U.S. Government Accountability Office

Carbon Credits: Limited Federal Role in Voluntary Carbon Markets

GAO-25-107128
Q&A
Report to Congressional Requesters
August 13, 2025

Why This Matters

In voluntary carbon markets, entities can purchase carbon credits from projects intended to reduce carbon dioxide or other greenhouse gas emissions or remove carbon dioxide from the atmosphere. These credits allow companies and individuals to voluntarily "offset" their greenhouse gas emissions to, for example, meet corporate environmental goals. The credits are a potentially lower-cost alternative to directly reducing emissions. The overall value of such markets was $535 million in 2024, down from a high of $2.1 billion in 2021, according to Ecosystem Marketplace, a non-profit initiative to provide information on environmental finance and markets.

However, observers of voluntary carbon markets have found evidence that several commonly used methodologies for producing carbon credits do not reliably reduce greenhouse gas emissions as they claim, according to a White House Fact Sheet from May 2024. Other recent reports have also discussed challenges related to the integrity of these markets. For example, a 2024 report by the International Organization of Securities Commissions, the international body that brings together the world's securities regulators, reported that voluntary carbon markets have vulnerabilities that may be affecting their growth and integrity. Such vulnerabilities include concerns about whether carbon credits produce the environmental benefits they claim and issues relating to the markets' limited transparency.

GAO was asked to examine federal efforts related to voluntary carbon markets. This report describes aspects of these markets, roles and efforts of federal agencies regarding these markets, and steps the federal government could take to promote the markets' integrity, if it chooses to do so.

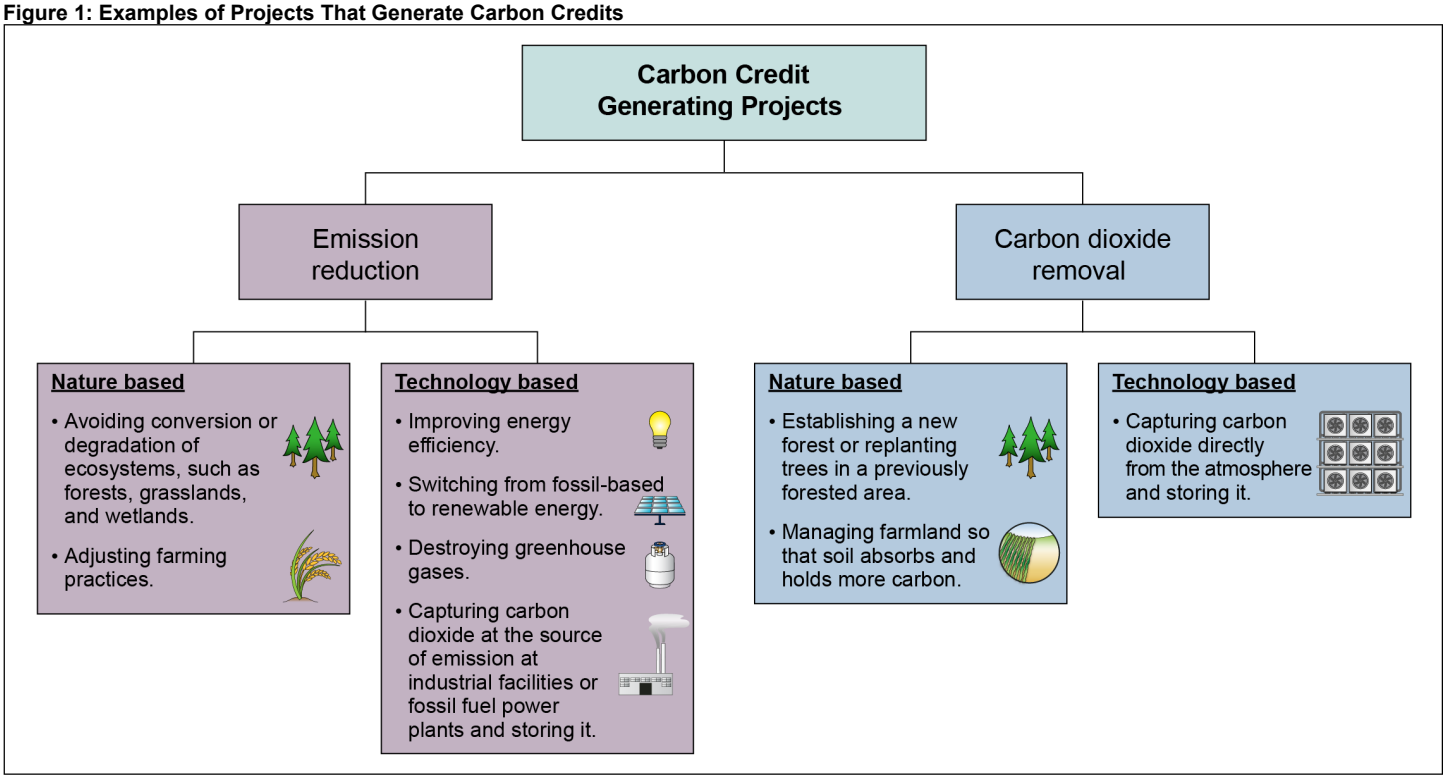
Key Takeaways

- Overall, the federal government has had a limited role in voluntary carbon markets through various agency efforts. For example, the Commodity Futures Trading Commission (CFTC) and the Federal Trade Commission (FTC), have undertaken efforts to provide some oversight or guidance related to voluntary carbon markets. In addition, certain federal entities supported the production of carbon credits and served as potential purchasers of carbon credits. These efforts could change as government priorities evolve.
- There was not a consensus among the eight experts we interviewed about specific steps that the federal government could take to promote integrity in the voluntary carbon markets, if it chooses to do so. A 2023 National Academies report and a 2008 GAO report identified tradeoffs between federal oversight to promote integrity in voluntary carbon markets and costs associated with carbon credits.

What types of projects can generate carbon credits?

In general, projects that reduce emissions and projects that remove carbon dioxide from the atmosphere can generate carbon credits (see fig. 1).[1]

Figure 1: Examples of Projects That Generate Carbon Credits

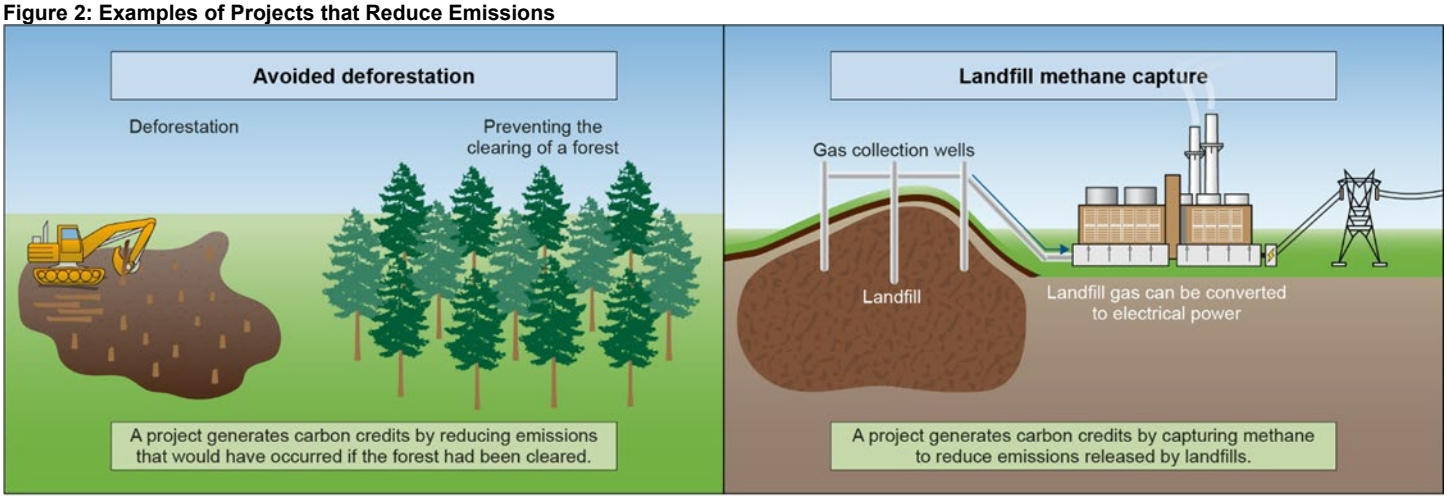


Source: GAO (text and icons). | GAO-25-107128

Emission reduction projects include a wide variety of projects that implement activities to reduce the level of greenhouse gas emissions typically associated with a practice or process.[2] These projects include

- nature-based activities to reduce deforestation or improve forest management, and
- technology-based changes in energy production and use practices or greenhouse gas destruction.[3] See figure 2 for examples of projects that reduce emissions.

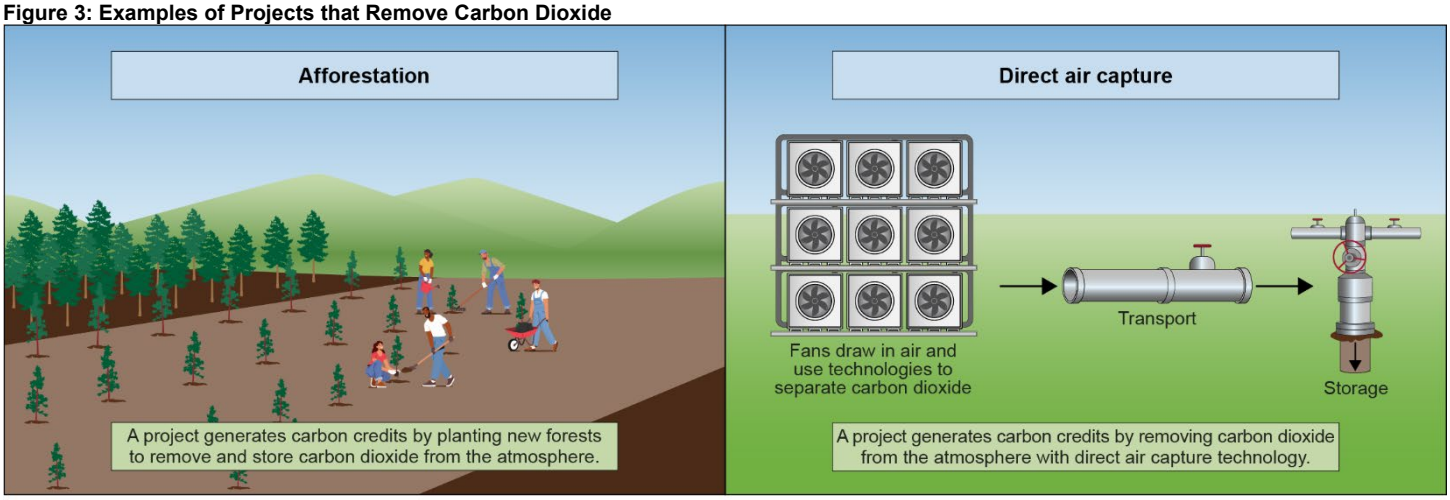
Figure 2: Examples of Projects that Reduce Emissions



Source: GAO. | GAO-25-107128

Carbon dioxide removal projects encompass a wide array of nature-based or technology-based approaches that remove carbon dioxide directly from the atmosphere and store or "sequester" it to create negative emissions.[4] Storage can occur in geological or biobased reservoirs, or in products, such as low-carbon concrete. See figure 3 for examples of projects that remove carbon dioxide from the atmosphere.

Figure 3: Examples of Projects that Remove Carbon Dioxide



Source: GAO; Hanna Syvak/stock.adobe.com (human figures). | GAO-25-107128

How is the amount of carbon credits for a project calculated?

The amount of greenhouse gas emissions reduced or removed by a project is calculated by comparing emissions that occur with a carbon credit project against baseline emissions. The baseline emissions could reflect (1) emissions that would have occurred without the project or (2) performance target or benchmark technology emissions.

A carbon credit generally represents 1 metric ton (1.1 U.S. tons) of emission reductions or removals. If a facility that was projected to emit 200 metric tons of carbon dioxide implemented a project that changed its emissions to 100 metric tons, the project would have resulted in 100 metric tons of emissions reductions, so it would generate 100 carbon credits.[5]

What is the difference between voluntary and compliance carbon markets?

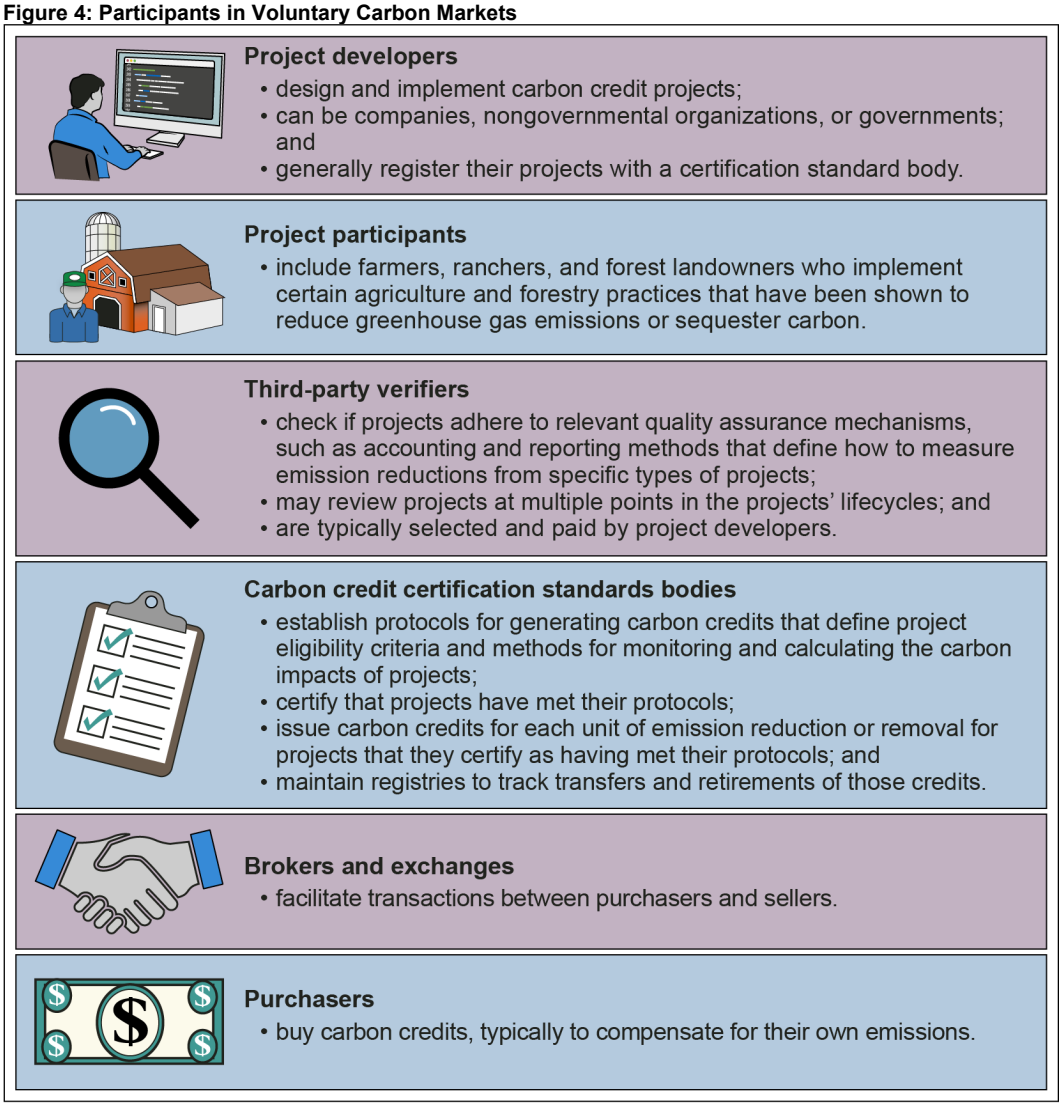
In voluntary carbon markets, entities can voluntarily purchase carbon credits generated from projects that are intended to reduce greenhouse gas emissions or remove greenhouse gases from the atmosphere. Entities can use carbon credits to offset their greenhouse gas emissions without being required to do so.

In contrast, compliance carbon markets support regulatory programs that require greenhouse gas emissions reductions, such as cap-and-trade programs. For example, some cap-and-trade programs allow the use of carbon credits to achieve targeted emission levels. Credits used in voluntary markets and compliance markets may come from the same projects, use the same registries, and be verified under the same standards—provided that the projects, registries, and standards meet the requirements of the compliance programs.

Who participates in voluntary carbon markets?

Voluntary carbon markets consist of different participants who generate, verify, purchase, and track carbon credits, as shown in figure 4 below.

Figure 4: Participants in Voluntary Carbon Markets



Source: GAO. | GAO-25-107128

Participants in voluntary carbon markets may play multiple roles. For example, a single company may develop projects, purchase credits from other developers, and market credits to consumers. Project developers may sell credits directly to purchasers without using brokers or exchanges.

In addition to these participants, there are also independent carbon credit quality initiatives.[6] These initiatives have developed guidance to support integrity in voluntary carbon markets for organizations (e.g., certification standards bodies) that set carbon credit standards and for purchasers of credits.

What are key challenges related to ensuring the credibility of carbon credits?

In literature we reviewed and our prior body of work on carbon credits, we identified key challenges to ensuring the credibility of carbon credits:[7]

- **Additionality and over-crediting.** To be credible, a carbon credit for emissions reductions must represent emissions reductions from a project that would not have occurred in the absence of the incentive created by carbon credit revenues (i.e., additionality) and reduce emissions below the quantity emitted in a business-as-usual scenario—among other criteria.

However, it can be difficult to determine whether carbon credit projects generate emissions reductions that would not have otherwise occurred, which can lead to over-crediting (i.e., credits that do not represent actual net emissions reductions).

- **Permanence.** To be credible, a carbon credit must represent the reduction or removal of greenhouse gases that will not be subsequently released into the atmosphere. However, it can be difficult to ensure that greenhouse gases sequestered by certain projects will not be subsequently released (i.e., permanence).[8]

Why is assessing additionality and over-crediting a challenge?

Assessing additionality and over-crediting is inherently challenging because it may not be possible to know what would have happened in the future had the projects not been undertaken. In 2011, we reported several reasons why assessing additionality and over-crediting can be challenging, according to experts, stakeholders, and available information, including the following:[9]

- **Asymmetric information.** Carbon certification standards bodies and third-party verifiers may not have access to all the information needed to assess carbon credits' additionality. They must often rely on information that applicants provide, which may be difficult to evaluate. For example, one way to confirm that a project is additional is to establish that, without the revenues from carbon credits, it either is not financially feasible or is not the most economically attractive option. Establishing this can involve complex analysis including assumptions about the internal rate of return for the project, the cost of financing, and the lifetime of the project. Research suggests that verifying these assumptions can be difficult, especially since applicants (1) know more details about the project than certification standards bodies or verifiers and (2) may present data selectively to support claims of additionality, according to our 2011 report.
- **Disincentives for policies that reduce emissions.** Some carbon credit certification standards may create disincentives for policies that reduce emissions. For example, U.S. firms might pay for credits generated from energy efficiency upgrades to coal-fired power plants in other nations. This may create disincentives for these nations to implement their own energy efficiency standards or similar policies, since doing so would cut off the revenue stream created by the carbon credit program. If policies to reduce emissions are not put in place partly because of disincentives from carbon credit programs, emissions reductions generated from those programs may not be additional.
- **Difficulty setting a baseline.** Setting a baseline for what emissions would have been without a carbon credit project involves assumptions. For example, baselines for some avoided deforestation projects are based on historical deforestation averages or trends. These baselines may become unrealistic if there are changes in economic or political conditions that would make deforestation rates differ from the historical averages. Unrealistic baselines can result in over-crediting.

What does evidence suggest about additionality and over-crediting?

The literature we reviewed found evidence of various projects generating carbon credits that likely did not represent additional emissions reductions or were a result of over-crediting, including projects to reduce deforestation, improve forest management, and hydro and wind power projects. For example, one study we reviewed found that a forest carbon credit program was awarding credits based on a comparison between projects' initial measured carbon stocks and calculations of regional average carbon stocks, but the averages were not

representative of the actual forests that participated in the program.[10] This faulty comparison resulted in projects generating credits that did not represent actual emissions reductions.

Of the 21 studies in our literature review, five assessed additionality or over-crediting.[11] All five estimated that some credits for projects they reviewed likely did not represent additional emissions reductions or resulted from over-crediting.

- One study that reviewed projects to reduce deforestation at 26 sites in six countries on three continents found that approximately 93 percent of the credits from these projects likely did not represent actual emission reductions.[12]
- A study that synthesized studies of projects across multiple sectors including forestry, household, renewable energy, and chemical processes projects, estimated that 88 percent of the credits from these projects were a result of over-crediting and did not represent actual emissions reductions.[13]
- A study that reviewed credits from a program established by the Kyoto Protocol estimated that approximately 73 percent of the credits from the program from 2013 to 2020 likely did not represent additional emissions reductions.[14]
- Finally, two studies reviewed forestry projects in California's forest offset program. One of these studies, from 2022, estimated that about 29 percent of the credits from the projects likely were a result of over-crediting.[15] The other study, from 2023, did not find evidence of additionality for the projects in California's forest offset program at the time.[16]

Why is ensuring permanence a challenge?

As we have previously reported, projects that "sequester" carbon carry the risk that the stored carbon will be re-released into the atmosphere, a concept known as a reversal.[17] The risk of reversal is most commonly associated with projects involving forestry and agricultural soil sequestration.

In these types of projects, reversals can occur because of human activity, such as logging or changes in tilling practices, or from natural events such as fires, storms, or insect infestations. For projects involving geological storage of captured carbon, risks of reversals can stem from poor storage site selection or operation.

What does evidence suggest about permanence of emissions reductions?

Of the 21 studies in our literature review, two assessed permanence challenges for forest projects.[18]

- One study found that 26 percent of credits from improved forest management projects in the U.S. face the hazard of wildfire.[19]
- Another study found that wildfires have depleted nearly one-fifth of the buffer pool for California's forest carbon offsets program in less than a decade.[20] The buffer pool was designed to help provide a 100-year guarantee on forest carbon claims. Projects contribute a certain percentage of their credits to the buffer pool to account for wildfire and other risks. If there are carbon losses from projects, credits are retired from the buffer pool to account for the reversal.

What can limit the transparency of voluntary carbon markets?

Our prior work and our review of literature found that the lack of standardization of carbon credits limited the transparency of voluntary carbon markets. The term "carbon credit" implies a uniform commodity, but carbon credits may originate from a wide variety of project types and have varying quality. In addition, they may be based on project protocols with different quantification and quality assurance mechanisms.

One of the articles in the literature we reviewed for this report described a "cacophony of national or jurisdictional measurement systems" leading to a confusing number of different types of credits and resulting in credits of "widely different quality."[21] These differences may make it difficult for consumers to understand what they are purchasing and to determine the quality of the credits they have purchased.

Similarly, in 2008, we found that certain factors, such as differences in the substance and application of protocols, limit the voluntary carbon market's transparency and raise questions about whether carbon credits are interchangeable commodities.[22] We found that the lack of standardization of credits may make it difficult for consumers to determine whether credits are fully fungible—interchangeable and of comparable quality.

According to a 2024 report by the International Organization of Securities Commissions, key vulnerabilities in voluntary carbon markets include

- data availability and accessibility,
- a general lack of transparency in the market, and
- a lack of standardization.

The report also states that while some level of differentiation across projects may be needed to satisfy the diverse objectives of some carbon credit purchasers, the availability of more uniform carbon credits on centralized trading platforms would make carbon credits more accessible to a broader pool of market participants.[23] A 2023 report by the International Organization of Securities Commissions also identified data availability as a challenge for participants in voluntary carbon offset markets.[24] According to the report, little high-quality granular data exist to support pricing and risk assessment for particular carbon credits.

What is the current federal role in voluntary carbon markets?

Overall, the federal government has had a limited role in voluntary carbon markets. The CFTC and the Department of the Treasury, among others, have undertaken efforts to provide some oversight or guidance related to voluntary carbon offset markets. Agencies initiated these efforts for various reasons, such as Congress providing new authority or requirements and investors' interest in climate-related information, according to agency officials.

In addition, certain federal entities have participated in the market through supporting the production of carbon credits and as potential purchasers of carbon credits. None of these agency efforts directly regulate carbon credit projects or voluntary credit use.

Table 1 below describes the roles federal agencies have had in voluntary carbon markets. These efforts could change as government priorities evolve.

Table 1: Federal Agency Roles and Efforts Related to Voluntary Carbon Markets as of March 2025

Agency	Roles and Efforts related to voluntary carbon markets[a]
	Providing oversight, guidance, or technical assistance related to voluntary carbon markets
Commodity Futures Trading Commission (CFTC)	• Issued a report in 2011 on the oversight of existing and prospective carbon markets as part of an interagency working group. • Convened stakeholders from the federal government, market participants, and exchanges on June 2, 2022, and July 19, 2023 to discuss how CFTC can promote integrity for high quality carbon credit derivatives—contracts based on the price of carbon credits.[b] • Approved final guidance in September 2024 on listing voluntary carbon credit derivative contracts for trading.[c]
Federal Trade Commission	• Provided guidance on environmental marketing claims, which it updated in 2012, including those related to carbon offsets.[d]
Securities and Exchange Commission (SEC)	• Adopted a rule in March 2024 to enhance and standardize climate-related disclosures provided to investors. The rule requires a public company to disclose, among other things, use of carbon offsets if they constitute a material component of the company's plan to achieve its climate-related targets or goals. If disclosure is required, it must include the following: the amount of carbon avoidance, reduction, or removal represented by the offsets; the nature and source of the offsets; a description and location of the underlying projects; any registries or other authentication of the offsets; and the cost of the offsets.[e] The rule was to become effective on May 28, 2024, with compliance dates phased in. • Issued a stay for this rule in April 2024 pending completion of litigation challenging the rule,[f] and in March 2025 decided to end its defense of the rule.[g]
U.S. Department of Agriculture (USDA)	• Received authorization under the Consolidated Appropriations Act of 2023 to develop a Greenhouse Gas Technical Assistance Provider and Third-Party Verifier Program to provide educational resources related to agriculture and forestry carbon credit markets and contact information for qualified providers and verifiers and to publish a list of agriculture and forestry offset protocols that are designed to ensure consistency, effectiveness, efficiency, transparency, and reliability.[h] • Published a report in 2023 on the role of agriculture and forestry in U.S. carbon markets. • Published a report in 2024 stating it will establish a technical assistance provider and third-party verifier program to reduce barriers to participation in voluntary carbon markets for farmers, ranchers, and private forest landowners.
U.S. Department of the Treasury	• Developed Principles for Net Zero Financing and Investing, including voluntary guidance for financial institutions that use carbon credits. These principles are intended to give stakeholders a clear understanding of the extent to which the voluntary use of carbon credits is part of a financial institution's commitment to reduce emissions.[i]
Interagency	• The Biden-Harris Administration released a Joint Statement of Policy and Principles for Responsible Participation in Voluntary Carbon Markets in May 2024.[j] The principles are voluntary.
	Potential federal agency purchase of carbon credits
Department of Energy (DOE)	• Launched the Carbon Dioxide Removal Purchase Pilot Prize in September 2023. The program provides awards to private entities and academic institutions to compete for the opportunity to sell carbon dioxide removal credits directly to DOE. In May 2024, DOE announced 24 semifinalists to receive a total of $1.2 million to scale up their carbon dioxide removal technologies.[k] • Issued a notice of intent in March 2024 to launch a Voluntary Carbon Dioxide Removal Purchasing Challenge. The challenge will call on other organizations to purchase high-quality, permanent Carbon Dioxide Removal credits.[l]
	Supporting the production and use of carbon credits
Department of State	• Announced, along with the Bezos Earth Fund and the Rockefeller Foundation, an Energy Transition Accelerator framework in 2023. The framework is intended to catalyze private investment in the transition from fossil fuels to clean power in developing and emerging economies. Key elements of the framework include (1) development of an independent sectoral-scale crediting standard for emissions reductions from electricity generation; and, (2) criteria for participating companies and information on how they could use carbon credits to help meet their voluntary climate commitments. • Helped found the LEAF Coalition, a public-private voluntary carbon market effort intended to help end tropical deforestation, in 2021.

Source: GAO analysis of agency information. | GAO-25-107128

[a]These efforts could change as government priorities evolve.

[b]A derivative is a financial instrument, the price of which is directly dependent on (i.e., derived from) the value of one or more underlying securities, equity indices, debt instruments, commodities, other derivative instruments, or any agreed upon pricing index or arrangement (e.g., the movement over time of the Consumer Price Index or freight rates). According to CFTC officials, the agency generally has jurisdiction over derivatives of commodities (as that term is understood in the Commodity Exchange Act) and only has limited anti-fraud and anti-manipulation authority over spot sales of commodities and other commodity transactions that are not derivatives.

[c]89 Fed. Reg. 83378 (Oct. 15, 2024).

[d]77 Fed. Reg. 62122 (Oct. 11, 2012) (codified at 16 C.F.R. pt. 260). The terms carbon credit and carbon offset are generally interchangeable. In this report we generally use the term carbon credit, but we use the term carbon offset when it is used by agencies.

[e]89 Fed. Reg. 21668 (Mar. 28, 2024).

[f]89 Fed. Reg. 25804 (Apr. 12, 2024). Challenges to the SEC rule have been consolidated with the lead case *State of Iowa, v. SEC*, No. 24-1522 (8th Cir.; filed Mar. 12, 2024).

[g]The acting SEC Chairman previously released a statement indicating there were recent developments that bear on the rule and the conduct of the pending litigation. He directed SEC staff to notify the court of the changed circumstances and request that the court not schedule the case for argument, providing time for the SEC to deliberate and determine the appropriate next steps. Following its March 2025 vote, the SEC issued a letter to the court indicating that it intended to withdraw its defense of the rule. Status Report/SEC letter to the Clerk, *State of Iowa, et al., v. SEC*, No. 24-1522 (8th Cir.) (Mar. 27, 2025). In a subsequent status report to the court, the SEC indicated that it does not intend to review or reconsider the rule at this time and requested that the court proceed to a decision in the litigation. Status Report, *State of Iowa*, No. 24-1522 (8th Cir.) (July 23, 2025).

[h]The statute mandates the Secretary of Agriculture determine whether establishing the program will further specified purposes, and if so, mandates the Secretary to establish it. Consolidated Appropriations Act, 2023, Pub. L. No. 117-328, div. HH, tit. I, § 201, 136 Stat. 4459, 5971–81 (2022) (codified at 7 U.S.C. § 6712).

[i]U.S. Department of the Treasury, *Principles for Net-Zero Financing and Investment* (Washington, D.C.; Sept. 2023).

[j]*Voluntary Carbon Markets Joint Policy Statement and Principles* (Washington, D.C.; May 2024). The Trump-Vance Administration has not released any official statements regarding these principles.

[k]The Carbon Dioxide Purchase Pilot Prize was authorized and funded by the Infrastructure Investments and Jobs Act. Pub. L. No. 117-58, div. D, tit. X, § 41005(b), 135 Stat. 429, 1129 (2021); *id*., 135 Stat. at 1374. This funding may have been frozen pending review under Executive Order 14154 of January 20, 2025, at § 7(a). 90 Fed. Reg. 8353 (Jan. 29, 2025).

[l]89 Fed. Reg. 18626 (Mar. 14, 2024). DOE also has programs intended to accelerate development and deployment of carbon removal technologies, which could be used to generate carbon credits.

How were federal efforts intended to affect integrity in voluntary carbon markets?

Several of the federal agency efforts were intended to improve integrity in voluntary carbon markets by promoting transparency or pursing enforcement against fraud. Most of these efforts were initiated in the past 2 years, making it too soon to evaluate their outcomes. As noted above, these efforts could change as government priorities evolve. Examples of recent federal efforts intended to improve integrity include:

- CFTC's guidance on listing voluntary carbon credit derivative contracts for trading may advance the standardization of such contracts in a manner that fosters transparency, according to CFTC. The guidance outlines matters to consider when designing and listing these contracts, such as transparency, additionality, and permanence.[25]
- According to a CFTC press release, CFTC took its first enforcement action regarding fraud in voluntary carbon markets in October 2024. It filed civil charges against the former chief executive officer of a carbon credit project developer, charging fraud and false, misleading, or inaccurate reports related to voluntary carbon credits.[26] The Chief Operating Officer of the project developer consented to a settlement with CFTC in an administrative proceeding regarding similar charges.
- The U.S. Department of Agriculture's (USDA) Greenhouse Gas Technical Assistance and Third-Party Verifier program plans to provide a list of qualified technical assistance providers and third-party verifiers who work with producers to generate carbon credits. This is intended to reduce market confusion, according to USDA officials. USDA officials also said in March of 2025 that the agency plans to list widely accepted voluntary carbon credit protocols designed to ensure consistency, reliability, effectiveness, efficiency, and transparency.

What additional steps could the federal government take to promote market integrity if it chooses?

There was not a consensus among the eight experts we interviewed around specific steps that the federal government could take to promote integrity in the voluntary carbon markets, if it chooses to do so. However, these experts identified certain additional steps that agencies could take if they chose and were authorized to do so. Examples of such steps include:

Promote transparency. Two of the experts we interviewed said that the federal government could help improve transparency in the markets by ensuring that sufficient data are available for market participants and researchers to, for example, help understand the integrity of carbon credits. Another expert we interviewed said that the federal government could help improve transparency by maintaining a registry to track credits.

Counter fraud. Two of the experts we interviewed said that the federal government could continue to take enforcement actions against fraud and false or misleading claims to promote integrity in voluntary carbon markets. One of the two experts said that the recent CFTC anti-fraud measures could be effective, but the appropriate level of resources would need to be devoted toward these efforts.

Protect consumers. Two of the experts said that the federal government could take steps to protect consumers from misleading claims about carbon credits to promote integrity in voluntary carbon markets. According to one expert, the public can be misled by low-quality credits, and the federal government could do more to protect consumers from low-quality credits. Another expert said that FTC is well placed to play a role in consumer protection. The FTC Green Guides, which have a section on carbon offsets, provide guidance to help companies avoid making deceptive claims, and FTC is in the process of considering updates to its guidance. FTC has not had any enforcement cases directly related to carbon offsets, according to FTC officials.

Regulate quality. Five of the experts also discussed the option of a federal agency regulating and certifying the quality of carbon credits and held different views. For example:

- One expert said that the Environmental Protection Agency (EPA) could establish a carbon credit standard and maintain a registry. This would allow for EPA to pursue an audit role to maintain compliance, although this may require new statutory authority. In addition, a registry would give EPA insight into carbon credits, according to the expert.
- A different expert said that EPA has the expertise in economics and in labeling products to potentially assess the validity of carbon credit programs. The expert was unsure if EPA would need additional authority to start such a program.
- Another expert stated that the federal government could regulate carbon credit quality, but that such a role would come with significant challenges. This expert said that assessing the quality of credits would take teams of researchers with diverse scientific, regional, and sectoral expertise for each project type. The expert said that an existing agency would not likely have the capacity for this oversight task. The expert said the government should take on this task only if sufficient resources would be devoted to it.
- One expert said that the government becoming involved in regulation could hinder improvements to market integrity if the government approves methodologies already in use by certification standards bodies that do not provide sufficient assurance of additionality or permanence.
- Finally, one of the experts said that they did not see a need for direct regulation of certification standards bodies. The expert said that the federal government should play its traditional market oversight role but not have an expanded role in voluntary carbon markets.

Similarly, our 2008 report found that stakeholders held different opinions about whether the government should play a larger role in voluntary carbon markets. Specifically, our report found that increased federal oversight of the U.S. voluntary market could enhance the market's transparency and improve consumer protection but also reduce flexibility, increase administrative costs, and stifle innovation, according to certain stakeholders.

In addition, a 2023 National Academies of Sciences, Engineering, and Medicine report found that it is unclear what role government regulation should play in the certification of carbon credits in voluntary markets.[27] The report also found that increased government involvement does not alter the fundamental trade-off between cost and integrity associated with carbon credit projects.

Agency Comments

We provided the Council on Environmental Quality, Commodity Futures Trading Commission, Environmental Protection Agency, Federal Trade Commission, U.S. Department of Agriculture, Department of Energy, Securities and Exchange

Commission, Department of State, and Department of the Treasury a draft of this report for review and comment. The Securities and Exchange Commission provided technical comments, which we incorporated as appropriate. The other agencies did not provide comments.

How GAO Did This Study

To describe aspects of voluntary carbon markets, roles and efforts of federal agencies regarding these markets, and steps the federal government could take to promote the markets' integrity we reviewed documentation, including prior GAO reports, relevant laws, regulations, and agency guidance and documents. We also interviewed officials and subject matter experts.

More specifically, to describe key challenges related to ensuring the credibility of carbon credits and the limited transparency of voluntary carbon markets, we reviewed prior GAO reports on carbon offsets from 2008, 2009, and 2011; International Organization of Securities Commissions reports on voluntary carbon markets from 2023 and 2024; and relevant studies identified through a literature review.

We conducted the literature review to identify more recent studies, published since our last report on the topic in 2011, that discussed any challenges related to carbon credits and voluntary carbon offset markets. We identified potentially relevant literature through searching the ProQuest database, searching references cited in the relevant section of a 2023 National Academies of Sciences, Engineering, and Medicine report, *Accelerating Decarbonization in the United States: Technology, Policy, and Societal Dimensions*; searching references cited by a study, *Managing Uncertainty in Carbon Offsets: Insights from California's Standardized Approach;* and searching references that cited the same study. We identified this study in our initial search, and it was recommended by a researcher we interviewed.

To determine which studies to include in our review, we examined summary level information for 294 studies, and then from this review, identified 63 studies that were potentially germane to our report, specifically studies that discussed if there were challenges related to carbon credits. We then reviewed the full text of the 63 studies and identified 30 that were germane to our report. For these studies, we evaluated the methods used in the research, eliminated some research if we determined the methods were not appropriate or rigorous, and then summarized the research findings. Two reviewers independently reviewed each study. We included 21 studies in our literature review that we identified as relevant and methodologically sound for the purposes of our report. See bibliography of literature review for the list of studies we reviewed.

To identify federal roles and efforts related to voluntary carbon markets and understand how these efforts are intended to improve the integrity of voluntary carbon markets, we reviewed relevant laws, executive orders, regulations, and agency guidance and documents, as well as a 2024 White House Fact Sheet, *New Principles for High-Integrity Voluntary Carbon Markets.* We also interviewed officials from the Council on Environmental Quality, Commodity Futures Trading Commission, Environmental Protection Agency, Federal Trade Commission, U.S. Department of Agriculture, Department of Energy, Securities and Exchange Commission, Department of State, and Department of the Treasury.

To identify additional steps federal agencies could take to promote integrity in voluntary carbon markets, we reviewed prior GAO reports and the 2023 National Academies report and interviewed subject matter experts. To identify the subject matter experts, we reviewed the authors that contributed to U.S. focused articles in our literature review and considered their research expertise regarding carbon credits and public policy. We also asked the subject matter experts we identified

to recommend other subject matter experts, and we interviewed those who had relevant expertise. Specifically, we interviewed:

- Grayson Badgley, Research Scientist, CarbonPlan
- Danny Cullenward, Senior Fellow, Kleinman Center for Energy Policy; Research Fellow, Institute for Responsible Carbon Removal at American University; and Vice Chair, California's Independent Emissions Market Advisory Committee
- Barbara Haya, Senior Fellow, Center for Environmental Public Policy, University of California, Berkeley
- Rita Hite, President and CEO, American Forest Foundation
- Alexia Kelly, Managing Director, Carbon Policy and Markets Initiative, High Tide Foundation
- Nathaniel Keohane, President, Center for Climate and Energy Solutions
- Mary Nichols, Former Chair, California Air Resources Board; and Distinguished Counsel for the Emmett Institute on Climate Change and the Environment, University of California Los Angeles
- Michael Wara, Senior Research Scholar, Stanford Woods Institute for the Environment, Stanford University

We conducted this performance audit from October 2023 to August 2025 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

List of Addressees

The Honorable Jared Huffman
Ranking Member
Committee on Natural Resources
House of Representatives

The Honorable Kathy Castor
Ranking Member
Subcommittee on Energy
Committee on Energy and Commerce
House of Representatives

We are sending copies of this report to the appropriate congressional committees, Chair of the Council on Environmental Quality, the Acting Chairman of the Commodity Futures Trading Commission, the Secretary of Energy, the Environmental Protection Agency Administrator, the Chairman of the Federal Trade Commission, the Secretary of Agriculture, the Acting Chairman of the Securities and Exchange Commission, the Secretary of State, the Secretary of the Treasury, and other interested parties. In addition, the report is available at no charge on the GAO website at https://www.gao.gov.

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Bibliography of Literature Review

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Endnotes

[1]The terms carbon credit and carbon offset are generally interchangeable. In this report we use the term carbon credit, unless agencies we are discussing use the term carbon offset. Carbon credits refer to representations of a unit of carbon dioxide reduced or removed. Some sources refer to carbon credits used specifically to mitigate emissions as carbon offsets.

[2]Major greenhouse gases include carbon dioxide, methane, nitrous oxide, and synthetic gases: hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

[3]Improved forest management projects may be emission reduction or avoidance projects or carbon dioxide removal projects depending on if they decrease emissions from forests or increase carbon removal and storage.

[4]Carbon dioxide removal refers to intentional interventions that introduce new processes or bolster existing processes for the purpose of creating negative emissions. Carbon dioxide removal is distinct from point-source carbon capture from the fossil power sector and heavy industry.

[5]Carbon credits are typically quantified and described in terms of metric tons of carbon dioxide equivalent. Carbon dioxide equivalents provide a common standard for measuring the warming potential of different greenhouse gases and are calculated by multiplying the emissions of the non-carbon dioxide gas by its global warming potential, a factor that measures its heat-trapping ability relative to that of carbon dioxide. For example, methane is estimated to have a global warming potential of 27 to 30 over 100 years, according to the Environmental Protection Agency. This is because methane is a more potent greenhouse gas than carbon dioxide, even though it has a shorter atmospheric lifespan.

[6]For example, the Integrity Council for the Voluntary Carbon Market developed Core Carbon Principles that are intended to identify high-quality carbon credits. In addition, the Voluntary Carbon Markets Integrity Initiative provides guidance for companies on how they can credibly make use of voluntary carbon credits.

[7]See GAO, *Climate Change Issues: Options for Addressing Challenges to Carbon Offset Quality*. GAO-11-345 (Washington D.C.: Feb. 15, 2011), *Carbon Trading: Current Situation and Oversight Considerations for Policymakers*. GAO-10-851R (Washington D.C., Aug. 19, 2010), *Climate Change: Observations on the Potential Role of Carbon Offsets in Climate Change Legislation.* GAO-09-456T (Washington D.C.: Mar. 5, 2009), *International Climate Change Programs: Lessons Learned from the European Union’s Emissions Trading Scheme and the Kyoto Protocol’s Clean*

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[8]EPA officials said that credits from the forestry and agricultural sectors rarely, if ever, represent permanent storage. Officials said that it is more realistic to discuss whether the credit will be durable over a given time horizon (e.g., 30 years).

[9]See GAO-11-345.

[10]"Carbon stock" refers to the total amount of carbon stored within a specific ecosystem or area, such as a forest. G. Badgley, J. Freeman, J. Hamman, B. Haya, A. Trugman, W. Anderegg, & D. Cullenward, "Systematic over-crediting in California's forest carbon offsets program," *Global Change Biology*, vol. 28, no. 4 (2022): 1433–1445. https://doi.org/10.1111/gcb.15943.

[11]The other studies in our review discussed challenges related to carbon credits but did not estimate the extent to which carbon credits represented additional emission reductions.

[12]This study examined the effects of 26 avoided deforestation project sites in six countries on three continents. Specifically, this study provides a pantropical comparison between deforestation counterfactuals, informed by observable control areas, and the baselines adopted by 27 voluntary projects in six tropical countries: Peru, Colombia, Democratic Republic of Congo, Tanzania, Zambia, and Cambodia certified under the Verified Carbon Standard. *T. West*, S. Wunder, E. Sills, J. Börner, S. Rifai, A. Neidermeier, G. Frey, & A. Kontoleon, "Action needed to make carbon offsets from forest conservation work for climate change mitigation," *Science*, vol. 381(6660) (2023): 873-877. https://doi.org/10.1126/science.ade3535.

[13]This study synthesized existing empirical studies that it identified as rigorous, which evaluated more than 2,000 offset projects across all major offset sectors. Specifically, this study looked at studies that examined offsets from forestry projects, household projects, renewable energy projects, and chemical processes projects. This study compared the achieved emissions reductions based on credible academic studies to the claims made by project developers when setting baselines for projects to identify what percentage of credits are likely to represent real, or "additional," emissions reduction. Benedict Probst, Malte Toetzke, Andreas Kontoleon, Laura Diaz Anadon, Volker H. Hoffmann, "Systematic review of the actual emissions reductions of carbon offset projects across all major sectors," Working Paper. (2023) https://doi.org/10.3929/ethz-b-000620307.

[14]This study analyzed the opportunities and limits of the Clean Development Mechanism (CDM) framework for ensuring environmental integrity, (i.e., ensuring that projects are additional and that emission reductions are not overestimated). It looked at the way in which the CDM framework had evolved over time, assessed the likelihood that emission reductions credited under the CDM ensured environmental integrity, and provided findings on the overall and project-type-specific environmental integrity of the CDM. The CDM was established by the Kyoto Protocol, an international agreement to limit the adverse effects of climate change developed within the United Nations Framework Convention on Climate Change. Dr. Martin Cames, Dr. Ralph O. Harthan, Dr. Jürg Füssler, Michael Lazarus, Carrie M. Lee, Pete Erickson, Randall Spalding-Fecher, "How additional is the Clean Development Mechanism: Analysis of the application of current tools and proposed alternatives," Study prepared for DG Clima (2016) http://dx.doi.org/10.13140/RG.2.2.23258.54728.

[15]This study evaluated the design of California's forest carbon offsets program. California's program awards large volumes of offset credits to forest projects with carbon stocks that exceed regional averages, according to the study. The study found that this paradigm allows for adverse selection, which could occur if project developers preferentially select forests that are ecologically distinct from unrepresentative regional averages. The study digitized and analyzed comprehensive offset project records alongside detailed forest inventory data and found that comparing projects against coarse regional carbon averages has led to systematic over-crediting of 29.4% of the credits the study analyzed. G. Badgley, J. Freeman, J. Hamman, B. Haya, A. Trugman, W. Anderegg, & D. Cullenward, "Systematic over-crediting in California's forest carbon offsets program," *Global Change Biology*, vol. 28, no. 4 (2022): 1433–1445, https://doi.org/10.1111/gcb.15943.

[16]This study examined the additionality of forest carbon offsets within California's U.S. Forest Projects compliance offset protocol. According to the study, since 2012, most of California's offset credits (84 percent) have been awarded to improved forest management projects. This study used a database of improved forest management project characteristics, locations, and remotely sensed forest disturbance data indicative of management activity and found that projects have been primarily allocated to forests with high carbon stocks (127 percent higher than regional averages) and low historical disturbance (28 percent less disturbance than regional averages since 1985). The study's matching and panel regression analysis failed to show additionality, as project creation did not significantly lower disturbance rates 3 and 5 years after project implementation relative to similar non-project lands. J. Stapp, C. Nolte, M. Potts et al, "Little evidence of management change

in California's forest offset program," *Communications Earth and Environment,* vol. 4, no. 331 (2023), https://doi.org/10.1038/s43247-023-00984-2.

[17]See GAO-08-1048, and GAO-11-345.

[18]The other studies in our review discussed challenges related to carbon credits but did not assess the extent to which permanence presented a challenge.

[19]Lilli Kaarakka, Julia Rothey, and Laura Dee, "Managing Forests for Carbon – Status of the forest carbon offset markets in the United States," *PLOS Climate*, vol. 2, no. 7 (2023): e0000158. https://doi.org/10.1371/journal.pclm.0000158.

[20]Grayson Badgley, Freya Chay, Oriana S. Chegwidden, Joseph J. Hamman, Jeremy Freeman, and Danny Cullenward, "California's forest carbon offsets buffer pool is severely undercapitalized," *Frontiers in Forests and Global Change* 5:930426. (2022) https://doi.org/10.3389/ffgc.2022.930426.

[21]Charlotte Streck, "Who Owns REDD+? Carbon Markets, Carbon Rights and Entitlements to REDD+ Finance," Carbon Rights and Entitlements to REDD+ Finance. *Forests*, vol. 11, no. 9 (2020): 959. https://doi.org/10.3390/f11090959.

[22]See GAO-08-1048.

[23]The Board of the International Organization of Securities Commissions, *Voluntary Carbon Markets, Final Report*, FR/08/2024 (November 2024).

[24]The Board of the International Organization of Securities Commissions, *Voluntary Carbon Markets, Consultation Report*, CR/06/23 (December 2023).

[25]89 Fed. Reg. 83378, 83402–03 (Oct. 15, 2024). According to the CFTC's Futures Glossary webpage, a derivative is a financial instrument, the price of which is directly dependent on (i.e., derived from) the value of one or more underlying securities, equity indices, debt instruments, commodities, other derivative instruments, or any agreed upon pricing index or arrangement (e.g., the movement over time of the Consumer Price Index or freight rates). According to CFTC officials, the agency generally has jurisdiction over derivatives of commodities (as that term is understood in the Commodity Exchange Act) and limited anti-fraud and anti-manipulation authority over spot sales of commodities and other commodity transactions that are not derivatives. As of August 2024, relatively few (29) derivative contracts on voluntary carbon market products were listed for trading by contract markets under the regulatory oversight of the CFTC.

[26]Complaint, *CFTC v. Kenneth Newcombe*, No. 1:24-cv-07477 (S.D.N.Y.; Dkt. 1, filed Oct. 2, 2024). As of July 2025, this case is currently stayed pending resolution of a related criminal prosecution by the U.S. Attorney for the Southern District of New York. Order granting Motion to Intervene and Stay, *id*. at Dkt. 18, filed Dec. 9, 2024. In 2010, we found that carbon products traded in the U.S. carbon markets have risks similar to those posed by other commodity products and have experienced problems (including fraud) domestically and internationally. See GAO-10-851R.

[27]National Academies of Sciences, Engineering, and Medicine, *Accelerating Decarbonization in the United States: Technology, Policy, and Societal Dimensions*. (Washington, D.C.: The National Academies Press, 2023) https://doi.org/10.17226/25931.