ROLE OF INTERNATIONAL STANDARDS IN CARBON OFFSETS

Exploring the demand for standards in Voluntary Carbon Markets

Presented By- Abhinandan Banerjee, David Feuerbach, Catharina Lekkerkerker, Heli Shah

02 December 2022

Table of Contents

Acknowledgement

The report is co-authored by Abhinandan Banerjee, David Feuerbach, Catharina Lekkerkerker and Heli Shah in a joint partnership with the Geneva Graduate Institute and the International Organization for Standardization (ISO). The research is conducted as a part of our Applied Research Project under the master's programme in International Affairs and Development Studies at the Geneva Graduate Institute.

We extend our humble gratitude to Belinda Cleeland (Head of Research and Innovation) and Noelia Garcia Nebra (Head of Sustainability) from ISO for providing us with this opportunity. We are thankful to the guidance and constant support provided by Romina Pezzot (Teaching Assistant) and Denis Ruysschaert (Faculty Advisor) for providing valuable feedback on our research.

Lastly, we are immensely grateful to all our interviewees for sharing with us their valuable insights, experience, and knowledge. This research wouldn't have been accomplished without the support of all the mentioned people and institutions.

Executive Summary

In order to achieve the Paris Agreement goals, massive reductions in emissions need to occur across all sectors. Many non-state actors, particularly, private corporations, have responded to this challenge by pledging to become net-zero. Offsets from Voluntary Carbon Markets (VCMs) constitute an important component for many of these pledges, particularly for emission-intensive industries. However, concerns have been raised about the quality, efficacy, and credibility of such offsets, leading to a popular perception that they provide corporations an avenue for greenwashing. This exposes a gap, which could possibly be plugged by standard setting organisations such as the ISO. The creation of new standards and the strengthening of existing standards could provide more guidance and regulation within VCMs, which could help to bolster integrity and build more trust. This provides fertile ground for the research carried out under this project, namely, to explore the role of international standards in carbon offsetting to achieve net-zero in VCMs, with a specific case study from the oil and gas sector.

Landscape of standardisation within VCMs

The first goal of the research was to identify the existing landscape of standardisation of carbon offsetting in VCMs. We found that a number of frameworks aim to provide governance on both the supply side (ensuring quality of offset projects and credits) and the demand side (ensuring integrity of corporate claims related to these credits). While there are a number of standards, principles, codes, guides, and programmes that exist, there is no central set of rules or authority which VCMs revolve around.

Supply Side

- ⇒ Offset Programmes such as the Verified Carbon Standard (VCS), Gold Standard, American Carbon Registry (ACR), and Climate Action Reserve (CAR) have developed standards and provide certification for offset project developers.

⇒ ISO 14064, ISO 14065, and the GHG Protocol are used as normative documents by several of the Offset Programmes in their standards and methodologies.

⇒ The Integrity Council for the Voluntary Carbon Market (ICVCM) is in the process of creating Core Carbon Principles (CCPs) which will outline criteria for high quality offsets and will attempt to provide governance over the Offset Programmes.

Demand Side

⇒ The Voluntary Carbon Markets Integrity Initiative (VCMI) is developing a Claims Code of Practice which will outline how companies can use offsets in a credible way to make progress towards net-zero commitments.

⇒ The Science Based Targets initiative (SBTi) Corporate Net-Zero Standard outlines pathways for companies to achieve net-zero in line with science.

⇒ In November 2022, the ISO published the International Workshop Agreement (IWA) 42 on Net Zero Guidelines with the aim of creating a common reference for organisations to help contribute to the achievement of global net-zero.

⇒ ISO 14068 on carbon neutrality is currently in development which will provide requirements for organisations, including companies, for making carbon neutrality claims.

Challenges of offsetting and VCMs

The next goal of the research was to identify and analyse the challenges that exist with respect to offsetting within VCMs:

⇒ **Credibility crisis:** A perception of a lack of governance and standardisation exists, with many believing that VCMs are a completely unregulated space. In reality, there are a number of frameworks, however, without a central set of rules or authority, this can create confusion for private actors attempting to navigate the space.

⇒ **Voluntary nature:** Despite the existence of standardisation, because VCMs are, by definition, voluntary, on the supply side, developers of offset projects do not necessarily need to comply with the standards, and on the demand side,

companies do not necessarily need to ensure that they are using offsets in a credible way.

- ⇒ **Quality of offsets:** Ensuring that an offset project produces high quality carbon credits which satisfy the requirements of additionality, permanence, and double counting can be a challenge even with well-intentioned standards.
- ⇒ **Social harm:** Although the existing standards have requirements for preventing negative impacts to the socio-economic systems of local communities, concerns remain that in some cases community interests are not fully addressed.
- ⇒ **Integrity and scale:** There are concerns that standards could set too high of a threshold that is not feasible on the ground, and that additional layers of governance will add unnecessary cost and time burdens to VCMs.
- ⇒ **Cost and time burden:** The cost involved in the process of evaluating, registering, validating, monitoring, reporting, and verifying outcomes is significant and may restrain the supply of carbon offset projects in the market, especially from small-scale project developers.
- ⇒ **Veracity of claims and a licence to pollute:** Misleading corporate net-zero claims based on carbon offsetting further exacerbate the credibility crisis surrounding VCMs. Many argue that VCMs can lead to more greenwashing and give companies a licence to pollute.

Oil and gas case study

The final goal of the research was to determine whether there is a demand for increased standardisation of carbon offsetting through a case study of the oil and gas sector. Due to limited access to experts within the oil and gas sector, we are unable to make definitive conclusions, however, from analysis of desk research and insights gained through an interview with experts, we can make the following inferences:

1. The net-zero pledges of the five oil and gas companies analysed (BP, Chevron, Eni, Shell, and TotalEnergies) contain wide variations and the extent to which offsets will be used toward net-zero targets contains ambiguity.
2. On the supply side, the offset projects purchased by the companies are certified by the major Offset Programmes.
3. On the demand side, i.e. the use of these offsets towards corporate net-zero pledges, there is an indication that companies might be interested in a clear and recognized standard.
4. New developments in the oil and gas industry point toward increased standardisation with respect to net-zero, such as the release of a Net Zero Standard for Oil and Gas Companies by the Institutional Investors Group on Climate Change (IIGCC) aimed at guiding sustainable investment decisions, as well as the current efforts of the SBTi to develop a specific methodology for companies in the oil and gas sector to set science based targets. This momentum points to increasing pressure on oil and gas companies from investors and consumers alike to reduce their impact on the climate.

1. Introduction

Since mid-2019, there has been an explosion of net-zero pledges, to an extent where they currently cover almost 91% of global GDP (Hans et al., 2022). However, in his opening statement at UNFCCC's COP 26 in Glasgow in 2021, the UN Secretary General acknowledged the ambiguous and questionable nature of these pledges, notably remarking that "…there is a deficit of credibility and a surplus of confusion over emissions reductions and net-zero targets, with different meanings and different metrics;" he subsequently stressed upon the need to have clear standards "to measure and analyse net-zero commitments from non-state actors" (United Nations, 2021). At COP 27, the recommendations in the report presented by the High-Level Expert Group on the Net-Zero Emissions Commitments of Non-State Entities, which was tasked by the UN Secretary General to 'draw a red line around greenwashing', have only bolstered the case for enhancing the credibility of such net-zero pledges by calling for more regulations.

Almost co-terminus with the observations made at COP26, the ISO General Assembly adopted the London Declaration in September 2021. The declaration demonstrates the ISO's commitment to ensure that standards play a role in accelerating the achievement of the Paris goals. As part of this commitment, and as one of the premier institutions for facilitating development of consensus-driven and market-relevant international standards, the ISO could have a role to play in helping to reduce ambiguity from net-zero pledges of non-state actors.

As more corporations set net-zero targets, the role of carbon offsets has come into the spotlight. Carbon offsets are greenhouse gas (GHG) "emission reductions or removals that compensate for CO2 emissions" outside of an actor's value chain (Broekhoff et al., 2019, p.6). Emission reductions refer to projects that reduce or prevent CO2 from being emitted; removals refer to projects that take CO2 out of the air. Carbon credits, which are "purchased credits representing a certified unit of emission reduction or carbon removal carried out by another actor," are increasingly an important part of many corporate climate goals (Allen et al., 2020, p.3). Broadly speaking, a corporation's emissions are

balanced by investing in external projects which have the effect of offsetting an equivalent amount of GHGs from the atmosphere. It is particularly popular amongst corporations engaged in emission intensive sectors such as aviation, oil and gas exploration, and heavy industries where emission reductions within their own value chain can be difficult to achieve.

There are two types of markets for carbon credits, compliance markets and voluntary carbon markets (VCMs). Compliance markets, such as the EU Emissions Trading System (ETS) and the Clean Development Mechanism (CDM), are created and regulated at the national, regional, or international level. VCMs, on the other hand, operate "outside of compliance markets and enable companies and individuals to purchase carbon offsets on a voluntary basis with no intended use for compliance purposes" (Carbon Offset Guide, n.d.). VCMs form an important component of the global carbon offset landscape and the overall net-zero picture. Considering that compliance carbon markets have geographical constraints, VCMs provide companies outside such geographies an opportunity to purchase carbon credits, thereby giving them an avenue to voluntarily offset unabated emissions on the path toward net-zero. However, at the same time, VCMs find themselves in the middle of a major credibility crisis, with many arguing that they are unregulated, low quality, ineffective, and amount to nothing more than greenwashing. This scepticism is prevalent with respect to both the supply side, meaning the quality of offset projects and the credits they generate, as well as the demand side, meaning the use of these credits toward a company's climate targets and claims. Thus, there is a dichotomy between the potentially significant role of VCMs and the credibility crisis surrounding them. This exposes a gap, which could possibly be plugged by standard setting organisations such as the ISO. The creation of new standards and the strengthening of existing standards could provide more guidance and regulation within VCMs, which could help to bolster integrity and build more trust.

With this in mind, our team has decided to research the role of international standards in carbon offsetting to achieve net-zero in VCMs. In order to do so, first it is necessary to

investigate the current landscape of standardisation within VCMs on both the supply side and the demand side. Second, it is important to investigate the various challenges that are affecting VCMs. Finally, it is important to determine whether there is a demand for more standardisation, and if so, why this demand exists. The remainder of this research paper will be structured as follows: Chapter 2 will lay out our research objectives and questions; Chapter 3 will outline the detailed methodology; Chapter 4 will examine the current landscape of standardisation within VCMs; Chapter 5 will discuss the challenges that exist within this landscape; Chapter 6 will investigate the question of demand for increased standardisation through a case study of the oil and gas sector; and finally, Chapter 7 will offer our conclusions.

2. Research Objectives and Questions

Overall Objective

Explore the role of international standards in carbon offsetting to achieve net-zero in Voluntary Carbon Markets, with a specific case study from an emissions intensive industry such as oil and gas.

Specific Objective 1

Determine the various frameworks available to offset emissions outside the actor's value chain and the prevalence of any standards currently being used for measuring, reporting, and verifying such offsets.

Research Questions

1. What are the existing frameworks for evaluation of carbon offsets?
2. What are the challenges of the current carbon offset frameworks?

Specific Objective 2

Explore the demand, or lack of demand, among non-state actors for international standardisation for carbon offsets.

Research Questions

1. What is the demand from non-state actors to develop international standards for carbon offsets?
2. Why do non-state actors want, or not want, the development of international standards for carbon offsets?

3. Methodology

This chapter explains and justifies the methodological approach undertaken in the research study. It is focused on establishing the credibility and reliability of our research based on our methods.

3.1. Specific Objective 1 Methodology

Specific Objective 1 was approached through a combination of desk research and interviews. Initial desk research helped us narrow the focus of our research specifically on the role of carbon offsets in the net-zero picture, and later, on the role of VCMs. Alongside desk research, an initial round of interviews was conducted with expert practitioners from international organisations, standard setting bodies, and research institutions, as well as with academics with expertise in environmental law, energy economics, and climate change mitigation. These interviews helped guide us toward the relevant documents to examine to analyse the existing standardisation within VCMs. Additionally, these interviews helped us to begin to identify some of the challenges that exist in VCMs. Pertinently, some of our interviewees have opted to remain anonymous when cited.

For Specific Objective 1 Research Question 1, our team reviewed the relevant frameworks, including standards, principles, codes, guides, and programmes. This process brought to light other frameworks which were also relevant, which were reviewed subsequently. Further insights were gathered from a second round of interviews with expert practitioners and academics.

For Specific Objective 1 Research Question 2, our team conducted desk research, analysing academic literature, journal articles, blog posts, podcasts and webinars. Insights for this question were also drawn from both rounds of interviews.

Importantly, while extensive research has been carried out to answer Specific Objective 1 and our results lay out a detailed mapping of the frameworks as well as the challenges, this should not be seen as exhaustive. Our research attempted to identify the most important and relevant frameworks as well as the most pressing challenges facing VCMs, however, it is possible that there are other frameworks and challenges that have not been included. Additionally, this field is in a constant state of flux. Many of the frameworks we reviewed were only recently published, or in some cases, were still in development at the time of research. Therefore, it is possible that this landscape will continue to evolve and that existing challenges will shift, and others will emerge.

3.2. Specific Objective 2 Methodology

The ISO aims to facilitate the development of consensus-driven and market-relevant international standards; therefore, it has a particular interest in the developments of market demands. In consultation with ISO, it was decided to narrow the scope to a particular sector. The oil and gas industry was chosen due to its position as the largest purchaser of carbon credits (Belletti & Schelble, 2022), and due to the fact that offsetting plays an important role in the net-zero targets for many oil and gas companies. To obtain a general view of the demand for standardisation in this sector, a collective case study was employed.

Case study selection

First, to provide an overview of the developments in the oil and gas industry, we identified a list of the twenty largest publicly-traded oil and gas companies in terms of revenue from data provided by Hale et al., (2022) and examined their overarching climate targets (see Ch.6 Table 1). The first part of this case study draws largely on the Net Zero Tracker database, which aims to provide “the definitive global resource for collating, assessing and presenting the scale and quality of net zero pledges” (Net Zero Tracker, 2022). Second, our team selected the companies that have submitted a net-zero target that includes scope 3 emissions. The focus on the inclusion of scope 3 emissions was based on preliminary research which indicated that best practices point to the importance of

including scope 3 emissions in net-zero targets. After this selection process, five integrated oil and gas companies were analysed: BP, Chevron, Eni, Shell, and TotalEnergies. Finally, when interpreting the conclusion of this study, it is important to note that several of these companies are considered frontrunners with respect to their climate pledges, especially when compared to the other large publicly-traded oil and gas companies. However, for the purpose of this study, the fact that several of these companies are frontrunners makes them suitable case studies because the strategies disclosed are aimed at achieving net-zero status.

The approach of the case study was first to conduct desk research to identify the net-zero strategies of these five companies, the use of offsets in these strategies, and whether standards were being used. This was done by drawing upon publicly available documents from these oil and gas companies, such as annual reports and climate reports. In addition to examining the strategies of these five companies, we also looked at broader developments with respect to standardisation in the oil and gas sector. The second aspect was to conduct interviews with experts from the oil and gas sector to help determine whether there is a demand for additional standardisation, both with respect to the supply side (the quality of offset credits), and the demand side (the use of offsets towards net-zero targets). However, the response we received from the sector was limited, and we were only able to conduct one interview. Therefore, we cannot make definitive conclusions regarding the question of demand for further standardisation. However, through the desk research and through the interview that was conducted, we are able to draw some inferences.

Finally, it is important to note that our findings can help to add to the conversation regarding the standardisation of carbon offsets and net-zero strategies within the oil and gas sector, however, it should not be assumed that these findings can be generalised across the entire sector. Likewise, the findings should not be generalised to other emission-heavy industries outside of oil and gas, such as aviation or construction, as

companies within these industries adopt different approaches to net-zero and have different considerations.

4. Landscape of Standardisation in VCMs

This chapter discusses the research and conclusions for Specific Objective 1 Research Question 1: *What are the existing frameworks for evaluation of carbon offsets?* Here we use the term frameworks to refer to the standards, principles, codes, guides, and programmes that attempt to provide governance of VCMs. It is also important to note that we have examined both the supply side (the offset projects and credits), and the demand side (the use of these offset credits by companies). This chapter provides a descriptive overview of these frameworks and then ends with a section summarising key takeaways. Additional detailed information about each framework can be found in Annexes A-D.

4.1. Supply - High Quality Offsets

This section examines the frameworks that aim to ensure that offset projects and credits meet high quality criteria on the supply side of VCMs.

4.1.1. Offset Programmes

Offset Programmes perform three main roles in the governance of VCMs: "(1) they develop and approve standards that set criteria for the quality of carbon offset credits; (2) they review offset projects against these standards (generally with the help of third-party verifiers); and (3) they operate registry systems that issue, transfer, and retire offset credits" (Broekhoff et al., 2019, p.8). The four major voluntary Offset Programmes are the Verified Carbon Standard (VCS) (which is managed by the nonprofit organisation Verra), Gold Standard, American Carbon Registry (ACR), and Climate Action Reserve (CAR). VCS is the largest, with almost 3,200 projects that have resulted in over 1 billion credits; Gold Standard is the second largest, with over 2600 projects that have resulted in over 200 million credits; ACR and CAR are smaller and have produced around 85 million and 70 million credits respectively (So et al., 2022).

There are many similarities between these four Offset Programmes. They all have overarching principles and requirements that apply to all offset projects, they all have

specific methodologies (also referred to as protocols or activity requirements) which set out the detailed procedures and rules for specific project types, they all have project cycles which offset project developers must follow to gain certification, they all require independent third-party verification, and they all issue their own version of offset credits to projects which have met the standard. More information about each Offset Programmes and their standards can be found in Annex A.

4.1.2. Use of ISO standards and GHG Protocol in Offset Programmes

All of the programmes, with the exception of Gold Standard, specifically note the use of ISO 14064-2 (Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements) as a normative document for their standards and methodologies. VCS and CAR make specific mention that their standards and methodologies align with the GHG Protocol.

Additionally, all of the programmes require that the independent validation and verification bodies (VVBs) which monitor the projects have gained accreditation from ISO 14065 (General principles and requirements for bodies validating and verifying environmental information). In the case of Gold Standard, VVBs must have accreditation from either ISO 14065 or the UNFCCC CDM.

4.1.3. Integrity Council for the Voluntary Carbon Market (ICVCM)

The ICVCM, which was founded in 2021 by the Taskforce on Scaling Voluntary Carbon Markets (TSVCM), will aim to provide governance for the Offset Programmes. The ICVCM is in the process of developing Core Carbon Principles (CCPs) which will aim “to provide a credible, rigorous, and readily accessible means of identifying high-quality carbon credits that create real, additional and verifiable climate impact with high environmental and social integrity” (ICVCM, 2022a, p.2). The CCPs will define whether Offset Programme standards and methodologies meet the requirements to be CCP-eligible. The CCPs are being developed “by the Integrity Council’s Expert Panel [...] made up of twelve

leading carbon market experts [...], supported by eleven subject matter experts in topics ranging from carbon sequestration science to the rights of indigenous peoples and local communities (IPLCs)" (ICVCM, n.d.). The development process has included open dialogue with Offset Programmes and other stakeholders.

A draft of the CCPs was published in July 2022 and is currently undergoing a public consultation period. The draft documents define 10 core principles:

- **Additionality** – emission reductions or removals would not have occurred without the incentive created by carbon credit revenues
- **Mitigation activity information** – transparent information provided by the Offset Programme
- **No double counting** – emission reductions or removals must only be counted once with no double issuing, double claiming, or double use
- **Permanence** – emission reductions or removals must be permanent or fully compensated in the case of reversals
- **Programme governance** – Offset Programme "shall have effective program governance to ensure transparency, accountability and the overall quality of carbon credits" (ICVCM, 2022b, p.3)
- **Registry** – Offset Programme shall operate or make use of a registry "to ensure credits can be identified securely and unambiguously" (ICVCM, 2022b, p.3)
- **Robust independent third-party validation and verification** – Offset Programme shall have requirements for "third-party validation and verification of mitigation activities" (ICVCM, 2022b, p.4)
- **Robust quantification of emission reductions and removals** – emission reductions or removals shall be quantified using conservative approaches and sound science
- **Sustainable development impacts and safeguards** – Offset Programme shall "have clear guidance, tools and compliance procedures to ensure mitigation activities conform with or go beyond widely established best industry best

practices on social and environmental safeguards while delivering on net positive sustainable development impacts" (ICVCM, 2022b, p.4)

- **Transition towards net-zero emissions** – "mitigation activity shall avoid locking in levels of emissions, technologies or carbon-intensive practices that are incompatible with achieving net zero emissions by mid-century" (ICVCM, 2022b, p.4)

The draft documents include an Assessment Framework which outlines how the CCPs will be applied and how Offset Programmes and their standards and methodologies will be assessed. However, the CCP draft documents have been met with concerns from multiple Offset Programmes including Verra, ACR, and Gold Standard, all of whom have supported the work of the ICVCM and are participating in the public consultation. Verra expressed its concerns in the sharpest terms, stating that their support for the ICVCM has been shaken and that a course correction is needed. Verra's main concerns are that the CCPs are a "blunt, one-size-fits-all approach," that the CCP requirements "are far too prescriptive and infeasible," and that "few, if any, credits would pass the test" which will hinder investment (Verra, 2022a). The ACR's concerns are that the CCPs go beyond the requirements of global compliance markets and create a threshold that no offset programmes or credits can meet which will halt investment, and that the approach is "overly subjective and cumbersome" (ACR, 2022a). The Gold Standard expressed that while the CCPs can help to instil the trust needed to allow VCMs to scale with integrity, the right balance needs to be struck between the rigour of the CCPs and the ability of Offset Programmes to innovate, move quickly, and improve and simplify rules and procedures (Gold Standard, 2022a). The Gold Standard is also concerned about the added cost and resource burden that the CCPs will add to the market.

More information about the ICVCM CCPs draft documents can be found in Annex B.

4.2. Demand - Credible Use of Offsets in VCMs

This section discusses the frameworks that set out guidance and rules for how companies can credibly use offsets as part of their climate action commitments on the demand side of VCMs.

4.2.1. Voluntary Carbon Markets Integrity Initiative (VCMI)

The VCMI is a multi-stakeholder platform that was established in 2021 to enhance credibility of VCMs and drive corporate climate action that aligns with net-zero. In 2022, the VCMI released the Provisional Claims Code of Practice to "provide clear guidance to companies and other nonstate actors on when they can credibly make voluntary use of carbon credits as part of their net-zero commitments; and ensure the credibility of claims made by companies and other private nonstate actors regarding this use of carbon credits'' (VCMI, 2022, p.13).

The Code requires companies to commit to achieving science-aligned long-term net-zero emissions for Scopes 1, 2, and 3[1] by no later than 2050, to make interim emission reduction targets that follow Science Based Targets initiative (SBTi) guidance, to make progress on these targets, and to purchase high-quality offsets. Companies are then able to make three levels of claims based on their progress. The highest level is VCMI Gold Net Zero. To achieve this, companies must be on track to reach their next interim target of emission reductions within their value chain for all three scopes of emissions and have purchased and retired offset credits to cover 100% of remaining unabated emissions. Companies can also make silver and bronze claims, which still require deep emission cuts, but are less stringent than the gold claim.

The Provisional Claims Code has undergone a consultation process and is being road tested by various companies. A final version of the Claims Code is expected to be

[1] Scope 1 refers to direct GHG emissions from owned or controlled sources. Scope 2 refers to indirect GHG emissions that are linked to the company's operations, such as generation of emissions from purchased energy. Scope 3 refers to emissions that are not produced by the company's owned or controlled assets but are responsible for the upstream and downstream of its value chain.

published in late 2022 or early 2023. More information about the VCMI Provisional Claims Code can be found in Annex B.

4.2.2. Science Based Targets initiative (SBTi) Corporate Net-Zero Standard

The SBTi, which was founded in 2015, released this standard in 2021 as the first framework for corporate net-zero target setting. While this standard is not directly focused on carbon offsetting or VCMs, offsetting is included in the standard, and the standard plays an important role in providing governance to corporate climate action. SBTi defines corporate net-zero as "reducing scope 1, 2, and 3 emissions to zero or to a residual level that is consistent with reaching net-zero emissions at the global or sector level in eligible 1.5°C-aligned pathways," and "neutralizing any residual emissions at the net-zero target year and any GHG emissions released into the atmosphere thereafter" (SBTi, 2021, p.8). There are four elements of setting net-zero targets. The first is to set near-term science based targets (SBTs) which are "5-10-year GHG mitigation targets in line with 1.5°C pathways" (SBTi, 2021, p.9). The second element is to set long-term SBTs which are targets to reduce value chain emissions to "align with reaching net-zero at the global or sector level in eligible 1.5°C pathways by 2050 or sooner" (SBTi, 2021, p.9). The third element is "beyond value chain mitigation" which refers to emission reductions or removals that occur outside of a company's value chain (SBTi, 2021, p.10). This is commonly referred to as offsetting, though the SBTi uses the term "beyond value chain mitigation." This is something that companies should pursue while they are in the transition to net-zero, and it is recommended by the standard, but not required. Beyond value chain mitigation cannot be used to count toward near or long-term SBTs, but rather is an additional activity. The final element is to neutralise residual emissions that remain once the long-term SBT has been achieved. For most sectors, the amount of residual emissions allowed for a long-term SBT is 10% or less. Companies must counterbalance residual emissions with permanent carbon removals and storage. This could also be referred to as offsetting, though the SBTi uses the term neutralisation.

Companies may only claim that they have achieved net-zero once they have reached their long-term SBT and have neutralised any residual emissions. Along the path to net-zero, companies can express that they have committed to achieving net-zero and that they have set targets with the SBTi Net-Zero Standard. More information about the SBTi Corporate Net-Zero Standard can be found in Annex D.

4.2.3. ISO International Workshop Agreement (IWA) 42 Net Zero Guidelines

At COP 27 in November 2022, the ISO published IWA 42 Net Zero Guidelines. An IWA is not a standard and is developed outside of the normal ISO committee system. It is developed through a consultation process in which market players and other stakeholders can debate and negotiate in a workshop environment. The purpose of this IWA is to provide "guiding principles and recommendations to enable a common approach with a high level of ambition, to drive organizations to reach net zero GHGs as soon as possible and by 2050 at the latest" (ISO, 2022a, p.vi). The IWA is not specifically aimed at corporate actors, but they are included, and thus it is important to discuss. Like the SBTi Corporate Net-Zero Standard, the IWA is not specifically focused on offsets or VCMs, however, they are an important aspect in the document. The IWA does not offer certification of net-zero targets as the SBTi Net-Zero Standard does, rather, the IWA is meant to be a common reference for organisations to help contribute to the achievement of global net-zero.

Similar to the VCMI and the SBTi, the key elements of the IWA follow the mitigation hierarchy, in which organisations should prioritise reducing emissions within the value chain first. Organisations should set long-term targets to be net-zero by 2050 at the latest with interim targets to substantially reduce all three scopes of their emissions in line with 50% global GHG reductions by 2030 or earlier. Residual emissions should be limited to the minimum "in line with science-based pathways that are aligned with a high likelihood of limiting global warming to 1,5°C above pre-industrial levels" (ISO, 2022a, p.23). To achieve net-zero, organisations must neutralise residual emissions with high-quality removals. Only at this point should organisations claim to be net-zero. With respect to

offsets, the IWA states that they must not be counted toward the achievement of interim targets, only to counterbalance residual emissions, and in this case, they must be removals. More information about the ISO IWA 42 can be found in Annex D.

4.2.4. ISO 14068 Carbon Neutrality

The ISO is also in the process of developing ISO 14068 which will outline requirements for achieving carbon neutrality. Like the SBTi Corporate Net-Zero Standard and ISO IWA 42, this standard is not solely focused on private actors nor specifically on carbon offsetting. However, private actors are included and carbon offsetting plays a role in carbon neutrality pathways, and thus, this standard is important to include. To achieve carbon neutrality, an organisation must reduce emissions within its value chain and then purchase high quality offsets to counteract any unabated emissions. The ISO defines carbon neutrality differently than net-zero. For net-zero, organisations are only allowed to offset residual emissions, which are defined as the emissions remaining once "all the technically and economically feasible GHG emission reductions" have been achieved (ISO, 2022b, p.3). For carbon neutrality, organisations are allowed to offset unabated emissions, which are any emissions remaining after reductions within the value chain have taken place. According to an interview conducted with Ian Byrne, an expert on energy and carbon management and also the convenor of the draft ISO 14068, carbon neutrality can be seen as a transition state on the path to net-zero (Ian Byrne, personal communication, 25 November, 2022). In order to continue to be carbon neutral, companies must continually reduce emissions within their value chain over time.

4.3. Summary

Our research shows that there are a number of different frameworks that attempt to provide governance to VCMs on both the supply side and the demand side. On the supply side, Offset Programmes such as VCS, Gold Standard, ACR, and CAR have developed standards and methodologies with the goal of ensuring integrity of offset projects. ISO standards such as 14064 and 14065 are used as normative documents in the Offset Programme standards and methodologies. Several of the Offset Programmes also draw

upon the GHG Protocol. Additionally, the ICVCM is in the process of developing the CCPs with the goal of providing governance over Offset Programmes and the projects they certify. However, it is important to note that there are significant concerns from several Offset Programmes that the draft version of the CCPs would do more harm than good in VCMs. On the demand side, the VCMI Claims Code, once finalised, will strive to ensure that offsets are used credibly by companies toward their net-zero targets. Another layer of governance comes from the ICROA Code of Best Practice, which is meant to ensure that ICROA Accredited Organizations and their corporate clients are utilising offsets in a way that leads to impactful climate action. In addition, the SBTi Corporate Net-Zero Standard, ISO IWA 42, and ISO 14068 (in development), while not specifically focused on offsets and VCMs, contain requirements as to how offsets can be used toward corporate net-zero and carbon neutrality goals.

Thus, our research points to the fact that a number of frameworks exist in this space and that standardisation is playing a role in the governance of VCMs. However, while there are a number of frameworks, there is no central set of rules or authority which VCMs revolve around. Additionally, standardisation within VCMs is a rapidly evolving landscape, with a number of new frameworks emerging. For example, the VCMI Provisional Claims Code, the ICVCM CCPs, ISO IWA 42, and ISO 14068 were only recently published or are still in development at the time of writing. Therefore, we can conclude that standardisation in VCMs does exist, that this landscape is a diverse set of frameworks without a central set of rules or authority, and that this landscape is in flux.

5. Challenges of Offsetting and VCMs

This chapter discusses the research and conclusions for Specific Objective 1 Research Question 2: *What are the challenges of the current carbon offset frameworks?*

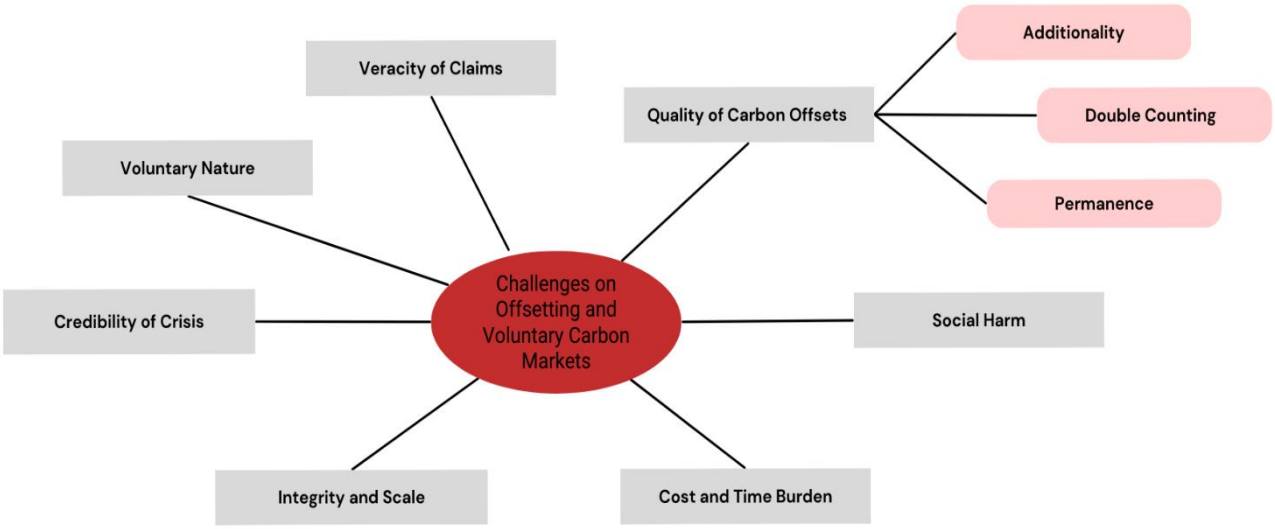

Figure 1

5.1. Credibility Crisis

Much of the public controversy surrounding the effectiveness and credibility of carbon offsets stems from the perception that there is a lack of standardisation (Newburger, 2022; Greenfield, 2021; Oliver, 2022). However, upon deeper examination, this perception is not entirely true. As described by Miguel Naranjo, an expert on mitigation and carbon market mechanisms at the UNFCCC, this perception that no standardisation exists is a major challenge because it creates a lack of trust. Naranjo noted that, in reality, good guidance already exists on the criteria for high-quality offset projects (Miguel Naranjo, personal communication, 19 May 2022). Our findings outlined in Chapter 5 corroborate that there is indeed standardisation that outlines high-quality criteria for carbon offsetting.

Thus, it is worth investigating what has given rise to this perception crisis surrounding offset quality. In our interview, Naranjo provided insights into this question. He noted that not everyone is applying best practices and that even if only a few project developers do this, it can create the wrong public perception. He also noted that there are a number of different standards and different project developers, but that there is a lack of oversight over all of these various frameworks (Miguel Naranjo, personal communication, 19 May 2022). This appears to be the essence of the conundrum. The existence of multiple standards and project developers without a common centralised mechanism, authority, or reference point creates a fragmented landscape. This can lead to confusion for stakeholders operating in VCMs. For example, with the decentralised landscape of standardisation, some companies may find it challenging to discern what the best practices are and which frameworks they should choose to follow. Additionally, this could lead to a situation where, as described by Ian Byrne, “There is a danger that we can end up with competing rules and competing standards, in the broadest sense of the word standard, and that corporations will simply choose the one they think is easiest” (Ian Byrne, personal communication, 25 November, 2022). Thus, it is important that new developments in standardisation match or enhance the quality of the existing frameworks.

5.2. Voluntary Nature

Concerns about the integrity and effectiveness of VCMs on both the supply side and the demand side can largely be attributed to the voluntary nature of these markets themselves. Unlike compliance markets, VCMs are not created and regulated by government bodies. The frameworks examined in Chapter 4 aim to provide governance to the space, however, due to the voluntary nature, actors do not necessarily have to align with the standards and principles set out by the frameworks. Offset project developers do not have to become certified by one of the major Offset Programmes, and companies purchasing offset credits do not have to follow guidance set out by organisations like the VCMI or SBTi.

5.3. Quality of Offsets

Even with comprehensive and well-intentioned standards and methodologies provided by Offset Programmes such as VCS and Gold Standard, it can still be challenging to ensure quality of offsets, specifically with respect to additionality, permanence, and double counting. Additionality can be difficult to determine, especially in cases of emission reductions projects. For example, selling credits to protect a forest from being logged needs to be based on a genuine concern that without the carbon credits, this forest would be in danger. However, this is based on a counterfactual and is not a certainty. Thus, additionality is "a matter of confidence rather than absolute truth" (Broekhoff et al., 2019, p.18). Furthermore, the issue of permanence can lead to questions of quality. The long-term security of certain offsets such as forestry projects can come under threat from wildfires, droughts, or human activities such as illegal logging which can lead to reversals (Rosales et al., 2021, pg. 20). To ensure permanence, Offset Programme registries typically contain a buffer pool of credits which can compensate for reversals. However, it is unclear as to whether the buffer pools will be enough to counter the increase in wildfires and droughts brought on by climate change, especially since these buffer pools will also be susceptible to these same threats. Finally, double counting is a major concern in VCMs (Rosales et al., 2021, pg. 20). Though the Offset Programmes operate registries and have mechanisms in place to address this challenge, due to the decentralised landscape of VCMs, concerns remain over the difficulty of ensuring that projects and credits are not counted twice.

5.4. Social Harm

Concerns over social harm are especially prevalent in nature-based projects as they can affect both the environment and the socio-economic systems of local communities (Miltenberger et al., 2019; Blum & Lovbrand, 2019). This challenge was confirmed during an interview with experts in the field of climate change and standardisation. The experts, who have expressed they would like to remain anonymous, have witnessed instances of land grabs that adversely impact the cultural and social aspects of communities

(personal communication, 16 November 2022). The major Offset Programmes have mechanisms in place to prevent this, such as conducting stakeholder consultations. However, according to the experts we spoke with, concerns remain as to whether these mechanisms are able to fully address the interests of the communities.

5.5. Integrity and Scale

An overarching challenge on both the supply side and the demand side of VCMs is the balance between integrity and scale. Organisations such as the ICVCM and the VCMI argue that integrity will lead to scalability as it will ensure trust in the process. However, there are also concerns that this effort, if not done properly, could have the opposite effect. On the supply side, as discussed in Section 4.1.3, the ICVCM draft CCPs have received criticism from Verra, Gold Standard, and ACR for being unattainable, infeasible, and adding additional cost and time burdens for project developers and Offset Programmes (Verra, 2022a; ACR, 2022a, Gold Standard, 2022a). They argue that this could cause significant harm to VCMs by greatly reducing the number of eligible projects and disincentivizing investment.

On the demand side, attempts to ensure integrity have led to the creation of frameworks that outline requirements for the use of offsets toward corporate targets. As discussed in Section 4.2, some frameworks require that offsets must only be used to neutralise residual emissions once a company has made all possible emission reductions within its value chain. While deep emissions cuts must be the priority to achieve the Paris goals, if companies are only allowed to credibly use offsets for residual emissions, then this could potentially reduce the incentive to invest in offset projects in the present, which could have a negative consequence on the development of negative emissions technologies such as Direct Air Capture and Storage (DACS). Thus, the challenge is to ensure that companies are reducing emissions internally to the greatest extent possible while also incentivizing investment in scaling up removal projects and technologies. Perhaps a model such as the VCMI Claims Code, which allows companies to make claims on their path to net-zero through a combination of emission reductions and offsets, or perhaps

ISO 14068, which once finalised, would allow companies to make carbon neutrality claims along the path to net-zero, could strike this balance.

5.6. Cost and Time Burden

The cost and time burden involved in the process of evaluating, registering, validating, monitoring, reporting, and verifying outcomes depending on different geographies and economies is significant (Knox-hayes et al., 2020). As a result, it can be a challenge for small-scale project developers to take on this burden to undergo the certification process with one of the major Offset Programmes. This could have the effect of restricting the supply of carbon offset projects in the market (Gold Standard, n.d.)

5.7. Veracity of Claims and a Licence to Pollute

The lack of trust in VCMs is further exacerbated by misleading corporate net-zero claims based on carbon offsetting. As described in an interview with a leading expert in the field of climate change and standardisation, there is a need to disconnect the offset project itself from the corporate claims being made on the basis of the project (personal communication, 19 May 2022). In other words, it is important to not only examine the quality and effectiveness of the offset project itself, but also at the veracity of the corporate claims resting on these projects.

A major concern is that companies are purchasing offsets in lieu of reducing their own emissions, effectively using carbon offsets as a 'licence to pollute'. Notably, several of the frameworks examined in chapter 4 outline that the use of carbon offsets should be reserved for unabated or residual emissions once efforts to reduce emissions within the value chain have been pursued (Pomeroy, 2022). As explained by Miguel Naranjo, "Carbon credits are only the final step of the process [...] Without a serious effort to reduce emissions, the use of carbon credits is considered inappropriate" (Miguel Naranjo, personal communication, 19 May 2022). However, the fragmented and voluntary nature of standardisation within VCMs has led to many companies using offsets as a quick fix solution, without undertaking efforts to reduce emissions in their value chains. As

described by Anne-Marie Warris, who currently serves as vice chair on the Board of Verra, “In some net-zero claims that we see, there is no conformity assessment because the organisations claiming net-zero are not using any international standard (be they ISO or others such as SBTi, VCMI etc.) to underpin their claim” (Anne-Marie Warris, personal communication, 20 June 2022). In light of this, some experts argue that these voluntary frameworks disincentivize the core investments which are required for operational efficiencies, transition to renewable energy, technological innovations and switching to low carbon inputs within the supply chain (Fattouh & Maino, 2022).

6. Oil and Gas Case Study

This chapter discusses the research and conclusion of Specific Objective 2: *Explore the demand, or lack of demand, among non-state actors for international standardisation for carbon offsets*. This objective was approached through a case study of the oil and gas sector. The ambiguity in the VCM, stemming from multiple standards being used by private developers on the supply side, and the inconsistency in the application of such carbon credits to net-zero claims on the demand side, has been explained at a principle level in the preceding chapters. The case study will contextualise these observations in a real-world scenario and provide inferences as to whether a demand exists for additional standardisation for carbon offsetting in the oil and gas sector.

6.1. Oil and gas industry: Overall ambitions for net-zero

Table 1 shows the twenty largest publicly-traded oil and gas companies in terms of revenue, based on the ranking and data provided by Hale et al., (2022). Upon scrutiny, the table shows differences in the long-term climate pledges made by these companies, for instance, several companies aim to be net-zero, others carbon neutral or zero-carbon, and others have only reduction targets. Also, not all companies include scope 3 emissions in these targets.

The integrated oil and gas companies from Table 1 that have set net-zero targets for 2050 that include scope 3 emissions are Shell, BP, TotalEnergies, Chevron and Eni. Note that Engie is left out of this because its core business is electricity, natural gas, and energy services and not oil per se. These five companies are further subject of this case study.

Name	Country	Pledge	Scope1	Scope 2	Scope 3	Status
Shell	GBR	Net-zero in 2050	Yes	Yes	Yes	In corporate strategy
Saudi Aramco	SAU	Net-zero in 2050	Yes	Yes	No	Declaration / pledge
PetroChina Co.	CHN	Zero carbon in 2050	N.S.	N.S.	N.S	Proposed / in discussion
Exxon Mobil	USA	Net-zero in 2050	Yes	Yes	No	In corporate strategy
BP	GBR	Net-zero in 2050	Yes	Yes	Yes	In corporate strategy
Sinopec	CHN	Carbon-neutral(ity) in 2050	Yes	Yes	N.S.	Proposed / in discussion
TotalEnergies	FRA	Net-zero in 2050	Yes	Yes	Yes	In corporate strategy
LukOil	RUS	Net-zero in 2050	Yes	Yes	No	In corporate strategy
ValeroEnergy	USA	Emission reduction target in 2035	Yes	Yes	No	In corporate strategy
JX Holdings	JPN	Carbon-neutral(ity) in 2040	N.S.	N.S	N.S.	In corporate strategy
Chevron	USA	Net-zero in 2050	Yes	Yes	Yes	Declaration / pledge
Gazprom	RUS	Emission reduction target 2031	Yes	Yes	No	In corporate strategy
Petrobras	BRA	No target (interim target)	Yes	Yes	No	Declaration / pledge
Marathon Petroleum	USA	Intensity emission reduction target in 2030	Yes	Yes	Yes	In corporate strategy
Eni SPA	ITA	Carbon-neutral(ity) in 2050	Yes	Yes	Yes	In corporate strategy
Indian Oil	IND	Net-zero in 2046	Yes	Yes	N.S.	Declaration/pledge
PTT exploration & production public company	THA	Other	N.S.	N.S.	N.S	In corporate strategy
Rosneft	RUS	Other	Yes	Yes	No	In corporate strategy
SK Holdings	KOR	Carbon-neutral(ity) in 2050	N.S.	N.S.	N.S.	Declaration/pledge
Engie	FRA	Net-zero in 2045	Yes	Yes	Yes	In corporate strategy

Table 1

6.2. The discrepancy in targets and metrics

Even though these five companies have set a net-zero target that includes scope 3 emissions, each company target is framed differently and consists of varying calculations, methodologies, and exclusions (see Annex E for an overview of these targets) (Coffin, 2021 p.1). In fact, according to the Transition Pathway Initiative, “no two oil and gas companies (BP, Eni, OWV, Shell, Repsol and Total) publish emissions, energy or target data using exactly the same boundaries (or scopes)” (Dietz et al., 2020a, p.8). Remarkable variation was found in how companies use different emissions boundaries, organisational boundaries, and energy boundaries. This variation causes ambiguity in understanding the extent to which offsetting contributes to the achievement of the net-zero target.

6.3. Role of offset projects in net-zero strategy

Broadly, oil and gas net-zero strategies can be grouped into four main paths of action: Reducing operational emissions; Decreasing sales of fossil fuel energy; Netting off residual gross emissions; Increasing sales of lower carbon energy. Essentially, the company will choose the most cost-effective and scalable strategy (Gardiner, 2021). Often, offsetting emissions plays a crucial role in the net-zero pathway.

In general, companies have been conservative in publishing information on their offset portfolio, which highlights a lack of transparency. However, in light of a questionnaire published by CDP, an NGO aiming to create a global disclosure system for environmental impact management by companies, there is publicly available information on offsetting strategies and projects for Shell, BP, TotalEnergies, and Eni which is illustrated in Annex F (CDP, n.d.). Based on this data, it can be concluded that the majority of the offset projects of these companies are certified by one of the major recognized voluntary Offset Programmes such as VCS, Gold Standard, and ACR, with VCS being the most popular choice. Considering that Chevron’s response to the CDP questionnaire is not publicly available, this analysis couldn't be made for Chevron. However, in a press release, Chevron stated that its carbon projects are verified by the VCS (Chevron, 2021a).

Moreover, Shell, TotalEnergies, and Eni have stated that offsetting is used for reducing residual emissions (Shell plc, 2022a; TotalEnergies, 2022b; Eni SpA, 2022). While BP is using offset projects for a voluntary carbon offsetting programme for its customers, it intends to not rely on offsets to achieve its 2030 targets, only its long-term goal (BP, 2022b). While TotalEnergies has indicated some residual emissions under scope 1 (TotalEnergies, 2022a), Chevron has not issued any statements on the matter. Overall, none of the companies have clearly disclosed how residual emissions are determined and how these emissions are relative to their total emissions These findings are in line with one of the conclusions by Dietz et al. (2020b) that “Currently, companies do not disclose enough information about their planned use of offsetting for us to assess the impact offsets will have on their targets.”

6.4. Demand and why such a demand might exist

In this background, we look to answer whether there is a demand (or lack thereof) among these oil and gas companies for international standardisation surrounding carbon offsets. At the outset, it is necessary to clarify that a conclusive answer to the question of demand can only be discerned on the basis of interviews with these companies. However, as we have had limited access in this regard, we have attempted to glean an answer by complementing these limited insights with the information surrounding net-zero targets shared by these companies in the public domain. With this approach, we have been able to make several inferences.

The twenty largest publicly-traded oil and gas companies in terms of revenue have formulated a climate target, though there are substantial differences in the type of climate target. Only five integrated oil and gas companies from this list (Shell, BP, TotalEnergies, Chevron, Eni) have set a net-zero target that includes scope 3. But among these five companies, there are differences in (sub)targets and on the metrics on which these are based. In each of these five strategies, offsetting plays a role. The offset projects deployed by these companies are verified by one of the major recognized

voluntary Offset Programmes. However, there is a lack of transparency about the contribution by offsets to the final net-zero target. Different metrics and targets add to this confusion. Therefore, on the supply side, it would appear that the use of standards is already providing some governance to the offset projects being purchased. However there appears to be a gap on the demand side, as observed from the differences in the net-zero pathways of different companies and the ambiguity in the role that offsets play in these pathways.

The existence of such a gap is further supported by the fact that various organisations are attempting to add standardisation in this space. Our research has examined two such initiatives, namely the Institutional Investors Group on Climate Change (IIGCC) Net-Zero Standard for Oil and Gas companies, which outlines what should be included in oil and gas net-zero transition plans in order to meet investor expectations, and the SBTi methodology for oil and gas science based targets, which is still under development. Guidance on the proper use of offsets forms an important part of both these standards. Notable to consider is that several oil and gas companies have participated in the development process of both of these standards.

While the above would indicate that there appears to be some demand for standardisation of oil and gas company net-zero pledges, it is not sufficient to answer whether such a demand emanates from within the industry itself. The answer to the latter is far more ambiguous. On condition of anonymity, during an interview, some experts working within the oil and gas sector clarified that while their own organisation would welcome an international standard on these lines, they could not confirm that this was a uniform demand across all other major companies in the industry.

It is pertinent here to look at why such a demand might arise from within the industry itself. In the recent past, oil and gas companies have come under immense pressure from the general public as well as their investors and shareholders, to align their operations with climate considerations. The recent instances of shareholder activism in the case of

Shell and Exxon Mobil (Bousso, 2021; Krauss & Eavis, 2021) as well as the IIGCC standard are examples of how oil and gas companies are now feeling pressure to be viewed as taking active steps to reduce their emissions and achieve net-zero. In this respect, the limited experts we interviewed from the oil and gas industry confirmed that it would be positive to have a standard that allows companies to show that they are on the path to net-zero.

7. Conclusion

The goal of this research was to examine the role of standards regarding offsets in VCMs. The increase in private actor net-zero pledges combined with the fact that not every country has implemented a compliance market creates the possibility for VCMs to be an impactful space. Our research began by examining the existing landscape of standardisation in VCMs on both the supply side, meaning the frameworks that attempt to govern the quality of offset projects and credits, and the demand side, meaning the frameworks that attempt to ensure integrity in the use of offsets toward company climate pledges and claims. From our research, we can conclude that on both the supply and demand side, there are a number of frameworks that attempt to provide governance and ensure integrity.

On the supply side, Offset Programmes, such as VCS, Gold Standard, ACR, and CAR provide standards and certification for offset project developers. Once certified, these projects can generate credits to be traded on VCMs. In addition to these Offset Programmes, the ICVCM, founded in 2021, is in the process of creating Core Carbon Principles (CCPs) which outline criteria for high quality offsets and will attempt to provide governance over the Offset Programmes. Offset Programmes and the projects they certify will be evaluated against the CCPs to determine CCP-eligibility. At the time of writing, the final version of the CCPs have yet to be published. Finally, other standards such as ISO 14064, ISO 14065, and the GHG Protocol are used as normative documents by many of the Offset Programmes in their standards and methodologies.

On the demand side, the VCMI, founded in 2021, has published a Provisional Claims Code of Practice which outlines how companies can use offsets in a credible way to make progress towards net-zero targets. If following the steps, companies are able to make claims with the VCMI. At the time of writing, the final version of the Code has yet to be published. In addition, there are standards focused on net-zero and carbon neutrality claims. While these standards are not specifically focused on VCMs, carbon offsets do

play a role. The SBTi Corporate Net-Zero Standard outlines pathways for companies to achieve net-zero in a credible way. Additionally, in November 2022, the ISO published IWA 42 on Net Zero Guidelines. This document is not a standard and will not offer certification of claims, rather, it is meant to provide guidance and align action by organisations, including private actors, toward achieving net-zero. Finally, ISO 14068, which is currently in development, will provide requirements for organisations, including private actors, for making carbon neutrality claims. Therefore, we can conclude that on both the supply and the demand side of VCMs, standardisation does exist and is attempting to provide governance in this space.

However, despite this, our research identified a number of challenges in VCMs. One challenge is the perception that there is a lack of governance and standardisation, with many believing that VCMs are a completely unregulated space. While our research has shown that there are, in fact, a number of frameworks in this space, this perception exists nonetheless, and creates a lack of trust. In reality, the number of frameworks that do exist creates a different challenge, and that is one of confusion. With the varied landscape of standards, principles, codes, guides, and programmes and without a central set of rules or authority, it can be very confusing for private actors to navigate the space and decide which frameworks to follow. Another challenge is the voluntary nature of VCMs. Despite the existence of frameworks, because they are voluntary, on the supply side, developers of offset projects do not necessarily need to comply with the standards, and on the demand side, companies do not necessarily need to ensure that they are using offsets in a credible way. There is also a challenge regarding the quality of offsets. Many argue that even with standards from well-intentioned Offset Programmes, determining additionality, ensuring permanence, and preventing double counting can be difficult to do. This can lead to questions surrounding the legitimacy of some offset projects, which can further erode trust in VCMs. There are also concerns that offset projects could cause adverse effects on the socio-economic systems of local communities. Another challenge that our research identified is trying to balance integrity and scale. The goal of the frameworks is to ensure integrity, but there are also worries that they could create a threshold that is too

high and not feasible on the ground, and that additional layers of governance will add unnecessary cost and time burdens. This could have an adverse effect on the growth of VCMs and the development of carbon removal technologies. Related to this, the process of gaining certification from one of the major Offset Programmes has a time and cost factor, which can be difficult for small-scale project developers to achieve. Finally, many argue that VCMs create more greenwashing and give companies a licence to pollute. While frameworks on the demand side are meant to ensure that companies follow a mitigation hierarchy, in which they prioritise emission reductions within their value chain before offsetting, this is often not reflected in reality.

We have attempted to contextualise the landscape and challenges surrounding VCMs through our case study by exploring whether there would be a demand for international standardisation of offsetting in the oil and gas sector. Ideally, we would have liked to answer this question based on insights from experts working in the oil and gas industry, but our access was limited to only one interview. Thus, while we are unable to conclude definitively due to these limitations, we have proceeded to draw inferences from publicly available documents, secondary sources, and the information gleaned from the interview conducted. On the supply side, the offset projects purchased by the companies we examined are certified by recognised Offset Programmes. However, on the demand side, i.e. corporate net-zero pledges using these offsets, there is an indication that companies might be interested in a clear and recognized standard. This inference is supported by an investigation into why such a demand might exist in the first place. A possible explanation is found in new third-party developments in the landscape of standardisation for the oil and gas industry. These efforts, including the IIGCC Net Zero Standard for Oil and Gas and the SBTi methodology for oil and gas science based targets (in development), have gained momentum in recent years due to increasing pressure on oil and gas companies from investors and consumers alike to reduce the impact of their operations on a changing climate. This suggests there is a potential role that standard setting organisations could play to ensure more trust and integrity in VCMs and net-zero pledges within the oil and gas sector.

References

Academic Sources

Allen, M., Axelsson, K., Caldecott, B., Hale, T., Hepburn, C., Hickey, C., Mitchell-Larson, E., Malhi, Y., Otto, F., Seddon, N., & Smith, S. (2020). *The Oxford Principles for Net Zero Aligned Carbon Offsetting*. University of Oxford.

Belletti, E., & Schelble, R. (2022, March 7). *How are oil and gas companies using carbon offsets to decarbonise?* https://www.woodmac.com/news/how-are-oil-and-gas-companies-using-carbon-offsets-to-decarbonise/

Blum, M., & Lovbrand, E. (2019). The return of carbon offsetting? The discursive legitimation of new market arrangements in the Paris climate regime. *Science Direct*, *Volume 2*, 8. https://doi.org/https://doi.org/10.1016/j.esg.2019.100028

Broekhoff, D., Gillenwater, M., Colbert-Sangree, T., & Cage, P. (2019). *Securing Climate Benefit: A Guide to Using Carbon Offsets.* Stockholm Environment Institute & Greenhouse Gas Management Institute. https://www.offsetguide.org/wp-content/uploads/2020/03/Carbon-Offset-Guide_3122020.pdf

Coffin, M. (2021). *Absolute Impact 2021*. Carbon Tracker. https://carbontracker.org/reports/absolute-impact-2022/

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology*, *11*, 100. https://doi.org/10.1186/1471-2288-11-100

Dietz, S., Jahn, V. J., Dan, G., & Jolien, N. (2020, March 6). *Emissions targets in the oil and gas sector: How do they stack up?* Grantham Research Institute on Climate Change and the Environment. https://www.lse.ac.uk/granthaminstitute/news/emissions-targets-in-the-oil-and-gas-sector-how-do-they-stack-up/

Dietz, S., Jahn, V. J., Dan, G., & Noels, J. (2020). *Carbon Performance of European Integrated Oil and Gas Companies:* Transition Pathway Initiative. https://www.transitionpathwayinitiative.org/publications/58.pdf?type=Publication

Ebneyamini, S., & Sadeghi Moghadam, M. R. (2018). Toward Developing a Framework for Conducting Case Study Research. *International Journal of Qualitative Methods*, *17*(1), 160940691881795. https://doi.org/10.1177/1609406918817954

Fattouh, B., & Maino, A. (2022, May). Article 6 and the voluntary carbon market. *The Oxford Institute of Energy Studies*. https://www.oxfordenergy.org/publications/article-6-and-voluntary-carbon-markets/

Gardiner, D. (2021). *Net Zero Standard for Oil and Gas*. IIGCC. https://www.iigcc.org/download/iigcc-net-zero-standard-for-oil-and-gas/?wpdmdl=4866&refresh=61405adc1a5c21631607516

Hale, T., Kuramochi, T., Lang, J., Yeo, Z. Y., Smith, S., Black, R., Peter, C., Hans, F., Hay, N., Höhne, N., Hsu, A., & Hyslop, C. (2022). *Net Zero Tracker*. Energy and Climate Intelligence Unit, Data-Driven EnviroLab, NewClimate Institute, Oxford Net Zero. https://zerotracker.net/

Hans, F., Kuramochi, T., Black, R., Hale, T., Lang, J., Mooldijik, S., Beuerle, J., Höhne, N., Chalkley, P., Smith, S., Hyslop, C., Hsu, A., Yeo, Z. Y., & Axelsson, K. (2022). *Net Zero Stocktake 2022: Assessing the status and trends of net zero target setting* (p. 52). NewClimate Institute, Oxford Net Zero, Energy & Climate Intelligence Unit and Data-Driven EnviroLab. https://zerotracker.net/analysis/net-zero-stocktake-2022

Kalenski, Wilkens, & Zink. (2020). Do Corporate Carbon Emissions Data Enable Investors to Mitigate Climate Change? *The Journal of Portfolio Management Novel Risks 2022*. https://doi.org/https://doi.org/10.3905/jpm.2022.1.410

Knox-hayes, Vitali, & Wilkens. (2020). Knowledge for governance. *Springer*, *Volume 15*(Kalesnik, Vitali and Wilkens, Marco and Zink, Jonas, Do Corporate Carbon Emissions Data Enable Investors to Mitigate Climate Change? (November 24, 2020). The Journal of Portfolio Management Novel Risks 2022, jpm.2022.1.410;). https://doi.org/https://doi.org/10.1007/978-3-030-47150-7

Kreibich, N., & Hermwille, L. (2021). Caught in between: Credibility & Feasibility of the Voluntary Carbon Markets post 2022. *Tandfonline*, 939–957. https://doi.org/https://doi.org/10.1080/14693062.2021.1948384

Miltenberger, Jospe, & Pittman. (2021). The Good Is Never Perfect: Why the Current Flaws of Voluntary Carbon Markets Are Services, Not Barriers to Successful Climate Change Action. *Frontier*. https://doi.org/https://doi.org/10.3389/fclim.2021.686516

Sekera, J., & Lichtenberger, A. (2020). Assessing Carbon Capture: Public Policy, Science, and Societal Need: A Review of the Literature on Industrial Carbon Removal. *Biophysical Economics and Sustainability*, *5*(3), 14. https://doi.org/10.1007/s41247-020-00080-5

Turan, G. (2022). *CCS: Applications and Opportunities for the Oil and Gas Industry*. Global CCS Institute. https://www.globalccsinstitute.com/wp-content/uploads/2020/05/Brief-_CCS-in-OAG-3.pdf

Frameworks

Carbon Offset Guide. (n.d.). *What makes a high-quality carbon offset?> Permenance*. Carbon Offset Guide. https://www.offsetguide.org/high-quality-offsets/permanence/

Climate Action Reserve (CAR). (2021). *Reserve offset program manual.* https://www.climateactionreserve.org/wp-content/uploads/2021/03/Reserve_Offset_Program_Manual_March_2021.pdf

Gold Standard. (n.d.). CARBON PRICING: Why do prices vary by project type? [Company website]. *CARBON PRICING: Why Do Prices Vary by Project Type?* https://www.goldstandard.org/blog-item/carbon-pricing-why-do-prices-vary-project-type

Gold Standard. (2019). *Gold Standard For The Global Goals*. https://globalgoals.goldstandard.org/101-par-principles-requirements/

Gold Standard. (2022). *Standard documents | The Gold Standard*. https://www.goldstandard.org/project-developers/standard-documents

Gold Standard. (2022a. *Response from the Gold Standard Foundation to the Integrity Council for the Voluntary Carbon Market's Consultation on its draft Core Carbon Principles, Assessment Framework and Assessment Procedure*. https://www.goldstandard.org/sites/default/files/documents/draft_response_-_ic-vcm_consultation_-_27_september_2022.pdf

High-Integrity Voluntary Carbon Markets (VCM): Emerging Issues in Forest Countries. (n.d.).

Integrity Council for the Voluntary Carbon Market (ICVCM). (n.d.). *High Quality Voluntary Carbon Credits Principles*. Retrieved December 1, 2022, from https://icvcm.org/the-core-carbon-principles/

Integrity Council for the Voluntary Carbon Market (ICVCM). (2022a). *Part 1: introduction.* (Core Carbon Principles (CCPs)). https://icvcm.org/wp-content/uploads/2022/07/ICVCM-Public-Consultation-FINAL-Part-1.pdf

Integrity Council for the Voluntary Carbon Market (ICVCM). (2022b). *Part 2: Core Carbon Principles* (Core Carbon Principles (CCPs)). https://icvcm.org/wp-content/uploads/2022/07/ICVCM-Public-Consultation-FINAL-Part-2.pdf

Integrity Council for the Voluntary Carbon Market (ICVCM). (2022). *Part 4: Assessment Framework* (Core Carbon Principles (CCPs)). https://icvcm.org/wp-content/uploads/2022/07/ICVCM-Public-Consultation-FINAL-Part-4.pdf

Integrity Council for the Voluntary Carbon Market (ICVCM). (2022c). *Part 6: Assessment procedure* (Core Carbon Principles (CCPs)). https://icvcm.org/wp-content/uploads/2022/07/ICVCM-Public-Consultation-FINAL-Part-6.pdf

International Carbon Reduction & Offset Alliance (ICROA). (2022a). *ICROA Code of Best Practice*. https://www.icroa.org/_files/ugd/653476_d76cf631001143069f0d64a075d90efd.pdf

International Carbon Reduction & Offset Alliance (ICROA). (2022b). *Voluntary Carbon Market Standards: Review Criteria*. https://www.icroa.org/_files/ugd/653476_2e5379c215b64a609503b063e4de2e9f.pdf

International Organization for Standardization (ISO). (2018). *ISO 14067*.

International Organization for Standardization (ISO). (2018). *ISO 14080*.

International Organization for Standardization (ISO). (2022). *Net Zero Guidelines, Accelerating the transition to net zero* (International Workshop Agreement Reference number IWA 42:2022(E)). International Organization for Standardization (ISO).

Plan Vivo. (2022a). *Plan Vivo Standard, Methodology requirements - Version 1.0*. https://www.planvivo.org/Handlers/Download.ashx?IDMF=893ddc1b-bd1f-4932-be79-9d9308ba70d0

Plan Vivo. (2022b). *Plan Vivo Standard, Project requirements - Version 5.0*. https://www.planvivo.org/Handlers/Download.ashx?IDMF=9fd4491d-6851-4819-a970-e2e94338445e

Science Based Targets initiative (SBTi). (2021). *SBTi corporate net-zero standard* (Version 1.0). https://sciencebasedtargets.org/resources/files/Net-Zero-Standard.pdf

So, I., Haya, B., & Elias, M. (2022). *Voluntary Registry Offsets Database, Berkeley Carbon Trading Project - Version 5*. University of California, Berkeley. https://gspp.berkeley.edu/faculty-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database

The American Carbon Registry (ACR). (2022b). *The American Carbon Registry Standard Requirements And Specifications For The Quantification, Monitoring, Reporting, Verification, And Registration Of Project-Based Ghg Emissions Reductions And Removals.* (Version 7.0). https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard/acr-standard-v7-0_final_dec2020.pdf

The American Carbon Registry (ACR). (2022a, September 27). *ACR Provides Comments to ICVCM — American Carbon Registry*. https://americancarbonregistry.org/news-events/program-announcements/acr-provides-comments-to-icvcm

Verra. (2022). *Program Guide* (4.1). https://verra.org/wp-content/uploads/2022/01/VCS-Program-Guide_v4.1.pdf

Verra. (2022). *VCS Standard* (V4.3). https://verra.org/wp-content/uploads/2022/01/VCS-Program-Guide_v4.1.pdf

Verra. (2022a, September 21). Course Correction Needed: ICVCM's Draft Core Carbon Principles and Assessment Framework on Wrong Track. *Verra*. https://verra.org/icvcm-course-correction-needed/

Voluntary Carbon Markets Integrity Initiative (VCMI). (2022). *Provisional claims code of practice*. https://vcmintegrity.org/wp-content/uploads/2022/06/VCMI-Provisional-Claims-Code-of-Practice.pdf

Reports

BP. (2022a). *Reimagining energy for people and our planet* [Bp sustainability report]. https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/sustainability/group-reports/bp-sustainability-report-2021.pdf

BP. (2022b). *bp CDP Climate Change Questionnaire 2021*. https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/sustainability/group-reports/bp-cdp-climate-change-questionnaire-2021.pdf

Chevron. (2021b). *Climate Change Resilience, advancing a lower carbon future*. Chevron Corporation. https://www.chevron.com/-/media/chevron/sustainability/documents/2021-climate-change-resilience-report.pdf

Eni. (2022b). *Eni for 2021, carbon neutrality by 2050*. https://www.eni.com/assets/documents/eng/just-transition/2021/eni-for-2021-carbon-neutrality-2050-eng.pdf

Eni. (2022a). *Eni SpA CDP Climate Change Questionnaire 2022*. https://www.eni.com/assets/documents/eng/just-transition/2022/cdp-climate-change-2022-submitted.pdf

Shell plc. (2022a). *CDP Climate Change 2022 Information Request – Shell plc*. cdp-2022-climate-change-submission.pdf

Shell plc. (2022b). *Our climate target*. https://www.shell.com/energy-and-innovation/the-energy-future/our-climate-target/_jcr_content/par/relatedtopics.stream/1660578577521/3e2b80bcac2d053636ad41890ac7eebd33aadf8a/shell-our-climate-target-ax.pdf

TotalEnergies. (2022b). *Sustainability & Climate 2022 Progress Report*. https://totalenergies.com/sites/g/files/nytnzq121/files/documents/2022-05/Sustainability_Climate_2022_Progress_Report_accessible_version_EN.pdf

TotalEnergies. (2022a). *TotalEnergies - Climate Change 2022*. https://totalenergies.com/sites/g/files/nytnzq121/files/documents/2022-08/CDP_Climate_Change_2022.pdf

News & Media Sources

Bousso, R. (2021, May 18). Shell shareholders increase pressure for further climate action. *Reuters*. https://www.reuters.com/business/energy/shell-shareholders-overwhelmingly-support-energy-transition-plan-2021-05-18/

Carbon Offset Guide. (n.d.). *What makes a high-quality carbon offset?> Permenance*. Carbon Offset Guide. https://www.offsetguide.org/high-quality-offsets/permanence/

CDP. (n.d.). *About CDP*. CDP, Disclosure Impact Action. Retrieved November 30, 2022, from https://www.cdp.net/en/info/about-us

Chevron. (2021a, May 31). *customers fuel up for carbon offsets*. Chevron. https://www.chevron.com/newsroom/2022/q2/customers-fuel-up-for-carbon-offsets

Chevron. (2021c, November 10). *Chevron Sets Net Zero Aspiration and New GHG Intensity Target*. Chevron.Com. https://www.chevron.com/newsroom/2021/q4/chevron-sets-net-zero-aspiration-and-new-ghg-intensity-target

Greenfield, P. (2021, May 4). Carbon offsets used by major airlines based on flawed system, warn experts. *The Guardian*. https://www.theguardian.com/environment/2021/may/04/carbon-offsets-used-by-major-airlines-based-on-flawed-system-warn-experts

Kramer, L. (2022, March 7). *Upstream vs. Downstream Oil and Gas Operations*. Investopedia. https://www.investopedia.com/ask/answers/060215/what-difference-between-upstream-and-downstream-oil-and-gas-operations.asp

Krauss, C., & Eavis, P. (2021, May 26). Climate Activists Defeat Exxon in Push for Clean Energy. *The New York Times*. https://www.nytimes.com/2021/05/26/business/exxon-mobil-climate-change.html

Nasralla, S., Bousso, R., & Isla, B. (2022, February 8). Factbox: Big Oil's climate targets. *Reuters*. https://www.reuters.com/markets/commodities/big-oils-climate-targets-2022-01-18/

Net Zero Tracker. (2022, September 28). *About & Contact*. Net Zero Beta Tracker. https://zerotracker.net/about

Newburger, E. (2022, August 31). *Stricter standards needed for carbon offsets, several House Democrats urge*. CNBC. https://www.cnbc.com/2022/08/31/stricter-standards-needed-for-carbon-offsets-congressional-reps-urge.html

Oliver, J. (2022, August 21). Carbon Offsets: Last Week Tonight with John Oliver (HBO). In *LastWeekTonight*. HBO. https://www.youtube.com/watch?v=6p8zAbFKpW0&ab_channel=LastWeekTonight

Pomeroy. (n.d.). *Carbon offsets - how do they work, and who sets the rules?* https://www.weforum.org/agenda/2022/09/carbon-offsets-radio-davos/

United Nations. (2021, January 11). *Remarks to the World Leaders Summit - COP26 | United Nations Secretary-General*. https://www.un.org/sg/en/content/sg/speeches/2021-11-01/remarks-the-world-leaders-summit-cop26

ANNEX A: Voluntary Offset Programmes

	Gold Standard	Verra (Verified Carbon Standard)	Climate Action Reserve	American Carbon Registry	Plan Vivo
Founded By	WWF, HELIO International, SouthSouthNorth	The Climate Group, International Emissions Trading Association, World Business Council for Sustainable Development, World Economic Forum	Began as the California Climate Action Registry, created by the State of California	Winrock International	Began in 1994 planting trees in Chiapas, Mexico; first VCM carbon credits created in 1997; 1998 nonprofit BioClimate Research & Development began managing the Plan Vivo System, 2009 Plan Vivo Foundation formed to take over management
Organization Type	Not for profit organization	Nonprofit organization	Nonprofit organization	Nonprofit organization	Charity
Year Created	2003	2005	2001	1996	1994
Standard Name	Gold Standard for the Global Goals	Verified Carbon Standard (VCS)	Climate Action Reserve	American Carbon Registry Standard	Plan Vivo Standard
Most Recent Standard Year	2019	2022	2021	2020	2022
Offset Credits	Verified Emission Reduction (VER)	Verified Carbon Unit (VCU)	Climate Reserve Tonne (CRT)	Emission Reduction Tonne (ERT)	Plan Vivo Certificate (PVC)
Geography	Global	Global	North America	Global	Global
Recognition	Endorsed by ICROA; CORSIA Eligible Emissions Units; ISEAL Code Compliant Status	Endorsed by ICROA; CORSIA Eligible Emissions Units; follow ISEAL's Code of Good Practice	Endorsed by ICROA; CORSIA Eligible Emissions Units	Endorsed by ICROA; CORSIA Eligible Emissions Units	Endorsed by ICROA

	Gold Standard	Verra (Verified Carbon Standard)	Climate Action Reserve	American Carbon Registry	Plan Vivo
Requirements	>>Project Eligibility Principles and Requirements: 1) Contribution to Climate Security & Sustainable Development (project is of a type pre-identified as eligible by Gold Standard or has sought and obtained approval as a new project type, additionally, project must contribute to 3 SDGs (one of which must be SDG 13); 2) Safeguarding Principles (projects must conduct an assessment to identify, prevent, and mitigate negative social, economic, and environmental/ecological consequences; 3) Stakeholder Inclusivity; 4) Demonstration of Real Outcomes; 5) Financial Additionality & Ongoing Financial Need	>>GHG emission reductions and removals must be: 1) Real; 2) Measurable; 3) Permanent; 4) Additional; 5) Independently Audited; 6) Unique (no double counting); 7) Transparent; 8) Conservative. >>Projects shall apply methodologies eligible under VCS Program Projects shall not violate any laws. >>Projects must contribute to at least 3 SDGs. >> Projects shall not negatively impact the natural environment or local communities.	>>GHG emission reductions and removals must be: 1) real (accurate emissions accounting, conservative, addressing unintended effects such as leakage); 2) additional; 3) permanent; 4) verified by third party; 5) owned unambiguously (no double counting). >>Offset Projects do not cause negative social, economic, or environmental outcomes. >>CAR strives for practicality (time and cost minimizing steps, "alleviating potential barriers to GHG project implementation without compromising credibility") (CAR, 2021, p.2).	>>GHG emission reductions and removals are "real, measurable, permanent, in excess of regulatory requirements and common practice, additional to business-as-usual, net of leakage, verified by a competent independent third party, and used only once" (ACR, 2020b, p.10). >> Projects adhere to all laws. >>Projects conduct "impact assessment to ensure compliance with environmental and community safeguards best practices" (ACR, 2020b, p.25). >>Project proponent must follow the specific methodology for a particular project type. If it does not exist, a project proponent may submit a new or amended methodology for approval	>>Projects "must protect, restore, or improve management of land or marine areas; provide long-term increases in carbon storage or reductions in greenhouse gas emissions; and have positive impacts on local livelihoods and ecosystems" (Plan Vivo, 2022, p.7). >>Projects must take place where "Project Participants have statutory or customary rights that enable them to implement land management activities and benefit from the sale of Plan Vivo Certificates" (Plan Vivo, 2022, p.7). >>Projects developed in collaboration with Project Participants. >>Projects conduct stakeholder consultation. >>Projects are additional. >>Projects have environment and social safeguards. >>Projects have risk mitigation measures for reversals and leakage. >>Projects have no double counting.

	Gold Standard	Verra (Verified Carbon Standard)	Climate Action Reserve	American Carbon Registry	Plan Vivo
Project Types	Renewable energy connected to mini-grid or off grid; End-use energy efficiency (e.g. efficient cooking, heating, lighting, etc.); Waste management + handling (composting, biogas etc.); Water, sanitation and hygiene (WASH); Renewable Energy Projects (supply energy to a national or a regional grid); Afforestation/Reforestation (planting trees, single-species plantations, all silvicultural systems, agriculture)	Sectoral Scopes: 1) Energy (renewable/non-renewable); 2) Energy distribution; 3) Energy demand; 4) Manufacturing industries; 5) Chemical industry; 6) Construction; 7) Transport; 8) Mining/Mineral production; 9) Metal production; 10) Fugitive emissions from fuels (solid, oil, and gas); 11) Fugitive emissions from Industrial gases (halocarbons and sulphur hexafluoride); 12) Solvents use; 13) Waste handling and disposal; 14) Agriculture, forestry and other land use (AFOLU); 15) Livestock and manure management; 16) Carbon capture and storage	Adipic acid production; Biochar; Grassland; Halocarbon; Soil enrichment; Coal mine methane; Forest; Boilers; Landfill; Livestock; Ozone depleting substances; Nitric acid production; Nitrogen management; Organic waste composting; Organic waste digestion; Rice cultivation (new protocols for new project types can be developed with the CAR)	Afforestation and Reforestation; Improved Forest Management; Avoided Conversion of Grasslands and Shrublands to Crop Production; Restoration of Wetlands; Destruction of Ozone Depleting Substances (ODS) and High-GWP Foam; Use of Certified Reclaimed HFC Refrigerants and Advanced Refrigeration Systems; Transition to Advanced Formulation Blowing Agents in Foam Manufacturing and Use; Capturing and Destroying Methane from Coal Mines; Landfill Gas Destruction and Beneficial Use; Replacement of SF6 with Alternate Cover Gas in the Magnesium Industry; Transport/Fleet Efficiency; Recycling of Transformer Oil; Carbon Capture and Storage	1) "Protection – Reducing deforestation and/or degradation of forests, wetlands or other natural ecosystems" 2) "Restoration – Tree planting, assisted natural regeneration, and management of wetlands or other natural ecosystems to restore ecological function" 3) "Improved Management – Improving forest, agricultural land, grassland, livestock, wetland or marine management practices to increase carbon stocks and/or reduce greenhouse gas emissions" (Plan Vivo, 2022, p.7)
Ineligible Projects	Geoengineering; energy generated from fossil fuel or nuclear, fossil fuel switch. Exceptions for certain cases such as energy efficiency involving fossil fuels (for example, LPG stoves)	No specific mention of ineligible projects	No specific mention of ineligible projects	International project-level REDD (Reducing Emissions from Deforestation and Degradation) and forestry projects from REDD+ countries	Only focus on community-based agriculture, forestry, and other land use projects

	Gold Standard	Verra (Verified Carbon Standard)	Climate Action Reserve	American Carbon Registry	Plan Vivo
Specific Project Methodologies	Specific Activity Requirements for each project type	Specific methodologies for project types that set out detailed procedures/rules for project developers	Specific standardized Protocols for each project type	ACR sector standard and/or methodology for specific project types	Approved methodologies for calculating carbon benefits for specific project types
Independent Third Party Verification	Yes (Different Validation and Verification Bodies (VVBs) for different project types)	Yes (Validation/verification bodies (VVBs) for specific sectoral scopes)	Yes (Verification bodies)	Yes (Validation/Verification Bodies (VVBs))	Yes (Macro projects (carbon benefit of 10,000 t CO2e/yr or more) are required to use Validation and Verification Body (VVB). Micro projects may use VVB or may use internal Validation and Verification process overseen by Plan Vivo Foundation and Independent Expert (IE))

	Gold Standard	Verra (Verified Carbon Standard)	Climate Action Reserve	American Carbon Registry	Plan Vivo
Project Cycle	1) Project inception; 2) Preliminary Review (conducted by GS: review project eligibility principles, methodology, stakeholder consultation report); 3) Validation (conducted by VVB: review the project documents and site visit); 4) Design Review (conducted by GS: review of project documentation and validation report); 5) Verification (conducted by VVB: must occur within two years of project Implementation Date or Design Certification, site visit and review of Monitoring Report); 6) Performance Review (conducted by GS: review of Monitoring Report and Verification Report); 7) GS certified project status achieved and credits (VERs) can be issued; 8) Projects must submit annual reports to be reviewed by GS; 9) Recertification (after 5 year project cycle, project must undergo certification renewal beginning at the Design Review phase)	1) Project Proponent (PP) selects applicable methodology (existing VCS methodology or methodology developed under approved GHG Program such as CDM, if applicable methodology does not exist PP may propose their own to be reviewed by Verra and VVB); 2) PP submits draft project description; 3) 30 day public commenting period; 4) PP submit all required documents to Verra Registry; 5) PP finalize project description; 6) Project is reviewed by VVB; 7) PP submits project for registration; 8) PP monitors and measures GHG reductions/removals and completes monitoring report; 9) Project verified by VVB; 10) Verification approval conducted by Verra; 11) Project can receive VCUs in the Verra registry	Project Proponent (PP) completes appropriate forms for the project type; 2) CAR reviews forms and conducts preliminary assessment; 3) Project is listed and made publicly available on the Reserve; 4) Project activities conducted; 5) Verification body carries out verification activities by reviewing data and site visits as needed ("Required data is described in each protocol, and can include project information, monitored GHG emissions data, estimated GHG emission reductions, and other data required by the project monitoring guidelines" (CAR, 2021 p.28); 6) CAR reviews the verification report; 7) Issuance of CRTs; 8) Periodic verification as specified in each protocol by verification body (GHG reductions/removals generally quantified and verified on annual basis)	1) Project Proponent (PP) proposes project using ACR-approved methodology and submits project plan (describes project activity, addresses ACR requirements, details GHG quantification plan, details the monitoring and verification procedures, details outcomes from stakeholder consultations and environment and community impact assessment; 2) ACR Review of Project Plan; 3) VVB validation and verification (project monitoring report to be submitted to VVB for each reporting period); 4) ACR reviews validation and verification documents; 5) ACR registers the project and ERTs are issued; 6) Credit Period Renewal (Most non-AFLOU projects have 10 year crediting period, PP can apply to renew crediting period by re-submitting GHG project plan and repeating the approval, validation, verification steps)	1) Project Proponent (PP) submits Project Idea Note (PIN) (describes main elements of projects and shows how it will contribute to sustainable livelihoods); 2) Plan Vivo Foundation reviews PIN; 3) PP submits Project Design Document (PDD) and technical specifications; 4) Plan Vivo Foundation coordinates peer reviews of technical specifications and reviews PDD; 5) Project visited and assessed by a Validator; 6) Plan Vivo Foundation reviews validation report, if satisfactory, the project can be registered under Plan Vivo Standard and are eligible to issue PVCs; 7) Projects submit annual report to Plan Vivo Foundation with monitoring data to be approved; 8) Every five years, projects undergo third party verification visits

	Gold Standard	Verra (Verified Carbon Standard)	Climate Action Reserve	American Carbon Registry	Plan Vivo
Accepted by Other Voluntary Offset Programs	No mention	No mention	Program is approved by Verra and credits may be exported to VCS and converted into VCUs (with the exception of AFOLU projects)	No mention	No mention
Accept Other Voluntary Offset Programs	No	Approved Offset Programs: Climate Action Reserve (with the exception of their AFOLU methodologies)	No approved programs, but existing projects can be transferred to the Reserve if they meet, and are verified against, the Reserve requirements	No approved programs but projects can be transferred to ACR, but they must be reviewed by ACR-approved VVB and comply with ACR standard and relevant methodology	No
Use of ISO standards	VVB must have accreditation from either ISO 14065, UNFCCC-CDM Accreditation (AIE or DOE status) or ASI-FSC Certification Body Status	>>Normative Documents for VCS Program: ISO 14064-2 (guidance at project level for quantification, monitoring and reporting of GHG reductions or removal enhancements); ISO 14064-3 (guidance for the validation and verification of GHG assertions); ISO 14065 (Requirements for greenhouse gas VVBs for use in accreditation or other forms of recognition). >>VVBs must be accredited under ISO 14065 or accredited under a VCS approved GHG program	>>Offset Protocols designed to be consistent with ISO 14064-2. >>Verification bodies must achieve ISO 14065 and 14064-3 accreditation	>>ACR Standard builds on ISO technical specifications as set forth in ISO 14064 Parts 1- 3 and ISO 14065. >>VVBs must be accredited under ISO 14065	>> Methodologies aligned with ISO 14064-2. >>VVBs must be accredited either under ISO 14064 and ISO 14065 or UNFCCC-CDM (DOE status)
Use of GHG Protocol	No mention	GHG Protocol for Project Accounting	Offset protocols designed to be consistent with GHG Protocol	No mention	>> Methodologies aligned with GHG Protocol
Number of Projects	2411 as of April 2022 (So et al., 2022)	2416 as of April 2022 (So et al., 2022)	443 as of April 2022 (So et al., 2022)	280 as of April 2022 (So et al., 2022)	No mention

	Gold Standard	Verra (Verified Carbon Standard)	Climate Action Reserve	American Carbon Registry	Plan Vivo
Tonnes of CO2	201,552,836 as of April 2022 (So et al., 2022)	954,904,370 as of April 2022 (So et al., 2022)	88,748,800 as of April 2022 (So et al., 2022)	70,891,019 as of April 2022 (So et al., 2022)	No mention
Additional Information	NA	>> Verra has created and manages other standards as well such as the Jurisdictional & Nested REDD+ standard, Climate, Community and Biodiversity Standards, etc. >>Approved Offset Project Registry under California's Compliance Offset Program.	Approved Offset Project Registry under California's Compliance Offset Program.	Approved Offset Project Registry under California's Compliance Offset Program.	NA
Link	Gold Standard Principles and Requirements: https://globalgoals.goldstandard.org/101-par-principles-requirements/ Gold Standard Activity Requirements: https://www.goldstandard.org/project-developers/standard-documents	VCS Program Guide: https://verra.org/wp-content/uploads/2022/01/VCS-Program-Guide_v4.1.pdf VCS Standard: https://verra.org/wp-content/uploads/2022/06/VCS-Standard_v4.3.pdf	CAR Offset Program Manual: https://www.climateactionreserve.org/wp-content/uploads/2021/03/Reserve_Offset_Program_Manual_March_2021.pdf	ACR Standard: https://americancarbonregistry.org/carbon-accounting/standards-methodologies/american-carbon-registry-standard	Plan Vivo Standards Documents: https://www.planvivo.org/standard-documents Methodologies: https://www.planvivo.org/methodologies

ANNEX B: Principles & Codes with Accreditation

	ICVCM Core Carbon Principles (CCPs)	VCMI Provisional Claims Code of Practice	ICROA Code of Best Practice
Date Organization Founded	2021	2021	2008
Organization Type	Independent governance body for the VCM. Formed by the Taskforce on Scaling Voluntary Markets (TSVCM) to carry on its work	Multistakeholder platform funded by the Children's Investment Fund Foundation (CIFF) and the UK Government Department for Business, Energy, and Industrial Strategy (BEIS)	Non-profit initiative housed within the International Emissions Trading Association (IETA)
Date of Latest Code/Principles	>>Draft released July 2022. >>Final Projected Q4 2022	>>Provisional released June 2022. >> Final intended to be published in late 2022 / early 2023	2022
Purpose	"Set new threshold standards for high-quality carbon credits, provide guidance on how to apply the CCPs, and define which carbon-crediting programs and methodology types are CCP-eligible" (ICVCM, n.d.).	"Provide clear guidance to companies and other nonstate actors on when they can credibly make voluntary use of carbon credits as part of their net zero commitments; and ensure the credibility of claims made by companies and other private nonstate actors regarding this use of carbon credits" (VCMI, 2022, p.13).	"The Code of Best Practice ensures that ICROA Accredited organizations, and their corporate clients, undertake carbon management strategies that lead to ambitious and impactful climate action" (ICROA, 2022a, p.1)
Audience	Core Carbon Principles will be applied to carbon crediting programs (e.g. Gold Standard, VCS)	Claims Code of Practice will be applied to companies making climate claims	>> ICROA provides accreditation to organizations that provide a carbon offsetting service such as organizations that help other companies develop climate action strategies as well as organizations that develop offset projects (e.g. Climate Partner, South Pole, Allcot). >>ICROA also provides endorsement of carbon offsetting standards (e.g. Gold Standard, VCS).
Demand Side or Supply Side	Supply	Demand	Supply and Demand

	ICVCM Core Carbon Principles	VCMI Provisional Claims Code of Practice	ICROA Code of Best Practice
Principles / Steps	10 Principles: 1) Additionality; 2) Mitigation Activity Information (Offset program makes information transparent and public); 3) No double counting; 4) Permanence (compensate reversals); 5) Program Governance (Offset program has effective governance "to ensure transparency, accountability and the overall quality of carbon credits" (ICVCM, 2022b, p.3)); 6) Registry (Offset program operates or uses registry to make sure credits are unique and tracked); 7) Robust independent third-party validation and verification; 8) Robust quantification of emission reductions and removals ("based on conservative approaches, completeness and sound scientific methods" (ICVCM, 2022b, p.4)); 9) Sustainable development impacts and safeguards ("conform with or go beyond [...] best practices on social and environmental safeguards while delivering on net positive sustainable development impacts" (ICVCM, 2022b, p.4)) 10) Transition towards net- zero emissions ("avoid locking in levels of emissions, technologies or carbon-intensive practices that are incompatible with achieving net zero emissions by mid-century") (ICVCM, 2022b, p.4))	Step 1: Meet the Prerequisites (Commit to achieve science- aligned long-term net zero emissions for Scope 1, 2, and 3 by no later than 2050; Make interim emission reduction targets that "follow SBTi guidance for setting the target boundary and emissions coverage" (VCMI, 2022, p.20); Provide detailed plans and strategies to achieve the targets; Maintain a publicly available GHG emissions inventory that "follows the GHG Protocol (or equivalent)" (VCMI, 2022, p.20); "Make a public statement declaring that the company's advocacy activities […] are consistent with the goals of the Paris Agreement" (VCMI, 2022, p.20)). Step 2: Identify Claims to make (Enterprise wide claims (Gold, Silver, Bronze (see additional information) or Brand/Product/Service Level Claims). Step 3: Purchase High Quality Carbon Credits (See High Quality Offsets Criteria). Step 4: Report Transparently on the Use of Carbon Credits	ICROA Accredited organization commit to advance ICROA Principles: 1) Corporates measure and publicly report Scope 1, 2, and 3 emissions "following recognised standards (such as ISO/GHG Protocol)" (ICROA, 2022a, p.2); 2) "Corporates strive to abate their GHG emissions in line with climate science to deliver a net-zero carbon reduction pathway by 2050 or sooner" including short and medium-term targets to ensure action along the way (ICROA, 2022a, p.2); 3) Progress toward these targets is monitored yearly; 4) Along with the above steps, "corporates are encouraged to increase ambition and to use carbon credits from ICROA-endorsed standards to offset their GHG emissions beyond a science-aligned abatement pathway" (ICROA, 2022a, p.2).
Requirements for Using Offsets	>>NA (CCPs are on supply side, aimed at the carbon crediting programs not organizations purchasing offsets). >> Acknowledge work of VCMI on this point	"VCMI requires that companies only use carbon credits in addition to—not as a substitute for—science-aligned decarbonization across their value chains. The VCMI Prerequisites are designed to ensure that this is the case and to offer guidance to all companies on the steps they should take to align with the goals of the Paris Agreement" (VCMI, 2022, p.20). (See Step 1 of Principles/Steps)	Corporates should strive to abate their emissions in line with science by 2050 or sooner that includes setting interim short and medium term targets. Progress toward these targets is monitored and reported on an annual basis. Following the above steps, corporates are encouraged to use carbon credits to offset emissions beyond a science-aligned abatement strategy. >>"Accredited organisations shall only use/sell carbon credits that are approved by ICROA in relation to their offsetting services" (ICROA, 2022a, p.4)

	ICVCM Core Carbon Principles	VCMI Provisional Claims Code of Practice	ICROA Code of Best Practice
High Quality Offsets Criteria	See Principles/Steps	"VCMI does not provide detailed guidance for what constitutes a high-quality carbon credit; instead, VCMI acknowledges the work of CORSIA and the IC-VCM to identify cross-cutting quality criteria for carbon credits" (VCMI, 2022, p.30).	Real, Measurable, Permanent, Independently Verified, Additional and Unique (ICROA, 2022b, p.2)
Offering Accreditation / Certification	Offset Program standards and methodologies that meet the requirements will be CCP-eligible	Will offer validation of company claims with three levels: gold, silver, bronze	Provide accreditation to organizations that provide a carbon offsetting service
Detailed Information Accreditation / Certification	"Integrity Council assesses carbon-crediting programs (such as Gold Standard) and their methodologies (such as for efficient cookstoves) against the CCPs. If Gold Standard is assessed as meeting the program-level elements of the CCPs and a specific version of its cookstove methodology is assessed as meeting the relevant elements of the CCPs, credits of that "credit type" (i.e., credits issued by Gold Standard under that methodology version) are CCP-eligible, and will be tagged as such in Gold Standard's registry" (ICVCM, 2022c, p.2)	**VCMI Gold Net Zero:** "a company must be on track to achieve its next interim target for Scopes 1, 2, and 3 through emissions reductions within its value chain and have covered all (100 percent) remaining unabated emissions through the purchase and retirement of high-quality carbon credits"; **VCMI Silver:** "a company must be on track to achieve its next interim target for Scopes 1, 2, and 3 through emissions reductions within its value chain and have covered at least 20 percent of all remaining unabated emissions through the purchase and retirement of high-quality carbon credits. The proportion of remaining unabated emissions covered through the purchase and retirement of carbon credits must increase over time" ; **VCMI Bronze:** only available until 2030, "a company must: — Be on track to achieve its next interim target for Scopes 1 and 2 through emissions reductions within its value chain; — Reduce its Scope 3 emissions through a combination of emissions reductions within its value chain and purchase and retirement of carbon credits (up to a maximum of 50 percent of its Scope 3 footprint) to the level required for its interim target; and — Have covered at least 20 percent of all remaining unabated emissions through the purchase and retirement of high- quality carbon credits" (VCMI, 2022, pp.24-26)	Eligibility criteria to become ICROA Accredited Organizations: member of IETA; committed to reducing its own GHG emissions and strive for science-aligned pathway in line with Paris goals; has been in business of carbon management / offset services for one year or more; "offers services to estimate carbon footprints, identify and implement internal emission reduction opportunities and offset emissions" and/or sells a service to retire ICROA compliant carbon credits for voluntary offsetting purposes; "organisation is committed to achieving large absolute reductions across its client base and promoting alignment to the UNFCCC and Paris Agreement goals"; organization must sell or retire at least 10,000 tonnes of CO2e annually; minimum financial turnover of $100,000; disclose any pending / ongoing litigation with IETA member or other market actor; must file annual report demonstrating compliance with Code of Best Practice to be verified by third party audit (ICROA, 2022b, p.7)

	ICVCM Core Carbon Principles	VCMI Provisional Claims Code of Practice	ICROA Code of Best Practice
Additional Information	Verra, ACR, and Gold Standard who are involved in the public consultation process have expressed concerns with the CCPs	This is a provisional code of practice. Plan to release a Final Claims Code in late 2022/ early 2023 after a road test with corporate participants, deep dives with non-state actors, and a public consultation process	Endorsed Independent Offset Standards: Verified Carbon Standard, Gold Standard, American Carbon Registry, Climate Action Reserve, Plan Vivo.
Link	ICVCM Core Carbon Principles Documents: https://icvcm.org/public-consultation/#key-resources	VCMI Provisional Claims Code of Practice: https://vcmintegrity.org/wp-content/uploads/2022/06/VCMI-Provisional-Claims-Code-of-Practice.pdf	ICROA Code of Best Practice: https://www.icroa.org/_files/ugd/653476_d76cf631001143069f0d64a075d90efd.pdf ICROA VCM Standards Review Criteria: https://www.icroa.org/_files/ugd/653476_2e5379c215b64a609503b063e4de2e9f.pdf

ANNEX C: General Offsetting Principles & Guides

	Oxford Principles for Net Zero Aligned Carbon Offsetting	SEI and GHGMI Guide for Using Carbon Offsets
Purpose	"outline how offsetting needs to be approached to ensure it helps achieve a net zero society" (Allen et al., 2020, p.1).	"This guide is for companies and organizations seeking to understand carbon offsets and how to use them in voluntary GHG reduction Strategies" (Broekhoff et al., 2019, p.5)
Organization Type	Academic	Research Institute / Non profit
Date	Sep-20	Nov-19
Audience	Offset buyers (corporations, organizations, financial institutions), regulators and standard setters, civil society (to monitor private climate action/inaction), Initiatives and networks that promote net zero target setting and disclosure, researchers and academic institutions	Companies, organizations, individuals (interested in offsetting personal carbon footprint)
Demand Side or Supply Side	Demand	Demand
Principles	4 Principles: 1) Cut emissions, use high quality offsets, and regularly revise offsetting strategy as best practice evolves; 2) Shift to carbon removal offsetting 3) Shift to long-lived storage 4) Support the development of net zero aligned offsetting	NA
Requirements for Using Offsets	First part of principle 1: Prioritize reducing your own emissions first, thus minimizing the need for offsetting	Encourages organizations to focus on reducing their own emissions directly, and not to use carbon offsets as a replacement for direct emission reductions: "the focus should be on reducing GHG emissions directly (and dramatically) in line with global mitigation goals. Arguably, organizations should only use carbon offsets on top of efforts to reduce their own emissions to near-zero by 2050" (Broekhoff et al., 2019, p.13)
High Quality Offsets Criteria	1) Verifiable (real); 2) correctly accounted for (no double counting); 3) additional; 4) low risk of reversal (permanence); 5) low risk of negative social/environmental consequences	1) Additional; 2) Not overestimated; 3) Permanent; 4) Not claimed by another entity; 5) Not associated with significant social or environmental harms
Offering Accreditation / Certification	No	No
Link	Oxford Principles: https://www.smithschool.ox.ac.uk/sites/default/files/2022-01/Oxford-Offsetting-Principles-2020.pdf	SEI and GHGMI Guide for Using Carbon Offsets: https://www.offsetguide.org/wp-content/uploads/2020/03/Carbon-Offset-Guide_3122020.pdf

ANNEX D: Net Zero Standards & Guidelines

	SBTi Net Zero Standard	ISO International Workshop Agreement (IWA) Net Zero Guidelines
Organization Founded by	Partnership between CDP, UN Global Compact, World Resources Institute, and WWF	Founded by delegates from 25 countries. Today has membership of 167 national standards bodies
Year founded	2015	1947
Standard/ Guide Date	2021	2022
Purpose	"provide a standardized and robust approach for corporates to set net-zero targets that are aligned with climate science" (SBTi, 2021, p.5)	"This document provides guiding principles and recommendations to enable a common approach with a high level of ambition, to drive organizations to reach net zero GHGs as soon as possible and by 2050 at the latest. It is intended to be a common reference for governance organizations (including voluntary initiatives, adoption of standards, policy and national and international regulation), and can help organizations taking action to contribute to achieving global net zero" (ISO, 2022a, p.vi)
Audience	>>"corporates with more than 500 employees" (SBTi, 2021, p.5). >>"Although not directly intended for SMEs, SMEs should use this document to understand the key elements of a science-based net-zero target and the SBTi's recommended target-setting process. The SBTi offers a simplified route for SMEs to set net-zero targets" (SBTi, 2021, p.5). >>SBTi has separate Net Zero Framework for financial institutions	>>Governance organizations (national and sub-national (e.g. regional, local, municipal,) governments, as appropriate; regulators; voluntary initiatives; intergovernmental bodies; international and national non-governmental organizations). >>Other organizations ("includes, but is not limited to, sole-trader, company, corporation, firm, enterprise, authority, partnership, association, charity, or institution, or part or combination thereof, whether incorporated or not, public or private" (ISO, 2022a, p.7))
Definition of Corporate Net Zero	"Reducing scope 1, 2, and 3 emissions to zero or to a residual level that is consistent with reaching net-zero emissions at the global or sector level in eligible 1.5°C-aligned pathways [and] Neutralizing any residual emissions at the net-zero target year and any GHG emissions released into the atmosphere thereafter" (SBTi, 2021 p.8)	Not specified to just corporate net zero, as the IWA applies to a wider audience (governance organizations and other organizations), general net zero definition: "condition in which human-caused residual GHG emissions are balanced by human-led removals over a specified period and within specified boundaries" (ISO IWA, 2022, p.2)

	SBTi Net Zero Standard	ISO International Workshop Agreement (IWA) Net Zero Guidelines
Key Elements	1) Set near-term SBTs (5-10 year emission reduction targets in line with 1.5 Celsius; 2) Set long-term SBTs (reduce emissions by no later than 2050 to a residual level in line with 1.5 Celsius; 3) Beyond value chain mitigation (during transition to net zero - companies should purchase high quality jurisdictional REDD+ credits or invest in DACS (note that 'should' is a recommendation, not a requirement)); 4) Neutralization of residual emissions (when company has achieved long-term SBT, their residual emissions must be counterbalanced with permanent removal and storage of carbon from atmosphere (SBTi, 2021, p.9)	>> "Organizations set long term targets to meet net zero by or before 2050, and interim targets to achieve substantial emissions reductions of Scope 1, Scope 2 and Scope 3 emissions by 2030 or earlier" (ISO, 2022a, p.9). >> "The organization should set targets consistent with 50% global GHG emissions reductions by 2030 (from a 2018 global baseline)" (ISO, 2022a p . 1 5). >> "The organization should prioritize emissions reductions and mitigation actions that are within its direct control […] or within the value chain" (ISO, 2022a p.22). >> "The organization should [...] [limit] residual emissions to the minimum, in line with science-based pathways that are aligned with a high likelihood of limiting global warming to 1,5°C above pre-industrial levels" (ISO, 2022a, p.23). >>"To achieve and maintain net zero the organization should counterbalance residual emissions only through investment in high-quality removals" (ISO, 2022a, p.24). >>"The organization should determine indicators and tools to measure, monitor and calculate baselines and the impact of its mitigation actions" (ISO, 2022a, p.26). >>"The organization should consider how its net zero strategy aligns with the United Nation's Sustainable Development Goals (SDGs) and impacts" (ISO, 2022a, p.27). >>"The organization should take into account the principle of equity and justice [...] when determining fair share and how it should contribute to a just transition to global net zero" (ISO, 2022a, p.28). >>"The organization should implement processes to ensure transparent communication and reporting of progress to net zero to relevant interested parties" (ISO, 2022a, p.29). >>"The organization should use iterative and adaptive approaches on a regular basis with an increasing level of ambition to achieve interim targets, long-term targets and wider impacts, where feasible" (ISO, 2022a, p.33)
Emission Scopes	Near-term SBTs: Scope 1&2 95% minimum coverage, if Scope 3 emissions are at least 40% of total emissions, then 67% minimum coverage; Long-term SBTs: Scope 1&2 95% minimum coverage, Scope 3 90% minimum coverage for all companies	Targets should include Scope 1, 2, and 3 emissions

	SBTi Net Zero Standard	ISO International Workshop Agreement (IWA) Net Zero Guidelines
How to determine Residuals	"Residual emissions levels are grounded in what's needed to achieve net-zero CO2 emissions at the global level by 2050, limit warming to 1.5°C, and contribute to achieving the SDGs. In pathways used by the SBTi, residual emissions at the cross-sector level reflect the 2020-2050 emissions reduction needed" (SBTi, 2021, p.15). There are also sector specific pathways "available or in development for the energy supply sector, transport sector, industry sectors including cement and steel, buildings sector, and sectors with significant FLAG emissions" (SBTi, 2021, p.16)	>>"The organization should set interim and long-term targets and determine residual emissions using sector-specific science-based pathways which: — stay within the remaining carbon budget for a high likelihood of limiting global warming to 1,5°C above pre-industrial levels; — reduce energy and industrial process emissions, and the use of coal, oil and gas, by an amount consistent with an internationally recognized net zero emissions scenario; — reach net-zero CO2 at the global level by 2050 with low reliance on removals" (ISO, 2022a, p.16). >>IWA provides examples of sector specific pathways that are consistent with SBTi Net Zero Standard
Amount of Residuals Allowed	10% or less for the cross-sectoral approach, also 10% or less for most sectoral approaches	In a note from the section on reporting net zero claims: "residual emissions at net zero cannot generally exceed the range of 5-10% compared to baseline emissions" (ISO, 2022a, p.32)
Sectoral Targets	Yes (specific pathways for certain sectors)	Yes (aligned with SBTi Net Zero Standard, "which provides a methodology and breakdown of sectoral decarbonization pathways to help determine appropriate residual emissions for organizations" (ISO, 2022a, p.17))
Use of Offsets	>>Offsets cannot be used to count towards near-term or long-term SBTs. Offsets can only be used to neutralize residual emissions, and must be removal offsets with permanent storage. >>It is also recommended (but not required) that companies purchase high quality credits (could be emission avoidance/reductions or removals) during transition to net zero (Key Element 3: beyond value chain mitigation).	"If the organization offsets emissions, only those counterbalancing residual emissions should count towards its net zero target. The organization should not use offsets towards achievement of interim targets" (ISO, 2022a, p.24); "Only offsets that are removals can be used to counterbalance residual emissions to achieve net zero " (ISO, 2022a, p.6)

	SBTi Net Zero Standard	ISO International Workshop Agreement (IWA) Net Zero Guidelines
High Quality Offsets Criteria	No mention	>>a) based on credible accounting standards; b) additional c) monitored, reported, verified by competent third party; d) permanent or provide "sufficiently long-term storage," have plans to manage potential reversals (ISO, 2022a, p.24); e) not double counted; f) avoid leakage; g) do no social or environmental harm; h) "provide social safeguards, promote equity and benefit both ecosystems and local communities (ISO, 2022a p.24); i) "are sourced from activities that address urgent and transformational climate priorities that are beyond the reasonable reach of unilateral action by a single country or territory" (ISO, 2022a, p.24). >>In a note to section 10.2 (Credits), IWA references ICVCM: "The Integrity Council Voluntary Carbon Market Core Carbon Principles set out the basis for identifying high-quality carbon credits. The Core Carbon Principles form the basis of the ICVCM's Assessment Framework, which provides criteria for evaluating whether carbon credits and carbon-crediting programmed reach a high-quality threshold" (ISO, 2022a, p.25)
Claims	>>Company cannot claim net zero until they have reached their long-term SBT and neutralized any remaining emissions ("While companies may reach a balance between emissions and removals before they reach the depth of decarbonization required to limit warming to 1.5ºC, this is a transient state on the journey to net-zero emissions" ((SBTi, 2021, p.37). >>Guidance for expressing net zero target: "Company X commits to reach net-zero greenhouse gas emissions across the value chain by 2035" ((SBTi, 2021, p.29))	"To claim net zero only residual emissions should remain and these should be counterbalanced by removals. The organization should not make a net zero claim if it is on the path to net zero and still has GHG emissions that are not residual emissions, even if the emissions are counterbalanced" (ISO, 2022a, p.31)
Provide Validation	Yes (SBTi validates net zero targets)	No
Use of ISO standards	No mention of ISO standards, utilize the GHG Protocol for calculating company's carbon footprint	Draws upon existing ISO standards such as ISO 14000 series (environmental management) and references ISO 14068 (carbon neutrality for organizations) which is currently under development. Also makes reference to GHG Protocol

	SBTi Net Zero Standard	ISO International Workshop Agreement (IWA) Net Zero Guidelines
Additional Information	"The principle at the heart of the SBTi Net-Zero Standard is the "mitigation hierarchy". Under the mitigation hierarchy, companies should set science-based targets, both near- and long-term, to address value chain emissions and implement strategies to achieve these targets as a first order priority ahead of actions or investments to mitigate emissions outside their value chains" (SBTi, 2021, p.10). "Although setting and achieving science-based targets must be the priority, companies should go further and invest in mitigation outside their value chains to contribute towards reaching societal net-zero. The SBTi recommends that companies prioritize near-term science-based targets, followed by securing and enhancing carbon sinks (terrestrial, coastal and marine, etc.) to avoid the emissions that arise from their degradation. Examples include purchasing high quality, jurisdictional REDD+ carbon credits that support countries in raising the ambition on, and in the long-term, achieving their nationally determined contributions There is also a critical need for companies to invest in nascent GHG removal technologies (e.g. direct air capture (DAC) and storage) so that the technology is available to neutralize residual emissions at the long-term science-based target date" (SBTi, 2021, p.10)	The IWA is not a standard. It is indented to provide overarching guiding principles and recommendations. It is not directly targeted at the private sector, though it includes guiding principles and recommendations for private sector actors
Link	SBTi Corporate Net-Zero Standard: https://sciencebasedtargets.org/resources/files/Net-Zero-Standard.pdf	NA

ANNEX E: Overview of Oil and Gas Company Targets

Shell	**Metric:** Emissions intensity of all products (Gardiner, 2021) **Intensity long term targets**: It aims to reach a 100% reduction (net zero) in 2050 (scope 1, 2, and partly scope 3; categories 1, 3, 9, 11) (Shell plc, 2022a) **Intensity interim targets**: (Shell plc, 2022a) • 20% reduction by 2030; • 45% reduction by 2035 **Absolute targets**: • 100% reduction by 2050 manufacture of all products (scope 1 and scope 2) (Shell plc., 2022a) • 100% reduction by 2050 from the energy products sold (partly scope 3; categories 1,3,9,11) (Shell plc., 2022a) **Absolute interim targets**: 50% reduction by 2030 (scope 1 and scope 2) (Shell plc., 2022a) **Baseline**: 2016 Shell's approach to net-zero is in step with society, and that the achievements in 2035 and 2050 must take account of any action by customers. (Gardiner, 2021; Shell plc., 2022a)
BP	**Metric:** Emissions from oil and as production (Gardiner, 2021) **Intensity long term targets:** Net-zero in 2050 (BP, 2022b) **Intensity interim targets:** 5% reduction target in 2025%; 15-20% reduction in 2030; (BP, 2022a) **Absolute long term targets**: • Net-zero operations (scope 1 and 2): Net-zero by 2050 (BP, 2022a) • Net zero production (oil and gas) (Scope 1, 2, 3) : Net-zero by 2050 (BP, 2022a) **Absolute interim targets:** • Net-zero operations (scope 1 and 2) : 25% reduction in 2025; 50% reduction in 2030 (BP, 2022b) • Net zero production (oil and gas) (Scope 1, 2, 3) use of sold products (category 11): 20% reduction in 2025. 2030 aim of 50% reduction. (BP, 2022b) **Baseline**: 2019
TotalEnergies	**Metric:** Emissions of product sold in Europe (Gardiner, 2021)

	Intensity long term targets: Carbon intensity targets of energy products (scope 1, 2, 3, category 11) : 100% reduction in 2050 (TotalEnergies, 2022a) **Intensity interim targets**: Carbon intensity targets of energy products (scope 1, 2, 3): 10% in 2025; 20% in 2030. (TotalEnergies, 2022b) **Absolute targets** Production (scope 1 + 2) reduction target of 100% in 2050 (TotalEnergies, 2022b) Scope 3 emissions: reduction target of 100% in 2050 (Scope 3 Category 11; TotalEnergies, 2022a) **Absolute interm targets** Production (scope 1 + 2) reduction target of 40% in 2030 To cover the total carbon footprint, Total has set targets for carbon intensity, but also targets for different scopes that cover scope 3 emissions • Petrolonium products sold worldwide (scope 3); reduction target of 30% in 2030 (TotalEnergies, 2022b) • Energy products sold in Europe (scope 3); reduction target of 30% in 2030 (TotalEnergies, 2022b) • Global scope 3 emissions: reduction of target 3% in 2030 (TotalEnergies, 2022b) **Baseline** 2015
Chevron	**Metric**: Oil and gas operational emissions intensity (Gardiner, 2021) Net zero 2050 aspiration for equity upstream scope 1 and scope 2 emissions. (Chevron, 2021c) Chevron used an upstream carbon intensity (UCI) metrics that includes emission-intensity metrics for oil production, gas production, flaring, and methane. For oil and gas, it aims to reduce -40% (oil) and -26% (gas) in 2028 (Chevron, 2021b). The majority of Chevron's downstream emissions are from our refining business, therefore they also set an target for refining emissions, using the refining carbon intensity (RCI) metric. Chevron RCI (scope 1 and 2) reduction target for 2028 is 2% to 3% (Chevron, 2021b). Besides it used the metric of Portfolio Carbon Intensity (PCI) target inclusive of Scope 1 and 2 as well as Scope 3 emissions from the use of its products. It aims a 5% reduction in 2028 (Chevron, 2021b). **Baseline** 2016 (Gardiner, 2021)
Eni SPA	**Metric:** Emissions of all products (Gardiner, 2021) **Net carbon footprint (scope 1 + 2)** • Reduction of -65% for the upstream business in 2025, and a reduction of -40% for Eni's group in 2025

	• net zero emissions (Scope 1+2) for the upstream business by 2030 and for Eni's group by 2035 **Net GHG lifecycle emissions scope 1, scope 2, scope 3** • Long term: Net zero in 2050 • Interm targets: -35% in 2030, -55% in 2035 and -80% in 2040 **Net carbon intensity scope 1, scope 2, scope 3** • Long term: Net zero in 2050 • Intrem targets: >15% in 2030, -50% in 2040 (Eni, 2022b) **Absolute interim targets:** 40% reduction in 2025 (scope 1 and scope 2) (Eni, 2022a) 35% reduction in 2030 (scope 1, scope 2 and scope 3) (Eni, 2022a) 80% reduction in 2040 (scope 1, scope 2 and scope 3) (Eni, 2022a) **Baseline**: 2018

ANNEX F: Offset Portfolio for Shell, BP, TotalEnergies, and Eni

Offset Portfolio Shell 2021

The details of the project-based carbon credits originated or purchased by your organization in the reporting period. (year 2021)	Purchase or Origination	Type	Credits (metric tonnes CO2)	Verified to Standard	Status
The Quest CCS project	Origination	CCS	784241	Alberta Carbon offset system standard	[not cancelled]
Cordillera Azul National Park REDD Project	Purchase	Forest	2205699	VCS	cancelled
Katingan Peatland Restoration and Conservation Project	Purchase	Forest	2393040	VCS	cancelled
The Kasigau Corridor REDD Project - Phase II The Community Ranches	Purchase	Forest	791297	VCS	cancelled
Xiguan Afforestation Project in Guizhou Province	Purchase	Forest	243193	VCS	cancelled
Hechu Afforestation Project in Anhui Province	Purchase	Forest	171574	VCS	cancelled
Qianxinan Afforestation Project in Guizhou Province	Purchase	Forest	160087	VCS	cancelled
XinJiang Makit County Afforestation Carbon Sequestration Project	Purchase	Forest	84400	VCS	cancelled
CLEAN Cooking Solutions for the disadvantaged households, Nepal	Purchase	Energy Efficiency	43573	VER+	cancelled
Reforestation of degraded forest reserves in Ghana	Purchase	Forest	24632	VCS	cancelled
Darkwoods Forest Carbon Project	Purchase	Forest	16962	VCS	cancelled
GreenTrees ACRE (Advanced Carbon Restored Ecosystem)	Purchase	Forest	16464	ACR	cancelled
Haidong Afforestation Project	Purchase	Forest	9097	VCS	cancelled
Guinan Afforestation Project	Purchase	Forest	277	VCS	cancelled
Jilin Linjiang Afforestation Project	Purchase	Forest	101	VCS	cancelled
Jiangxi Afforestation Project	Purchase	Forest	216461	VCS	cancelled

Source: (Shell plc., 2022a)

Offset Portfolio BP (2021)

The list provided sets out the purchases of voluntary carbon credits for BP Target Neutral customers during 2020; it does not include other credit origination or compliance credit activity undertaken by BP's Low Carbon Trading team.	Purchase or Origination	Type	Credits (metric tonnes CO2e)	Verified to Standard	Status
Orb Energy Solar Program in India - VPA02	Purchase	Solar	90,000	Gold Standard	Cancelled
WIND power CGN Zhaoyuan	Purchase	Wind	66,037	CDM	Cancelled
Reducing Gas Leakages within the Titas Gas Distribution Network in Bangladesh	Purchase	Methane avoidance	132,967	CDM	Cancelled
Peru REDD+	Purchase	Forest	60,000	VCS	Cancelled
Peru REDD+	Purchase	Forest	380,000	VCS	Cancelled
Korat Waste To Energy	Purchase	Biomass energy	100,189	CDM	Cancelled
Mexico Nitrous Oxide Abatement	Purchase	N2O	50,000	CDM	Cancelled
Costa Rica Coal to Biomass Fuel Switch	Purchase	Biomass energy	3,995	CDM	Cancelled
ONIL Stoves Guatemala Uspantan	purchase	Energy efficiency: households	197,625	VCS	Cancelled
El Arrayan Wind Farm Chile	Purchase	Wind	573,552	CDM	Cancelled
San Pedro Wind Farm Chile	Purchase	Wind	389,716	CDM	Cancelled
CTL Landfill Gas Project Brazil	Purchase	Landfill gas	141,633	CDM	Cancelled
Solar Energy Project(s) by SB Energy Private Limited	Purchase	Solar	2,316	VCS	Cancelled

Source: (BP, 2022a)

Offset Portfolio TotalEnergies 2021

Description	"In addition to taking action to prevent and reduce GHG emissions, it will be necessary to offset residual carbon emissions for TotalEnergies to achieve net zero emissions together with society. For that reason, the Company is investing in natural carbon sinks, such as forests, regenerative agriculture and wetlands. The model for land management areas must be integrated and shared with the local population. Within this framework, operations may comprise a variety of techniques (conservation, afforestation-reforestation, agroforestry, agricultural transition, blue carbon, etc.) and appropriate types of contracts (purchase contract, sustainable financing mechanism, impact funds, financed project, etc.). The goal is to combine and balance the value of agricultural and forestry revenues with the value of co-benefits for the population, soil, biodiversity, and the water cycle and that of carbon credits. When this is done, the local standard of living improves and the causes of land degradation and deforestation, which are major sources of GHG emissions, recede. The Company works with experienced partners to manage the long-term approach required and the risks involved in these complex projects. Backed by an average annual budget of 100 M$ between 2020 and 2030, TotalEnergies aims to build up a stock of 100 million credits and develop the annual capacity to produce at least 5 million credits a year as from 2030. Case study: Republic of the Congo In March 2021, TotalEnergies and Forêt Ressources Management signed a partnership agreement with the Republic of the Congo for a large-scale, inclusive agroforestry management project that will sequester more than 10 Mt of CO2. It calls for integrated management with the project partners of more than 50,000 hectares over a 35-year period, and includes the planting of a 38,000 hectare forest, 2,000 hectares of agroforestry projects and preservation of gallery forests. The project aims to develop agricultural production and sustainable wood energy in cooperation with the local population."
Purchase or Origination	Origination
Type	Agriculture
Credits (metric tonnes CO2e)	7.000.000
Verified to standard	VCS
Status	Not cancelled

Source: (TotalEnergies, 2022a)

Offset Portfolio Eni 2021

Name	Purchase or Origination	Type	Credits (metric tonnes CO2e)	Verified to Standard	Status
N.S.	Origination	Wind	107,033	VCS	Cancelled
N.S.	Purchase	Forest	1,418,513	VCS	Cancelled
N.S.	Purchase	Forest	198,563	VCS	Not cancelled
N.S.	Purchase	Forest	700,000	VCS	Not cancelled

Source: (Eni SpA, 2022)