEPA; [accessed 2021 May 4] https://www.epa.gov/ozone-layer-protection/epas-vintaging-model-ods-substitutes

[36] ICF. 2018. ODS destruction in the United States and abroad. Washington, DC: Prepared for the U.S. Environmental Protection Agency. https://www.epa.gov/sites/production/files/2018-03/documents/ods-destruction-in-the-us-and-abroad_feb2018.pdf

[37] The SBTi is based on the methods of the GHG Protocol Corporate Standard. GHG Protocol. 2004. A corporate accounting and reporting standard: Revised edition. Geneva: World Business Council for Sustainable Development and Washington, DC: World Resources Institute. The new standard is entirely silent on ODS, and even prior versions made reporting on ODS optional: "GHG emissions not covered by the Kyoto Protocol, e.g. CFCs, NOx, etc. shall not be included in scope 1 but may be reported separately." Id. at 25.

[38] Tradewater. 2020. Giving Green Earth; [accessed 2021 May 4] https://www.givinggreen.earth/post/tradewater

[39] Decision I/12F: Clarification of terms and definitions: Destruction. The Montreal Protocol on Substances that Deplete the Ozone Layer; [accessed 2021 May 4] https://ozone.unep.org/treaties/montreal-protocol/meetings/first-meeting-parties/decisions/decision-i12f-clarification-terms-and-definitions-destruction

[40] UNEP Technology and Economic Assessment Panel. 2018. Volume 2: Decision XXIX/4 TEAP Task Force report on destruction technologies for controlled substances. Nairobi: UNEP. https://ozone.unep.org/sites/default/files/2019-04/TEAP-DecXXIX4-TF-Report-April2018.pdf

[41] EMC: Continuous Emission Monitoring Systems. USEPA; [accessed 2021 May 4] https://www.epa.gov/emc/emc-continuous-emission-monitoring-systems

[42] Song L. 2019 May 31. These 4 Arguments Can't Overcome the Facts About Carbon Offsets for Forest Preservation. ProPublica. https://www.propublica.org/article/these-4-arguments-cant-overcome-the-facts-about-carbon-offsets-for-forest-preservation

[43] American Carbon Registry. 2017. Methodology for the Quantification, Monitoring, Reporting and Verification of Greenhouse Gas (GHG) Emissions Reductions from the Destruction of Ozone Depleting Substances (ODS) and High-Global Warming Potential (GWP) Foam, v1.1. Washington, DC: Winrock International.

[44] Verified Carbon Standard. 2017. VM0016 Recovery and Destruction of Ozone-Depleting Substances (ODS) from Products, v1.1. Vienna: Energy Changes Projekt Entwicklung GmbH and Wels: USG Umweltservice GmbH.

[45] An example set of ODS carbon project documentation can be found at the Verra registry for the Tradewater Ghana ODS Project. Verra; [accessed 2021 May 4] https://registry.verra.org/app/projectDetail/VCS/1752