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Using Carbon Credits to Deploy Climate Solutions

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To limit the pace and scale of warming and avoid the worst damages from climate change, methods for removing carbon dioxide from the atmosphere will be needed in addition to significant emissions reductions. Markets for carbon credits, while imperfect, can help leverage the private investments that are essential to develop and finance climate solutions at scale.

Introduction

After a year in which global emissions of greenhouse gases[1] rebounded to near pre-pandemic levels, it is clear that the world is off track in its efforts to meet international targets on climate stabilization. As detailed in the most recent report[2] from the Intergovernmental Panel on Climate Change (IPCC), the toolkit of necessary climate solutions includes simultaneously reducing emissions and removing carbon dioxide directly from the atmosphere.

Despite the commitments made in Paris in 2015[3] and in Glasgow in 2021,[4] global progress toward a net-zero-carbon future—on both the policy and technology fronts—remains too slow. In this context, and despite the challenges they present, markets for carbon credits are an indispensable tool for leveraging private investment in novel strategies that can reduce greenhouse gas emissions and remove carbon dioxide from the atmosphere. This issue brief outlines key questions and challenges facing carbon credits today and contends that improved and strengthened markets will be essential to unlocking the investments needed for mitigating climate change.

What are carbon credits and what role do they play today?

Carbon credits represent a defined quantity of carbon dioxide[i] that is either prevented from reaching, or is directly removed from, the atmosphere as the result of a specified, verifiable action. Credits may have market value either to meet voluntary climate commitments (for example, a corporation that pledges to reduce its carbon footprint), or as an alternative compliance mechanism in the context of a mandatory emissions-reduc-

i Crediting programs can be designed to recognize reductions in other greenhouse gases (GHGs), such as methane or nitrous oxide. This can be done in a relatively straightforward manner by converting quantities of non-carbon GHGs to a carbon-dioxide-equivalent quantity based on their global warming potential, where global warming potential is a measure of radiative forcing in the atmosphere relative to the radiative forcing from CO_2.

tion policy (for example, to help a regulated entity meet applicable emissions reduction or emissions performance requirements).

The use of "credits" is not uncommon: Large-scale markets for carbon credits emerged out of international negotiations in the 1990s (see text box 1), and renewable energy certificates[5] (RECs) have provided significant financing for developing renewable energy infrastructure. Like carbon credits, RECs are a tradeable, monetizable product that represent a defined environmental attribute (in this case, a unit of electricity generated using renewable resources) and can be purchased to help meet regulatory or voluntary policy targets. By enabling wind and solar power generators to receive additional value for their product (beyond the value of the electricity itself), RECs have increased returns to renewable energy investments and have strongly boosted the usage of renewable technology.[6] An important motivation for this brief is the potential for carbon credit markets to do the same for carbon dioxide removal (CDR) technologies, which—unlike renewable energy generators—lack other market drivers for deployment.

Historical Perspective on Voluntary Carbon Markets

Large-scale markets for carbon credits, or "offsets," began to emerge in the 1990s when the international community sought to organize a global response to the problem of climate change. Allowing an entity to fund or purchase greenhouse gas reductions generated by another entity was seen as a way to advance multiple goals at once. A first goal was to address cost concerns by giving sources in hard-to-decarbonize sectors of the economy a means to reduce their emissions through lower-cost emission reductions. A second goal was to stimulate foreign investment in sustainable, climate-friendly economic development while also giving low-income countries an incentive to participate in international climate agreements. Finally, market-based mechanisms were seen as a way to help equalize the distribution of climate mitigation opportunities and burdens around the world. Reflecting these goals, provisions for international emissions trading and two distinct programs for recognizing emissions credits (or offsets)—the Joint Implementation (JI) program and the Clean Development Mechanism (CDM)[ii]—were included in the rules and agreements that grew out of the United Nations Framework Convention on Climate Change and

ii The JI program was designed to enable developed countries to undertake projects in other developed countries; the CDM program was designed to enable developed countries to undertake projects in developing countries. For a description of these Kyoto Protocol mechanisms, see: https://unfccc.int/process/the-kyoto-protocol/mechanisms. Because the Kyoto Protocol's "second commitment period" ended in 2020, the future of both programs is unclear.

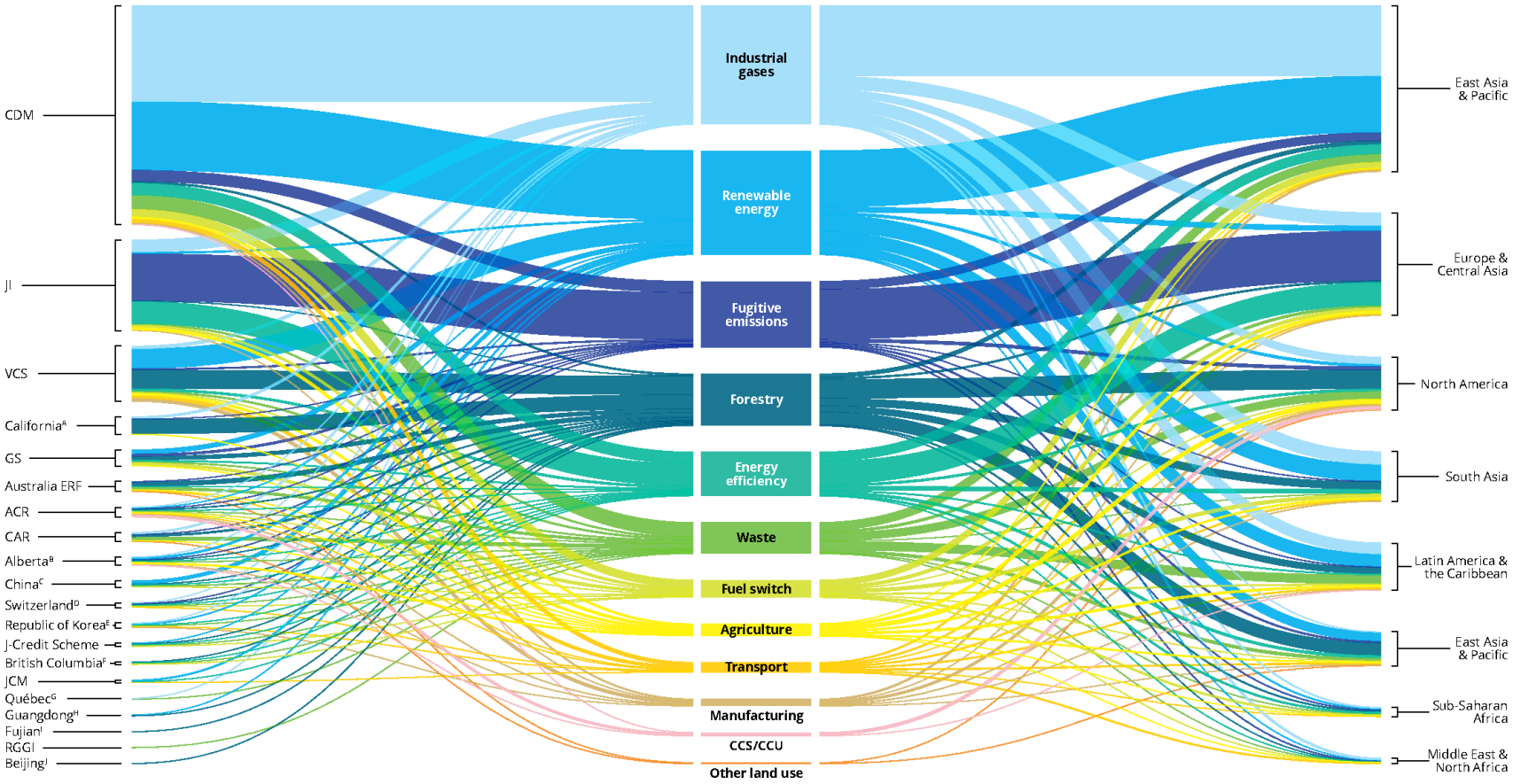
the Kyoto Protocol.

In subsequent years, new markets for carbon credits emerged as jurisdictions around the world began adopting mandatory climate policies. Some of these policies are being implemented at the subnational (e.g., state or provincial) level—an example is California's carbon cap-and-trade program. Several others, such as the European Union's Emissions Trading System (ETS), target particular sectors or types of emissions sources (e.g., large industrial emitters or the electric power sector). Most of these programs[7] allow some use of domestic offsets or credits for compliance purposes, subject to certain rules; a smaller number allow limited use of international offsets.

Carbon credits can be bought in marketplaces—either in a *compliance market*, for the purpose of fulfilling regulatory obligations, such as those under California's cap-and-trade program,[8] or in a *voluntary carbon market* (VCM) where corporations and others purchase credits to make progress toward their climate goals.

A growing number of corporations are voluntarily supporting climate action, often as part of broader environmental, social, and governance (ESG) initiatives. This activism is increasing demands on voluntary credit markets: The current market is estimated to exceed 100 million tons of CO_2-equivalent emissions per year worldwide. In dollar terms, trading in voluntary credits was on track to reach and surpass $1 billion for the first time in 2021.[9] Market growth is also accelerating, with some analysts predicting that demand for credits could increase as much as 500% to 900% by 2030.[10]

Globally, the total volume of credits purchased before 2020 under various programs reached approximately 3.9 billion tons CO_2-equivalent. This is roughly two-thirds of U.S. CO_2-equivalent emissions across all sectors in 2019. Figure 1 shows the composition of credits issued before 2020, broken down by the issuing program or registry, type of mitigation activity, and project location. The Clean Development Mechanism[11] and Joint Implementation[12] programs, two of the oldest programs created by the Kyoto Protocol, account for the largest share of credits issued to date. Most investments have gone toward projects that reduce or avoid new emissions (e.g., modernizing industrial plants or replacing fossil fuel generators with renewable energy sources). Projects involving forestry, and to a lesser extent agriculture and other land uses, have also generated carbon credits, but engineered CDR technologies, like direct air capture (DAC), have not yet been a major source of credit creation. However, as more companies like Microsoft[13] and Google[14] look for ways to address their legacy emissions, as well as avoid new emissions, interest in CDR projects will likely grow.



A California Compliance Offset Program
B Alberta Emission Offset
C China GHG Voluntary Emission Reduction Program
D Switzerland CO_2 Attestations Crediting Mechanism
E Republic of Korea Offset Credit Mechanism
F British Columbia Offset
G Québec Offset Crediting
H Guangdong Pu Hui Offset Crediting Mechanism
I Fujian Forestry Offset Crediting Mechanism
J Beijing Forestry Offset Mechanism

Note: To ensure consistency between the information presented from the different crediting mechanisms, the cut-off date for the data on the crediting mechanisms is December 31, 2019. Only the largest independent carbon crediting mechanisms which issue credits that can be used for compliance obligations have been considered in this report. The authors recognize that numerous other independent crediting mechanisms exist that generate credits sold on the voluntary carbon market. Credits generated under the Saitama crediting mechanism, the Saitama forest absorption certification system, the Switzerland CO_2 attestation crediting mechanism and Tokyo offset mechanism are not shown due to data limitations.

Figure 1: Total carbon credits issued as of December 31, 2019. Compliance or voluntary registry body is listed on the left, credit type is in the middle, and regional location of the credit is on the right. Width of the bars are proportional to the total volume of credits. Figures and data in the text are from the World Bank's States and Trends of Carbon Pricing 2020[35] report.

How are carbon credits verified and traded today?

Tracking and verification underpin credit value and market integrity, regardless of whether credits are used for compliance purposes under a mandatory policy or to satisfy a voluntary commitment. Figure 2 illustrates the current framework for carrying out these essential functions and the various participants in carbon markets.

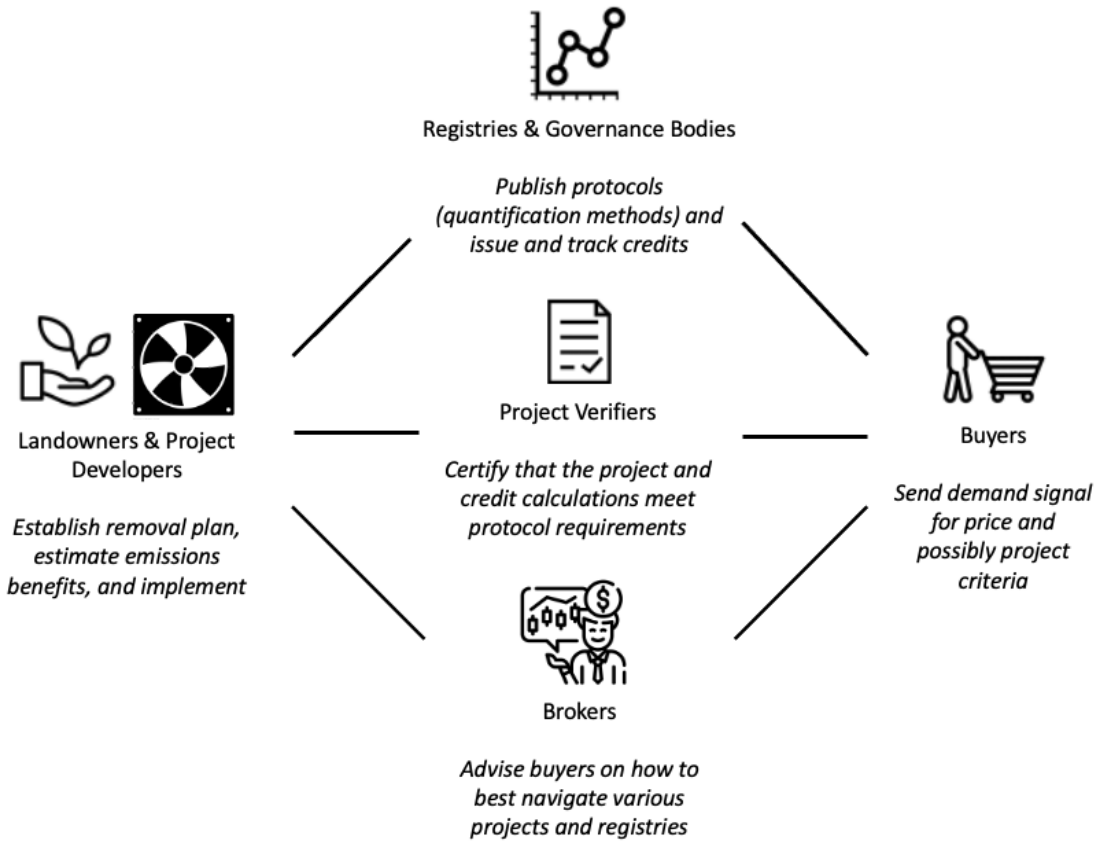


Figure 2: Simplified schematic of carbon market participants and how they interact. Icons from www.thenounproject.org.

Central to carbon markets are the registries and governance bodies that issue, track, and retire credits. They also establish the terms of interaction between project owners, credit buyers, and other third-party entities that can verify the climate benefits of a project over time. In the absence of government intervention to ensure quality carbon credits, registries have generally established their own rules and methodologies for measuring and tracking climate benefits generated by a particular project or technology application; these methods and rules are reflected in registry protocols. Dozens of self-governed registry bodies exist for carbon credits today, but four registries dominate: Verra Carbon Standard (VCS)[15]; Gold Standard (GS)[16]; American Carbon Registry (ACR)[17]; and Climate Action Reserve (CAR).[18]

On the project implementation side, project developers or landowners, or both, typically work together to establish a management plan, estimate emissions benefits, and implement the climate practice in a manner that is consistent with a given registry's protocols. On the demand side, buyers generally rely on brokers and registries to execute and document credit purchases.

Realizing true climate benefits from carbon credits depends on the integrity of the marketplace, has been called into question in recent years. These concerns have caused some brokers and buyers to bypass the traditional "registry-assisted" credit purchasing approach by going straight to the landowner or project developer. Advanced market commitments are another strategy that buyers are pursuing to confirm the quality of their investment. For example, Stripe and other companies have invested more than $925 million in advance market commitments by establishing their "Frontier" fund that is designed to accelerate CDR deployment by guaranteeing future demand for capturing carbon from the atmosphere.[19]

CHALLENGES FOR CARBON CREDITING SYSTEMS

Concerns about carbon credits are as old as the crediting concept itself.[iii] Some critics argue that allowing companies to reduce mitigation obligations by "offsetting" their own emissions is inherently problematic. They say offsets can be especially worrisome if companies are able to avoid or delay the more difficult actions needed to dramatically reduce atmospheric greenhouse gas concentrations. This criticism is known as the moral hazard argument. Projects for which it is difficult to quantify emissions avoided or reduced, or projects that only shift the timing or location of emissions, can compound the moral hazard problem. The concern is that resources invested in flawed projects or credit frameworks may be diverted from more effective climate mitigation pathways and ultimately could reduce incentives for meaningful carbon abatement.

In response to these valid concerns, most registries and buyers have followed a long-standing industry best practice that credits should be issued only for carbon reductions that meet four core conditions: They must be real, verified, durable, and *additional* (i.e., the action that produces the reduction would not have occurred without the incentive of a monetizable credit). The purpose of registries and governance bodies is to ensure that credits are issued only for projects or actions that meet these conditions, and to provide the quality assurance, standardization, and transparency needed to support well-functioning credit markets. The text box below outlines a taxonomy of these challenges.

iii A deeper critique of carbon credits focuses on the practical efficacy of market-based strategies, such as emissions taxes or cap-and-trade programs, for achieving climate goals more broadly. The international community's continued failure to achieve its stated climate goals has led some observers to conclude that whatever the theoretical benefits of market-based policies, the inherent political difficulty and structural challenges of creating and maintaining strong versions of such policies argue for an approach that relies instead on smart regulation and robust industrial policy.

Carbon Crediting Challenges: A Short Taxonomy

Studies that have sought to assess the performance of past crediting programs point to several common challenges for ensuring consistent credit quality:

Durability and risk of reversal—Existing registries typically establish minimum terms of 10, 20, 40, or 100 years as proxies for "permanence." This issue is especially challenging for land-based offset projects where the durability of claimed benefits depends on future land management practices and where unpredictable events, such as fires, drought, or disease, can result in the rapid release of sequestered carbon. In 2020, for example, wildfires in Oregon[20] affected one of the largest forest-carbon offset projects participating in California's carbon cap-and-trade program.

Additionality—Demonstrating additionality is often far from straightforward,[21] because multiple factors and considerations nearly always lead to actions that can produce a climate benefit. Rigorous analysis to establish a business-as-usual or no-action case that accounts for the full range of relevant economic and regulatory drivers can help increase confidence in a project's additionality. Nevertheless, some uncertainty is likely to remain given the inherent difficulty of proving a counterfactual.

Emissions leakage—Leakage refers to the possibility that an action to reduce emissions from one entity or location could lead to increased emissions elsewhere. An obvious example is when an entity claims emission credits for shutting down production in one location, but has merely shifted production to another jurisdiction (or to another entity). Concerns about leakage are an important reason some mandatory carbon programs recognize only domestic offsets.

Quantification, standardization, and transparency—Accuracy in establishing baselines and quantifying changes in carbon emissions (or changes in carbon sequestration) is essential to generating quality credits. Robust monitoring, reporting, and verification (MRV) requirements or protocols are generally seen as the main solution to this set of challenges. As noted in the main text, accurate quantification can be especially difficult in the case of land-based CDR strategies. Fortunately, methodological and technological advances, such as the use of remote sensing data to monitor landscape-scale changes, hold promise for reducing MRV costs and improving accuracy.

In the absence of government intervention to ensure quality carbon credits, voluntary

carbon markets have relied on self-governing credit registries and verification entities. This lack of oversight has amplified long-standing concerns about credit quality and transparency. Poor project design, flaws in protocol methodologies, or unreliable MRV can result in negligible climate outcomes for a given credit. Issues related to faulty credit development must be addressed to build confidence in the marketplace and unlock the full potential that carbon credits can provide in financing climate solutions.

What is the path forward for ensuring that voluntary carbon markets deliver real climate benefits?

Challenges facing carbon credits are significant but not insurmountable.[22] Indeed, necessary conversations about improving credit quality[23] and effectively scaling[24] robust and rigorous credit markets are underway. For example, the 2021 U.N. Climate Conference in Glasgow solidified international rules regarding carbon credits used for nationally determined contributions. This step could have positive spillover effects for credit quality in voluntary markets.

The magnitude of investment that carbon credits channel into urgently needed climate solutions warrants improved credit implementation.

The need for additional incentives to boost private investment in all forms of CO_2 reduction and removal provides a compelling rationale to support and strengthen voluntary carbon markets.[25] Recent analyses indicate that large-scale removal of carbon dioxide from the atmosphere and near elimination of new emissions by midcentury will be critical to limiting damage from climate change. The IPCC,[26] for example, estimates that 100 billion metric tons to 1,000 billion metric tons of legacy carbon dioxide must be removed from the atmosphere this century. CDR on this scale is unlikely to be achieved through natural,[27] land-use, and forestry-based strategies alone. Engineered means, such as direct air capture (DAC) technology[28] will also be needed. Indeed, there is evidence that demand for nature-based CDR solutions may already be oversubscribed. According to one recent study,[29] the land area required to meet existing pledges by governments and corporations through soil or forest-based CDR alone is roughly equivalent to all currently farmed land on Earth.[30]

Implementing CDR at scale will require major initiatives to retool and build-out associated infrastructure and the rapid emergence of new industries to manage the transport and geologic storage of billions of tons of carbon dioxide on an annual basis. Recent investments from the bipartisan infrastructure law[31] and the Energy Act of 2020 are increasing federal support for the creation of this infrastructure and technologies in the United States. But voluntary carbon markets and carbon credits represent one of the few available mechanisms for delivering additional private-sector investments at the magnitude needed to move the needle on CDR development and deployment.

Using carbon credits to help jumpstart financing for engineered CDR would constitute a relatively new development in terms of the kinds of projects and technologies that have historically participated in carbon markets (Figure 1). In other ways, however, projects that combine DAC or other forms of engineered CDR with geological carbon dioxide storage could be considered especially strong candidates for carbon credits because they avoid many of the credit-quality challenges previously discussed. In contrast to many nature-based CDR strategies, engineered CDR projects are more straightforward to quantify, verify, and monitor. Similarly, geological storage of carbon dioxide is not susceptible to the durability concerns of nature-based carbon sequestration. The carbon dioxide reductions achieved by direct air capture projects can be considered "additional" almost by definition.[iv]

Moving forward, careful consideration needs to be given to ensuring that credit markets effectively incorporate CDR projects, provide meaningful incentives to advance a wide range of innovative climate solutions, and contribute to the achievement of core policy goals. Key questions to address to improve credit quality include:

1. How should uncertainty be defined, documented, and mitigated in future crediting frameworks? How should credit requirements for CDR projects vary based on approach (e.g., nature-based solutions, geologic storage, etc.)? What level of uncertainty and cost is acceptable to investors?

2. What is an appropriate role for government to play in encouraging quality credits and promoting standardization and transparency across credit registries?

3. How should project effects related to non-climate environmental or social outcomes (positive and negative) be evaluated and documented within crediting frameworks?

Considering the opportunity that carbon credits present, multiple efforts are underway to resolve some of these issues and propose potential solutions. Noteworthy examples include the Taskforce on Scaling the Voluntary Markets,[32] the Oxford Prin-

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iv As discussed in other BPC briefs, a few limited markets for captured CO_2, unrelated to any climate benefit, currently exist—primarily for use in the production of carbonated beverages or enhanced oil recovery (EOR) operations. However, both these markets—particularly the beverage market—are small, relative to the quantities of CDR that will be needed for meaningful climate mitigation. In addition, well developed and cheaper sources of CO_2 already exist to serve these markets (currently, for example, most EOR operations use CO_2 from geologic reservoirs). Thus, the additionality requirement should be relatively easy to satisfy for most if not all direct air capture projects, including those that incorporate EOR, provided the captured CO_2 is permanently stored underground.

ciples for Net Zero Aligned Carbon Offsetting,[33] and the Science Based Targets Initiative.[34] Properly balancing the need to ensure a high level of credit quality with the desire to reduce barriers to market participation will remain the core challenge going forward. In the U.S. context, federal leadership can play a pivotal role in convening the key stakeholders, funding the development of critical analytical tools and improved crediting methodologies, promoting coordination and standardization, and providing an overarching policy vision.

Endnotes

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