1POINTFIVE

CDR BASICS

An Overview of CO_2 Removals and Why 1PointFive is Your Net-Zero Partner

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INTRODUCTION

THE PATH TO NET ZERO

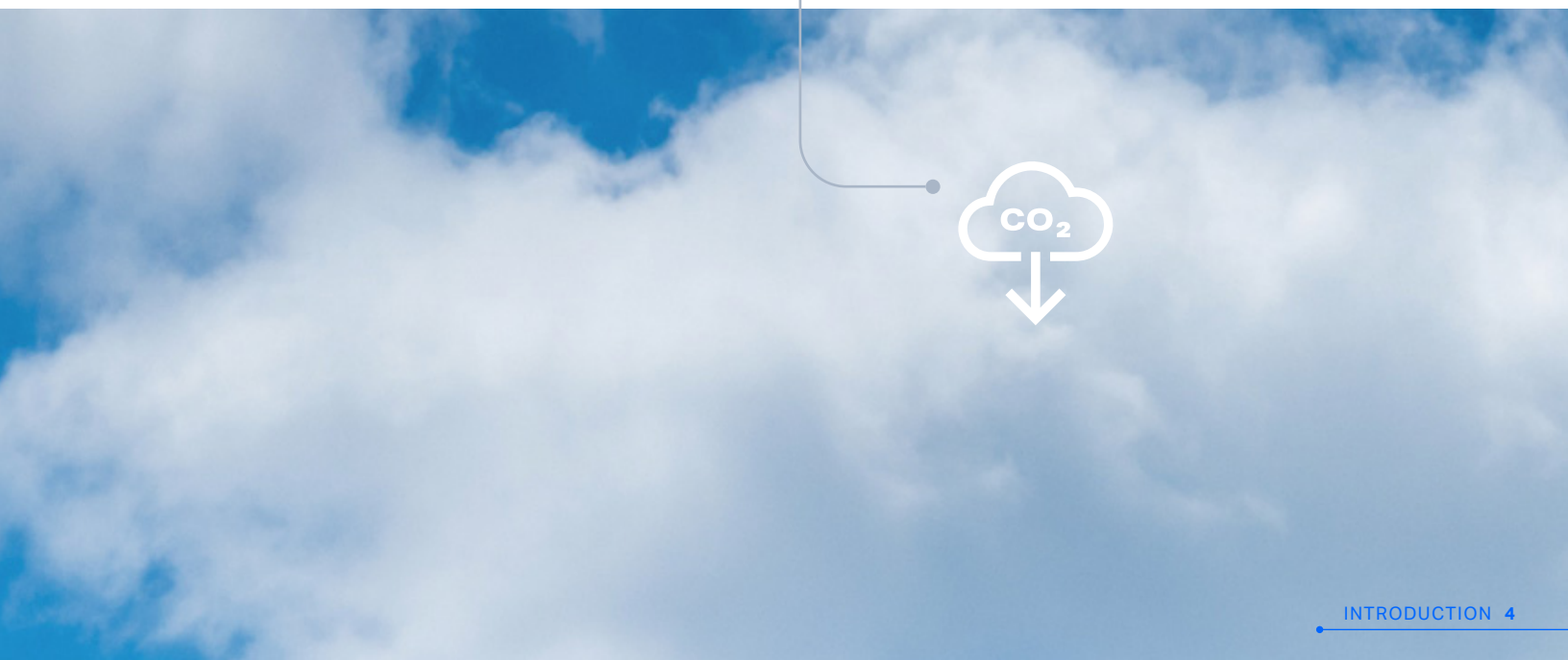
Many corporations and governments are actively working to decrease greenhouse gas (GHG) emissions and, ultimately, to reach the goal of net zero emissions. To limit global warming to 1.5°C—as called for in the Paris Agreement— it is estimated global emissions must reach net zero by 2050. Of course, organizations can choose, and are in fact encouraged, to set their own net-zero goals and achieve them prior to 2050.

Companies can look inward, reducing GHG emissions within their operations or value chain. This is called operational decarbonization. For emissions that cannot be feasibly addressed operationally, as well as those beyond the confines of their business, carbon dioxide removal can play a pivotal role.

To compensate for these residual emissions, a company can purchase carbon dioxide removal credits, or CDRs for short.

The role of CDRs

While operational decarbonization is considered a must for companies in virtually every industry, external carbon dioxide removals are now widely seen as necessary to achieve global climate targets. In fact, leading net-zero scenarios such as those posed by the Intergovernmental Panel on Climate Change (IPCC), the Network for Greening the Financial System (NGFS) and the International Energy Agency (IEA) rely on the removal of between 5 and 15 Gt CO_2/year by 2050 to limit global warming to 1.5°C.



This guide is designed to help you learn more about CDRs, how they can help your company reach its goals and help the global community reach theirs.

THE BASICS OF CARBON CREDITS

What is a CDR?

A carbon dioxide removal credit is a tradable certificate representing one metric ton of carbon dioxide equivalent (CO_2e).

Carbon dioxide is either removed from the atmosphere or is prevented from being emitted into the atmosphere via a carbon-reduction project. Examples include investing in reforestation and creating renewable energy.

Carbon credits are certified by third-party registration and issuance bodies and have applications in both voluntary carbon markets and compliance markets, such as the sectoral compliance mechanism for international aviation, Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

Not all carbon credits are the same.

Know the difference between avoidance and removals.

Carbon credits, in one form or another, have been around for a while. For years, they were primarily carbon-avoidance offsets, tied to efforts that prevented CO_2 from being emitted into the atmosphere, in comparison to a hypothetical baseline scenario of emissions. Those are still available today. As a result of such projects, emissions are avoided.

It is important to note these are not examples of CO_2 reduction, because no amount of existing CO_2 is reduced or removed from the atmosphere. Carbon avoidance projects can be either nature-based or technology-based.

Technology-based avoidance

These offsets are generated by avoiding emissions—primarily from fossil fuels—in situations where there is not an existing economic incentive or regulatory requirement to do so. If a manufacturing company decided to convert to renewable energy generation, or a moving company decided to convert its entire fleet to electric vehicles, these interests would no longer generate new emissions from that part of their operations.

Nature-based avoidance

These offsets are generated when the destruction of natural carbon sinks is prevented. For example, a project is funded to protect a section of forestland or peatland—natural resources that sequester large amounts of carbon—from being destroyed. This is what happens when a community preserves green space rather than clearing many acres of forest to make way for a residential development or shopping mall.

CO_2 removals are critical to achieve net zero.

Removals differ from avoidance because they are tied to projects that actually reduce the amount of CO_2 currently in the atmosphere.

Given the amount of CO_2 in the air today, as well as the emissions expected in the coming decades, carbon dioxide removal will be a critical tool to achieve net zero. This tool can be employed in a couple of ways.

CO_2 removal differs from avoidance offsets and provides a true net-reduction of emissions.

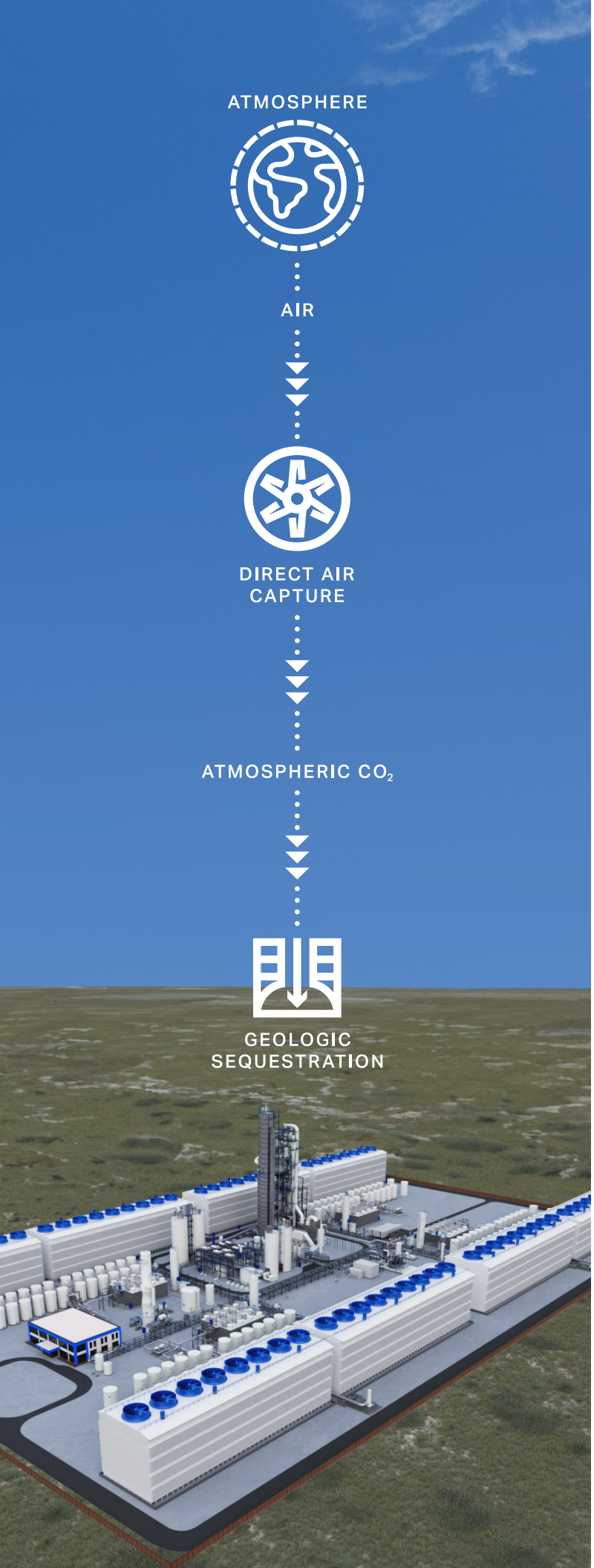
Nature-based removals

This technique uses natural means of capturing CO_2 to remove it from the biosphere. This could include efforts such as reforestation or restoring soil, mangroves, seagrass or peatlands. Again, for them to be classified as removal, such efforts need to add to or expand upon the environment's natural sequestration of CO_2. Planting trees is a way of increasing nature's ability to remove CO_2 from the atmosphere.

Tech-based removals

These projects remove and safely store existing CO_2 from the atmosphere with the help of an engineered solution such as Bioenergy with Carbon Capture and Storage (BECCS) or Direct Air Carbon Capture and Storage (DACCS). BECCS involves capturing CO_2 from process emissions resulting from biofuel or biohydrogen production, or from combustion emissions as a result of heat and power generation. DACCS involves capturing CO_2 directly from the atmosphere.

In both solutions, the CO_2 that is separated can then be stored deep underground in porous rock formations—a process called geologic sequestration—or otherwise utilized to produce products or fuels.



How does CO_2 removal work?

The simplest explanation for CO_2 removal is a two-step process.

First, you capture the CO_2 from the atmosphere.

Then you store it somewhere safe and secure.

Common removal techniques

Nature-based solutions (NBS)

These solutions are restoration and land-management activities that remove CO_2 from the atmosphere and keep it in biological storage. NBS can be implemented in an array of natural ecosystems including forests, wetlands, croplands and grasslands. Reforestation is an example of a nature-based solution, and should not be confused with avoided deforestation, which is considered CO_2 avoidance.

Bioenergy with carbon capture and storage (BECCS)

BECCS involves a broad spectrum of technologies that combust biomass while capturing and storing the CO_2 emissions. CO_2 captured via BECCS can be used to produce desirable end products, industry inputs (e.g., cement, lime) and fuel—helping reduce CO_2 emissions by storing it in these items.

Direct Air Capture (DAC)

With DAC, CO_2 from ambient air is captured and compressed, then stored underground in geologic reservoirs or utilized as a feedstock to create other products. Technology to capture CO_2 varies (e.g., between liquid sorbent and solid sorbents), but the major steps are similar.

DETERMINING CDR QUALITY

Who sets the standard for carbon credits?

Standard-setting organizations have been established to provide quality assurance and to track carbon credits, though it is still an evolving process. There are several organizations involved to enhance credibility and verification in the carbon crediting process.

Carbon standards, such as VERRA and Gold Standard, develop benchmarks and rules and approve project methodologies for the carbon crediting program.

Third-party validation and verification bodies (VVB), such as DNV and TUV SUD, review and validate a carbon project prior to registration at a carbon standard and then verify said carbon project prior to credit issuance.

Registries, typically operated by a carbon standard, handle the issuance, transfer, and retirement of carbon credits.

Carbon dioxide removal via DAC with geologic sequestration is already recognized and governed by compliance markets—California and Alberta, Canada, for example—yet the current voluntary market for CDRs is still in a nascent stage.

1PointFive is engaged in helping establish standardization.

1PointFive is working with key voluntary market stakeholders to leverage existing government regulations, international best practices and industry expertise to develop high-integrity monitoring, reporting and verification methodologies for large-scale commercial projects.

Our parent company, Oxy, co-founded the CCS+ Initiative, one of the most comprehensive carbon capture and sequestration methodology development processes to date for the voluntary carbon market, which is expected to be used by VERRA.

What makes a carbon credit high quality?

All carbon credits are not equal.

The quality of a carbon credit refers to the level of confidence one can have that the credit constitutes a true reduction or avoidance of GHG emissions. Hence, all carbon credits are not equal.

Independent governance bodies for the voluntary carbon market, such as the Integrity Council for the Voluntary Carbon Market (IC-VCM), are setting threshold standards for high-quality carbon credits. The core carbon principles (CCPs) outlined on the following page are criteria used to inform and guide the assessment of carbon-crediting programs and different types of carbon credits.[1]

[1]Mitigation of Climate Change (2022) Working group III contribution to the sixth assessment report of IPCC https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf

Additionality

A CDR-generating project is considered additional if reductions or removals would not have occurred in the absence of the incentive created by carbon credit revenues. The carbon avoidance or removal would not have happened in a business-as-usual case due to economics or government regulation.

For example, Direct Air Capture (DAC) credits are considered highly additional because they do not require any net change in operations or feedstocks, and instead capture emissions already in the air regardless of source.

Durability

Reductions or removals from the mitigation activity must have durability, or, if they have a risk of reversal, any reversals must be fully compensated. For example, a forestry project keeps carbon in trees and soils. But, if later, a fire burns down the project's trees, some or all the carbon may be re-emitted, leading to a reversal. Conversely, geologic sequestration—storing the CO_2 deep underground in mineralized formations that naturally trap the gas—is considered one of the more stable and durable forms of carbon storage.

Mitigation activity information

Sources of high-quality carbon credits provide comprehensive and transparent information on mitigation activities and make it publicly available.

Clear guidance and compliance procedures in place

Mitigation activities must conform with industry best practices on social and environmental safeguards. For example, when sequestering CO_2, wells used must meet Class VI specification as set by the U.S. Environmental Protection Agency (EPA), and all operations must be conducted under an EPA-approved monitoring, reporting and verification program. As stated above, 1PointFive's parent company, Oxy, participates in one of the most comprehensive carbon capture and sequestration methodology development processes for the voluntary market.

Quantification of emission reductions and removals

Reductions or removals from the mitigation activity must be quantified and based on conservative approaches, completeness and sound scientific methods. One of the benefits of employing a technology-based solution such as Direct Air Capture with sequestration is that the process allows for actual measurement and tracking of exactly how much CO_2 gets removed and stored.

Independent third-party validation and verification

High-quality carbon credit issuers will establish a program-level requirement for robust, independent third-party validation and verification of mitigation activities. This helps enhance quality and transparency.

Transition toward net-zero emissions

High-quality carbon credit projects will avoid locking in levels of emissions, technologies or carbon-intensive practices that are incompatible with achieving net-zero emissions by mid-century.

Unique risks in the voluntary carbon market

Shortage of high-quality credits

We believe demand for high-quality carbon credits is currently much higher than existing supply, and this gap may increase as regulatory standards and corporate commitments set higher standards for the types of credits used. This shortfall might make sourcing high-quality credits difficult down the road and, consequently, could increase their price.

Reputational risk

Public scrutiny of corporate decarbonization plans has increased in recent years. Companies' sustainability plans with portfolios weighted too heavily in lower-quality carbon credits could court skepticism. At the same time, there is a growing recognition that carbon removals—rather than avoidance alone—are needed to achieve a real impact.

Credit invalidation

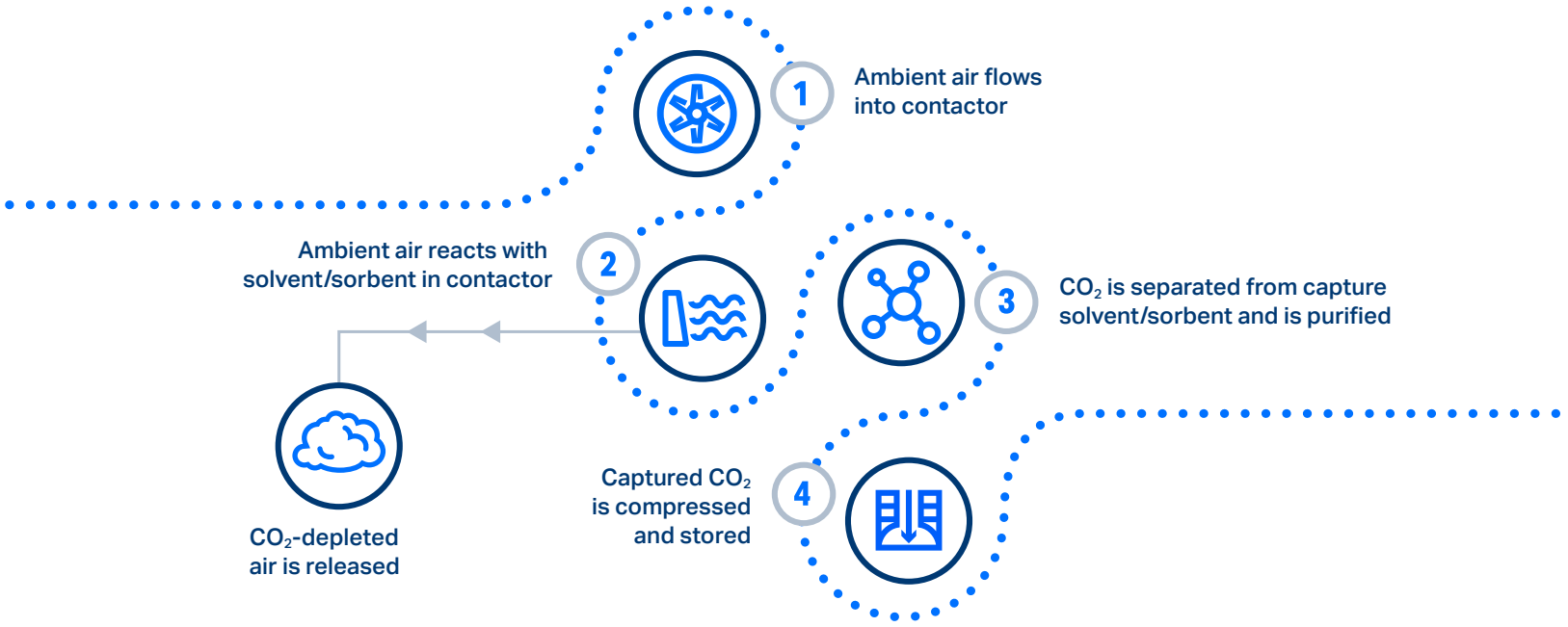
Validation and verification bodies (VVBs) audit the carbon project against methodologies, but they do not monitor the standard itself or the methodology on which the project is based. Hence, there is the potential for credits from low-quality projects to be invalidated in the future.

DIRECT AIR CAPTURE + SEQUESTRATION

How is CO_2 removed from the air?

DAC works by drawing air into the facility using a series of large fans. The air comes in contact with a liquid or a solid sorbent, depending on the technology, that binds to the CO_2 molecules.

The CO_2-rich solution is then processed through a series of reactions that separate, purify and compress the CO_2. The resulting CO_2 can then be stored or used as a feedstock in the making of other products.



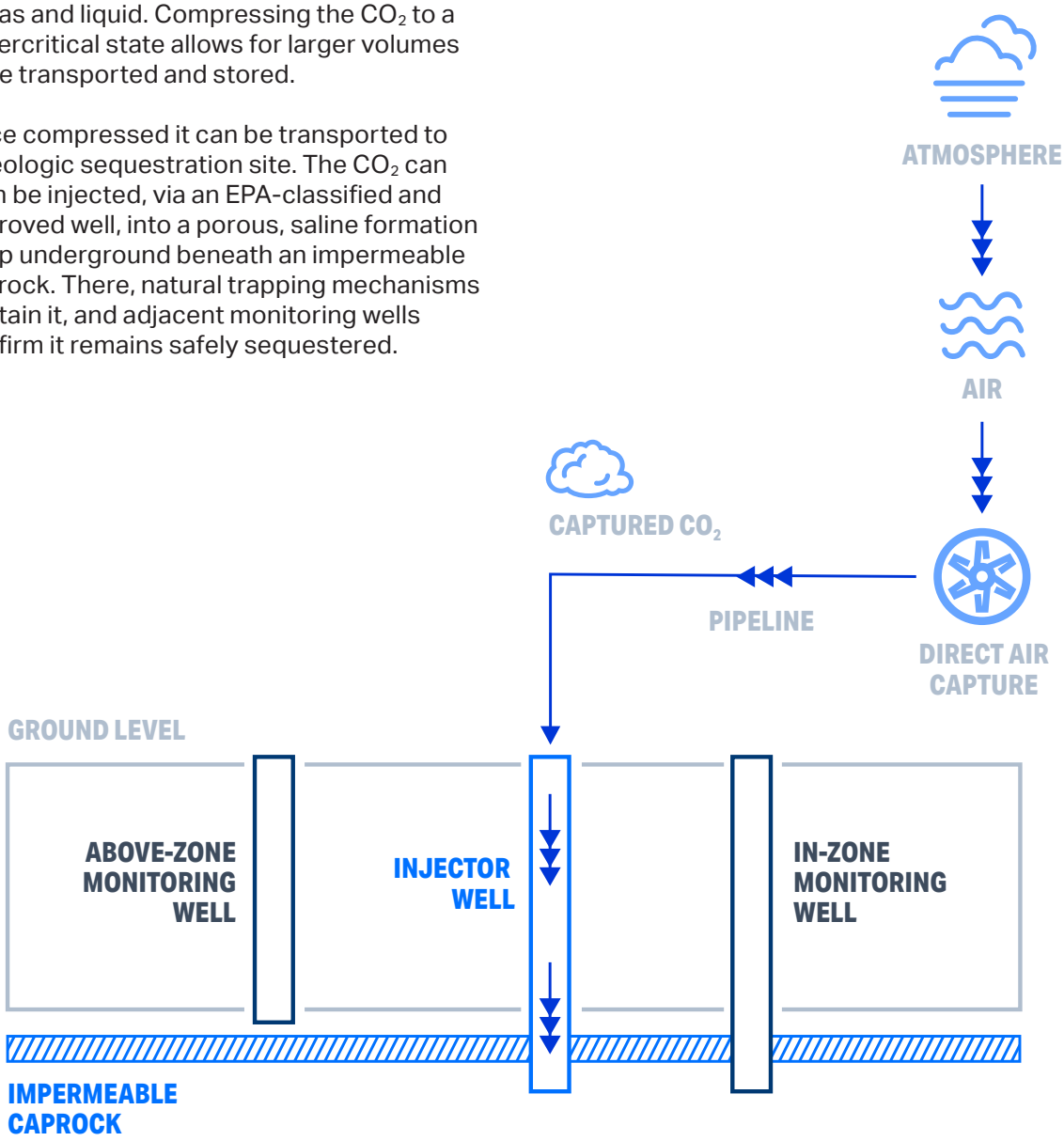
Advantage of Liquid Sorbent over Solid Sorbent

Liquid sorbent enables a continuous-loop process (versus a batch process used in solid adsorbent technologies). This continuous-loop process, which will be used at 1PointFive DAC facilities, allows operation 24/7, a key enabler for megaton-scale removal.

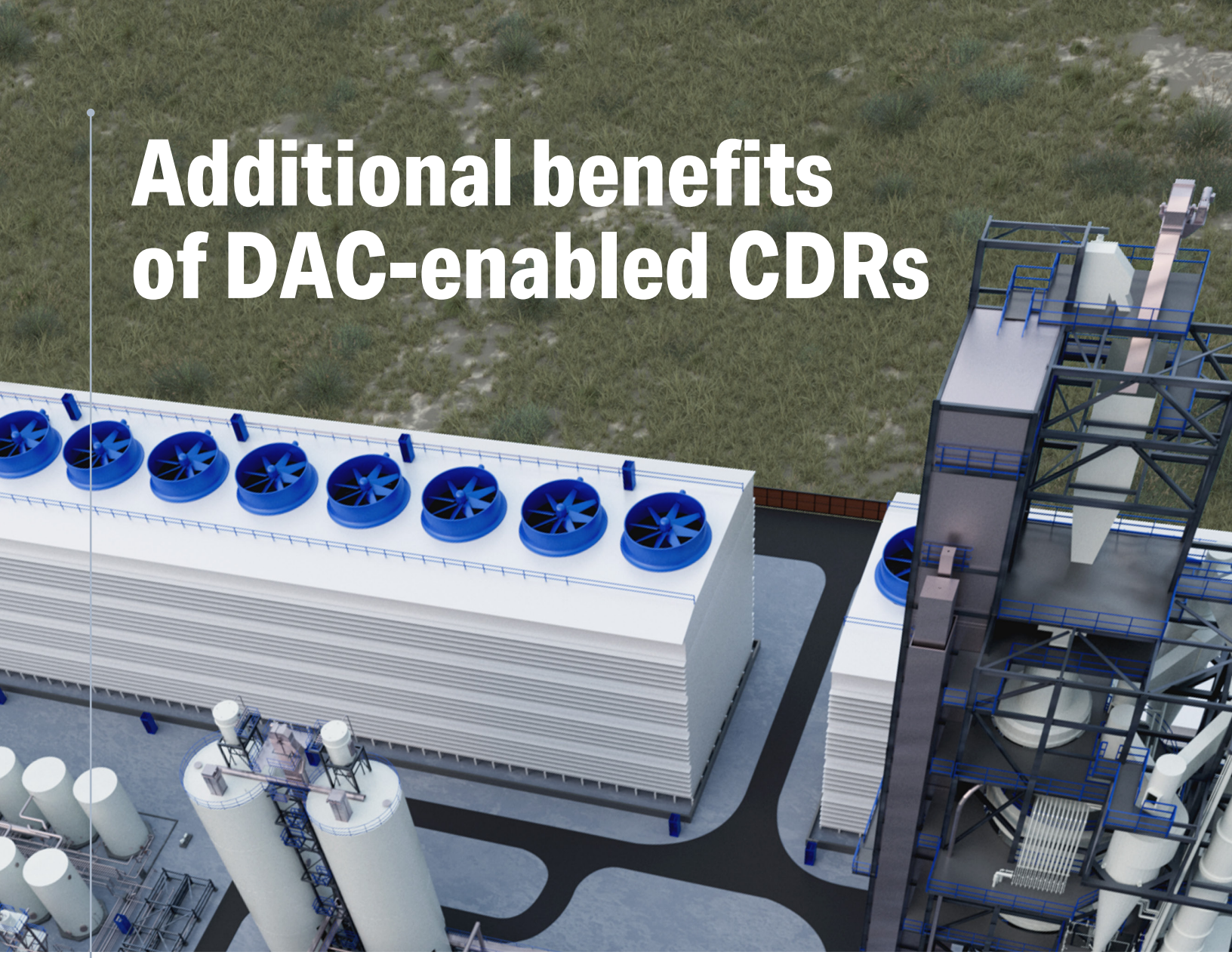
Where is CO_2 stored once it's been captured?

Once CO_2 has been captured from the atmosphere, it is separated, purified and compressed into a supercritical phase, which is a state with combined properties of gas and liquid. Compressing the CO_2 to a supercritical state allows for larger volumes to be transported and stored.

Once compressed it can be transported to a geologic sequestration site. The CO_2 can then be injected, via an EPA-classified and approved well, into a porous, saline formation deep underground beneath an impermeable caprock. There, natural trapping mechanisms contain it, and adjacent monitoring wells confirm it remains safely sequestered.



Additional benefits of DAC-enabled CDRs



Beyond the direct emission-specific issues DAC CDRs help you with, there are other benefits that come from pursuing this solution.

Meets urgent net-zero timeline

DAC is expected to be highly scalable and cost effective for hard-to-abate emissions. We believe DAC CDRs are the only way to address residual emissions at the scale required to meet your goals and ultimately achieve net zero.

Highly skilled jobs and a just transition

This solution creates good, long-term jobs, and we believe is safe to build even near populated areas. Many of these jobs require people with skill sets from industries that will be affected by the energy transition.

Support to disadvantaged communities

DAC offers flexibility in location, so buildout of this clean infrastructure could be targeted toward disadvantaged areas/countries.

No competition with food

DAC facilities can be built on non-arable land, so they don't compete with food production.

DEVELOPING A PORTFOLIO OF CARBON CREDITS

CDRs for residual emissions

So, you've set about implementing the operational and supply chain measures you need to reduce the emissions you can. Now you're addressing those that are beyond your reach.

First decide how much of these residual emissions you will address and which types of credits to use. Companies typically assemble a portfolio of different types of credits that align with their mission, stakeholder interests and decarbonization goals.

DAC-generated CDRs can help you achieve a well-balanced portfolio.

DAC credits are considered one of the highest quality credits in the market today due to their high durability and measurability, as captured CO_2 is measured with meters and monitored over time. Including these credits helps de-risk any carbon-credit portfolio and demonstrates strong decarbonization ambitions.

Purchasing DAC-generated CDRs in the near-term not only provides access to a supply of scarce, high-quality credits but also mitigates potential future price volatility that often characterizes markets where demand exceeds supply.

DAC CDRs support long-term business sustainability goals.

Pursuing DAC credits can have an impact that extends well beyond the immediate benefit to a company's decarbonization efforts. Purchasing these credits today supports market creation, signaling to producers that demand is ramping up, a crucial factor for scaling carbon dioxide removals as stated in *The Oxford Principles for Net Zero Aligned Carbon Offsetting*.

Buying credits sooner not only helps the DAC CDR market scale up, but also builds internal purchasing capabilities and relationships with producers, helping secure preferred access to credit volumes necessary for meeting net-zero ambitions.

We believe DAC-generated CDR buyers will be seen as climate leaders for their support of crucial decarbonization technology. Buyers can use credits to offer potential sustainable solutions to their own customers, building new green business opportunities and differentiating brands.

Buying, selling and retiring credits

Based on your need, a portfolio combining carbon avoidance offsets and carbon dioxide removal credits can be bought in one of two ways.

Purchase

You can purchase through intermediaries such as a broker or in a marketplace or exchange. Or you can purchase directly from a developer, an entity that is removing the CO_2 itself, such as 1PointFive.

Resell / retire the credits

Once purchased, credits can be retired against residual emissions or resold to another party. When they are retired, they are permanently removed from the market to avoid double counting. Those credits that are resold remain valid until they are finally retired.

SUMMARY

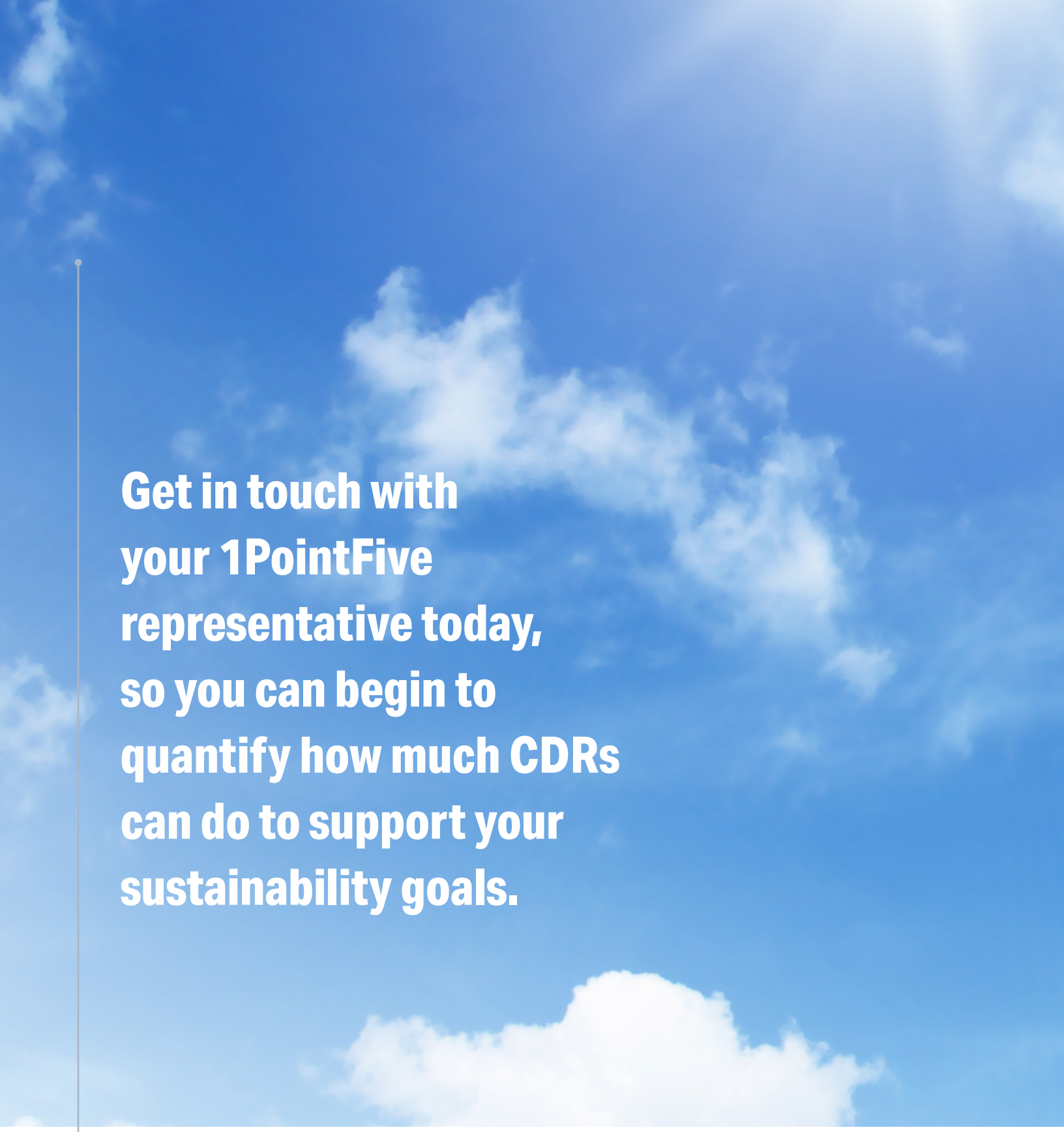
The case for purchasing DAC CDRs today

An immediate tool to accelerate your efforts to reach Net Zero.

We hope this overview has helped you understand the basics of CDRs, as well as some of the complexities of the carbon crediting process. We understand purchasing CDRs for the first time can be a significant step in your climate journey so we are here to help with this critical milestone towards your net-zero goals.

Purchasing DAC CDRs today, even at small volumes, is an important step towards demonstrating your commitment to meeting your future sustainability goals and is invaluable to developing a CDR market that will be critical for the world to address climate change.

We look forward to being your CDR partner at 1PointFive.



Get in touch with your 1PointFive representative today, so you can begin to quantify how much CDRs can do to support your sustainability goals.

sales@1pointfive.com

GLOSSARY

Carbon dioxide equivalent (CO_2e)

Obtained by converting a mixture of GHGs to a single number based on the global warming potential of each individual GHG in the mixture.

Carbon dioxide removal

Anthropogenic activities removing CO_2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological or geochemical sinks and direct air capture and storage but excludes natural CO_2 uptake not directly caused by human activities.

Decarbonization

The process by which countries, individuals or other entities aim to achieve zero fossil carbon existence. Typically refers to a reduction of the carbon emissions associated with electricity, industry and transport.

Direct air capture (DAC)

Chemical process by which CO_2 is captured directly from the ambient air, with subsequent storage. Also known as direct air capture and storage (DACCS).

Greenhouse gas (GHG)

A gas in the earth's atmosphere that absorbs infrared radiation and traps heat. The primary GHGs are: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride and nitrogen trifluoride.

Net-zero emissions

Net zero emissions are achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period. Where multiple greenhouse gases are involved, the quantification of net zero emissions depends on the climate metric chosen to compare emissions of different gases (such as global warming potential, global temperature change potential, and others, as well as the chosen time horizon).

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