SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

EVIDENCE SYNTHESIS REPORT PART 2: ENERGY CARRIERS AND COMMODITIES CERTIFICATES

A synthesis of the relevant evidence on environmental attribute certificates for energy carriers (including for electricity and fuels) and commodities submitted to the Science Based Targets initiative during the 2023 call for evidence on the effectiveness of environmental attribute certificates in corporate climate targets.

March 2025

sciencebasedtargets.org /science-based-targets @sciencetargets info@sciencebasedtargets.org

ABOUT SBTi

The Science Based Targets initiative (SBTi) is a corporate climate action organization that enables companies and financial institutions worldwide to play their part in combating the climate crisis.

We develop standards, tools and guidance which allow companies to set greenhouse gas (GHG) emissions reductions targets in line with what is needed to keep global heating below catastrophic levels and reach net-zero by 2050 at latest.

The SBTi is incorporated as a UK charity, with a subsidiary SBTi Services Limited, which hosts our target validation services. Partner organizations who facilitated SBTi's growth and development are CDP, the United Nations Global Compact, the We Mean Business Coalition, the World Resources Institute (WRI), and the World Wide Fund for Nature (WWF).

ACKNOWLEDGEMENTS

This document has been developed by the Science Based Targets initiative with support from ERM led by Jo Howes, Lucy Liu, Paolo Natali, Daisy Tyrer, and Ignacio Rabsiun. The SBTi primary authors are Emma Borjigin-Wang, Piera Patrizio.

The SBTi would like to acknowledge the support of ERM in processing and synthesizing the body of evidence received, and the individuals and organizations that submitted evidence to the SBTi during the open Call for Evidence on the Effectiveness of Environmental Attribute Certificates in Corporate Climate Targets.

DISCLAIMER

The Science Based Targets initiative (SBTi) affirms that the document is provided without warranty, either expressed or implied, of accuracy, completeness or fitness for purpose. The SBTi hereby further disclaims any liability, direct or indirect, for damages or loss relating to the use of this document to the fullest extent permitted by law.

The information (including data) contained in the document is not intended to constitute or form the basis of any advice (financial or otherwise). The SBTi does not accept any liability for any claim or loss arising from any use of or reliance on any data or information in the document.

The SBTi reserves the right to revise this document according to a set revision schedule or as advisable to reflect the most recent emissions scenarios, regulatory, legal or scientific developments, and GHG accounting best practices. The SBTi aims to incorporate the latest global scientific climate insights, such as those from the IPCC[1], into the development of pathways, methodologies, metrics, and standards. However, as new findings emerge, some time may be required to fully integrate these updates into the SBTi Standards. Consequently, the claims permitted by the SBTi are designed to align as closely as possible with the most current scientific consensus.

The SBTi does not take any responsibility for legal implications of the use of this Standard, and does not claim that following this Standard will result in legal compliance. The guidance given here is not intended as a substitute for legal advice.

“Science Based Targets initiative” and “SBTi” refer to the Science Based Targets initiative, a private company registered in England number 14960097 and registered as a UK Charity number 1205768.

[1] The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.

VERSION HISTORY

Version	Change/update description	Release date
Version 1.0	• Original publication	March X, 2025

CONTENTS

1. EXECUTIVE SUMMARY

In 2023, as part of the CZNS 2.0 revision process, the SBTi issued a Call for Evidence on the Effectiveness of EACs in Corporate Climate Targets. The initiative sought input from a wide range of stakeholders on the role of environmental attribute certificates (EACs) for electricity, fuels, emission reduction (carbon) credits, and commodities, based on a range of research questions.

EACs encompass a diverse range of instruments that certify and communicate specific environmental or sustainability attributes of a given activity or commodity. By ensuring that certain environmental standards or quality criteria have been met, these certificates can potentially enable companies to substantiate their environmental claims and support compliance with voluntary or regulatory schemes.

Generally speaking, certificates used to enable climate-related claims by corporates can be classified into two broad categories:

1. **Instruments that convey the mitigation outcome(s) of an intervention:** These instruments, referred to herein as carbon credits, are used to measure and communicate the mitigation outcomes of an intervention. Carbon credits can be issued from a wide number of activities and are often measured in tonnes of carbon dioxide equivalent (tCO_2e) associated with the intervention. The main categories of activities that can issue carbon credits based on the type of mitigation outcome include emissions avoidance credits, emissions reductions credits and carbon removal/sequestration credits.

2. **Instruments that convey the climate-related performance of an activity:** These instruments are used to establish the emissions profile of an activity, such as the production or processing of a given commodity. The emissions profile can be established directly through the emissions intensity of the activity, or indirectly by conveying attributes that help determine the emissions profile of the activity. This could include whether the commodity was produced using zero-carbon technologies or from activities or areas that result in no deforestation and/or no conversion.

The purpose of this report is to provide a summary of the evidence collected from this process related to instruments that convey the climate-related performance of an activity:

- **Electricity certificates**, also known as energy attribute certificates, generally convey the emissions profile of a unit of electricity generation (or less commonly, heat, steam or cooling). Instruments within this category include renewable energy certificates and guarantees of origin.
- **Fuel certificates,** these instruments are generally used to certify that a unit of fuel was produced in a manner that reduces its overall climate impact. Instruments within this category include sustainable aviation fuel certificates (SAFc), renewable gas certificates and green hydrogen certificates.

- **Commodity certificates**, these instruments certify and convey sustainability information about the production process of different commodities, such as “green” steel or “green” cement.

The document also provides an overview of process, methodology, key concepts, cross-cutting take-aways, and limitations of the review of evidence. Please notice that the SBTi has also published a similar report for carbon credits (see Evidence Synthesis Report Part 1: Carbon Credits).

Across all EAC types, a total of 406 unique pieces of evidence were submitted via a survey form and 32 additional unique pieces of evidence were submitted via email. The SBTi has published a table compiling the evidence submitted and the aggregated survey response results of the unique pieces of evidence submitted via the survey form. Specifically, there were:

- 220 unique pieces of evidence that were submitted to the SBTi’s Call for Evidence that submitters tagged as being relevant to electricity certificates;
- 190 unique pieces of evidence tagged as being relevant to fuels certificates;
- 44 unique pieces of evidence tagged as being relevant to commodities certificates.

Methodology

The examination of the evidence follows the standardized methodology that the SBTi had developed for the synthesis of the evidence relating to carbon credits. The methodology aims at systematically reviewing the evidence and summarizing its findings in relation to the research questions. Each piece of evidence was first assigned a default tier based on the evidence type, whether it was published in a peer-reviewed journal, and whether it was published by a governmental entity. The tiers are not intended to strictly represent a hierarchy of quality, but are meant to aid general prioritization of evidence in terms of bias and relevance. Table 1 shows the default tiers for each evidence type. The full description of methods for compiling this report can be found in Annex A.

Table 1. Default evidence tiers. See Annex A for more details about the evidence type categorisation

Default tier	Evidence type	Peer- reviewed journal	Published by a gov. organization
A	**Controlled research study**	**Yes**	**Any**
	Law or regulation	**No**	**Any**
	Legal or regulatory analysis	**Yes**	**Any**
	Literature review	**Yes**	**Any**

B	Case study or example	Yes	Any
	Controlled research study	No	Any
	Legal or regulatory analysis	No	Yes
	Report or white paper	No	Yes
	Survey or poll	No	Any
C	Case study or example	No	Any
	Commentary	Any	Any
	Legal or regulatory analysis	No	No
	Literature review	No	Any
	News Coverage	No	Any
	Report or white paper	No	No
	Statistical information	No	Any

Evidence synthesis

Following the methodology summarized in the above and described in detail in Annex A, a total of 359 pieces of evidence submitted to the SBTi were either relevant or partially relevant to both the research questions posed and to energy carriers and commodities certificates. Specifically, the evidence synthesis has found:

- 181 unique pieces of evidence relevant or partially relevant to electricity certificates;
- 150 unique pieces of evidence relevant or partially relevant to fuels certificates;
- 28 unique pieces of evidence relevant or partially relevant to commodities certificates.

Table 2 summarises the resulting tiers categorisation for each EACs type.

Table 2. Total number of evidence pieces per tier across EACs types

EAC type	Tier A	Tier B	Tier C
Electricity	15	30	136

Fuels	**1**	**18**	**131**
Commodities	**0**	**5**	**23**

The goal of this research is to assess the effectiveness of these instruments in driving net-zero aligned transformation and in substantiating corporate climate related claims. The evidence received was assessed with the aim of providing insights into the following broad themes:

1. The effectiveness of the instruments to deliver their intended mitigation outcomes,
2. The ways in which companies use the instrument and implications for the net-zero transformation, and
3. The types of claims that may or may not be credibly used by companies when using these instruments. The synthesis of the evidence pertaining to the EACs discussed in this report do not follow this same structure, but are grouped by recurring topics identified within each EAC type.

Drawing firm conclusions on each of these themes from the evidence submitted was challenging due to the nascent nature of the various types of EACs, which often meant there was a shortage of rigorous evidence, and within evidence there was a lack of consistency in methodologies and definitions.

This notwithstanding, there were few common concepts that arose from the evidence submitted, hereby discussed.

Diverging views on the purpose and impacts of EACs: There is no consensus on whether EACs should strictly convey the emissions profile of a product or also reflect emissions savings.

Electricity EACs (e.g., renewable energy certificates, guarantees of origin) primarily represent emissions performance, conveying a near-zero gCO2/MWh emissions factor. However, there is ongoing debate on whether they should also reflect avoided emissions. Some evidence suggests that in fossil-heavy grids, EACs may indirectly reduce emissions by shifting demand to renewables, while in renewable-rich regions, their additional impact is minimal. Others argue that EACs track energy attributes rather than direct emissions reductions, since avoided emissions claims are more closely aligned with consequential or intervention-based accounting, which assesses the system-wide effects of an action (e.g., whether purchasing an EAC actually leads to more renewable energy production or displaces fossil fuels).

Fuel EACs (e.g., sustainable aviation fuel certificates) primarily represent emissions performance, reflecting the lifecycle emissions of the fuel, including direct emissions from combustion and indirect factors such as land-use change and displacement effects. However, some submissions highlight that there are differences in how regulatory and voluntary frameworks account for indirect emissions, which introduces uncertainty in lifecycle emissions accounting. In some regulatory contexts, fuel EACs may also be used to claim

emissions reductions relative to a baseline fossil fuel comparator, which raises concerns about whether these reductions are additional or if they merely shift emissions within existing regulatory limits.

Commodity EACs (e.g., green steel, sustainable palm oil) lack a standardized approach, with no consensus on whether they should reflect direct product emissions only or broader systemic impacts. Unlike electricity and fuel EACs, which are often linked to established GHG accounting methodologies, commodity EACs operate in a fragmented landscape with varying chain-of-custody models and verification standards. However, the evidence base for commodity EACs was notably limited, making it difficult to draw robust conclusions about their effectiveness and impact.

Lack of consensus on GHG accounting methodologies: Despite the fact that EACs are widely accepted across multiple geographies and certification systems, there is no universally accepted methodology for attributing emissions to these certificates. Different sectors apply distinct approaches, leading to inconsistencies in how emissions are assigned and accounted for.

Electricity EACs use an attributional approach (e.g., market-based scope 2 accounting), which allows entities to claim zero emissions for procured renewable electricity. However, evidence highlights that this approach does not systematically account for the emissions impact of time- and location-based grid variability. Some sources argue that marginal emissions factors should be incorporated to better reflect the actual impact of renewable electricity procurement .

Fuel EACs incorporate regulatory lifecycle analysis (e.g., EU RED, California LCFS), but there is ongoing debate over whether indirect emissions, such as those from land-use change and feedstock production, should be included. Some policies, like California's Low Carbon Fuel Standard, factor in displacement credits, while others exclude these considerations .

Commodity EACs exhibit the highest level of inconsistency, with some frameworks relying on sectoral benchmarks while others propose intervention-based accounting approaches. Unlike electricity and fuels, there is no widely accepted method for defining emissions reductions, and evidence remains insufficient to determine best practices .

Risk of double counting: Evidence suggests that differences in emissions accounting frameworks and the lack of harmonized tracking mechanisms across markets contribute to double counting risks. While some registries have been established to prevent erroneous double counting, inconsistencies persist, particularly in cross-border and voluntary market applications

Evidence highlights risks of double counting renewable attributes when EACs are claimed under both corporate inventories and national reporting frameworks, with some submissions

indicating that residual mix calculations and stronger regulatory safeguards could address these risks .

Commodity EACs present the highest double counting risk, as multiple entities along the supply chain may claim emissions benefits for the same material flow. Some evidence suggests that global or regional registries are needed to prevent this issue, but no such system currently exists .

Conclusions and next steps

Due to the nascency and heterogeneity of EACs our review of the submitted evidence concluded that

1. There is limited consensus on on whether or not EACs can be effective in substantiating claims of emissions performance or also emissions reductions
2. The evidence assessed reveals a high degree of heterogeneity in underlying GHG accounting methodologies for these instruments, which difficult their use to substantiate claims in a standardised way,
3. Across EACs further evidence is required on how to ensure positive impacts of EACs on the wider system.

The potential of EACs to facilitate system-wide decarbonisation is expected to depend significantly on the exact conditions through which these certificates are generated and procured. However, the evidence revealed that there is still a lack of clear guidance on key conditions under which EACs become effective.

Moreover, several areas of debate in EACs were notably not mentioned in any of the evidence submitted.

The findings summarized in this report should be understood as findings specific to the pieces of evidence submitted to SBTi and not generalized beyond this. The results of this research will be considered, along with other research outputs, in the revision of the SBTi Corporate Net-Zero Standard. This revision will be conducted in accordance with the Standard Operating Procedure (SOP) for Development of SBTi Standards, which includes Expert Working Groups (EWGs) and public consultations, pilot testing, redrafting, review and approval by the Independent SBTi Technical Council and consideration and adoption by the SBTi board. The SBTi expects Version 2.0 of the Standard to be published in 2025.

2. GLOSSARY

Please see the SBTi glossary for a list of key terms used across SBTi documents. Key definitions that are relevant to this document and the three instrument types in scope for this paper are set out in the table below.

Table 1. Glossary

Term	Definition
Abatement	Measures that companies take to prevent, reduce, or eliminate sources of GHG emissions within their value chain.
Abatement cost	The abatement cost is the unitary cost of an intervention that will reduce greenhouse gas emissions by one tonne of carbon dioxide equivalent (adapted from World Bank, 2023).
Achievement (of science-based targets)	The state of having met the required emissions reductions and other actions stated in a company's science-based target in the target year or earlier.
Additionality	Additionality is the extent to which something happens as a result of an intervention that would not have occurred in the absence of that intervention. Additionality is a defining concept of interventions quantified with consequential accounting, including carbon credit projects and programs.
Baseline emissions	The GHG Protocol for Project Accounting defines baseline emissions as "An estimate of GHG emissions, removals, or storage associated with a baseline scenario or derived using a performance standard" (GHG Protocol, 2005). The GHG Protocol Corporate Accounting Standard highlights that the term "baseline emissions" (in the context of project-based accounting) should be differentiated from the term "base year emissions," which is mostly used in the context of inventory accounting. The term base year emissions focuses on a comparison of emissions over time, while a baseline is a hypothetical scenario for what GHG emissions would have been in the absence of a GHG reduction project or activity (GHG Protocol, 2005).
Baseline scenario	The GHG Protocol for Project Accounting (i.e. for intervention or consequential accounting) defines a baseline scenario as: "A hypothetical description of what would have most likely occurred in the absence of any considerations about climate change mitigation" (GHG Protocol, 2005). In the context of carbon credit generating projects, the determination of the baseline scenario outcome establishes

	whether a proposed project is additional (GHG Management Institute, 2022).
Base year (or base period)	In the context of inventory accounting, a base year refers to a historic datum (a specific year or, in the case of a base period, an average over multiple years) against which a company's emissions are tracked over time.
Base year emissions	In the context of inventory accounting, base year emissions refer to a company's scope 1, 2 and 3 emissions in a specific year against which a company's emissions are tracked over time.
Book and claim chain of custody model	Chain of custody model in which the administrative record flow is not necessarily connected to the physical flow of material or product throughout the supply chain (GHG Protocol, 2022). Commonly referred to as "unbundled certificates" to support claims.
Bundled	An energy attribute certificate or other instrument that is traded with the underlying energy produced (WRI & WBCSD, 2015).
Carbon credit	A carbon credit is a tradable unit that represents one metric tonne of avoided GHG emissions, reduced GHG emissions or GHG removals.
Carbon offset credit	A carbon credit is a tradable unit that represents one metric tonne of avoided GHG emissions, reduced GHG emissions or GHG removals. When a carbon credit is purchased and retired for offsetting purposes, it is sometimes referred to as a carbon offset credit.
Carbon inset credit	Quantified mitigation outcomes of projects or broader interventions which are credited for GHG claims to be transferred between entities, and which are generated from projects or interventions that reduce emissions or increase removals inside the reporting company's value chain. Credited GHG reductions or removal enhancements are quantified using project or intervention accounting methods, which quantify systemwide GHG impacts relative to a counterfactual baseline scenario or performance benchmark that represent the conditions most likely to occur in the absence of the mitigation project that generates the credit (GHG Protocol, 2022).
Chain of custody model	The general term to describe the process by which inputs and outputs and associated information are transferred, monitored

	and controlled as they move through each step in the relevant supply chain (ISO, 2020)
Climate finance	The financial flows whose expected effect aims to reduce net greenhouse gas (GHG) emissions and/or to enhance resilience to the impacts of current and projected climate change (Kreibiehl et al., 2022).
Climate finance dilution	The risk that climate financial resources are allocated to projects with limited or no verifiable impact, thereby weakening their effectiveness. This can for instance occur due to ambiguous eligibility criteria, insufficiently stringent monitoring, reporting, and verification (MRV) frameworks, or the inclusion of projects with marginal climate benefits.
Commodity certificates	Instruments that certify and convey sustainability information about the production process of different commodities. These certificates provide verified data on the environmental and/or social performance of a commodity in conformance with a specific sustainability standard.
Compliance (carbon) market	The market for carbon credits used to reach emissions targets under a regulatory regime. (UN-REDD Programme, 2021). Compare with the voluntary (carbon) market.
Controlled blending chain of custody model	Chain of custody model in which materials or products with a set of specified characteristics are mixed according to certain criteria with materials or products without that set of characteristics resulting in a known proportion of the specified characteristics in the final output (GHG Protocol, 2022).
Corporate climate abatement target	A company target to prevent, reduce, or eliminate sources of GHG emissions within its operations and wider value chain to a defined level by a defined future date compared to a historic base year of emissions inventory.
Counterfactual baseline	Carbon credits can be quantified through a baseline-and credit system that compares actual GHG emissions to a counterfactual baseline emissions scenario. The differences between actual and counterfactual emissions are accounted for as mitigation outcomes that would not have occurred in a business-as-usual scenario. This business-as-usual scenario is a counterfactual scenario that will not actually occur, but would have occurred in an alternative reality without the carbon credit-generating project or program. This makes the definition of conservative reference scenarios essential for the credibility of baselines (VCM Primer, 2023).

Decarbonization	The process by which countries, individuals or other entities aim to achieve zero fossil carbon existence. Typically refers to a reduction of the carbon emissions associated with electricity, industry and transport (IPCC, 2018).
Dispatchable	A source of electricity is dispatchable if it can be turned on and off quickly in response to demand (University of Calgary, 2024).
Double claiming	A type of double counting in which the same emissions reduction or removal is claimed by two different entities towards achieving mitigation targets or goals. The double claiming of emissions reductions and removals often happens between a company's GHG inventory and the national inventory where that mitigation outcome occurred. In the context of voluntary carbon markets, double claiming can occur between a country, jurisdiction or other entity that reports lower emissions or higher removals for the purpose of demonstrating achievement of a mitigation target or goal, and the entity retiring the carbon credit for the purpose of making a claim (adapted from ICVCM, 2022).
Double counting	A situation in which a single emissions reduction and/or removal is counted more than once towards achieving mitigation targets or goals (adapted from ICVCM, 2022). Double counting may refer to a situation in which a quantity of GHG emissions is included in more than one organization's GHG inventory. This can occur across scopes (scope 1, 2 and 3) and within a single scope due to differing consolidation approaches, differing emissions calculation methodologies, and the intentional design of emissions accounting standards.
Emission reductions	Measures that companies take to prevent, reduce, or eliminate sources of GHG emissions within their value chains, or measures that companies take to reduce emissions beyond their value chains compared to a historic baseline.
Energy attribute certificates	A contractual instrument that conveys information (attributes) about a unit of energy, including the resource used to create the energy and the emissions associated with its production and use. EACs may also include information about the location of the facility that generated the unit of energy, when that facility began operations, and when the unit of energy was produced. Instruments that certify the production of renewable and/or low carbon energy (US EPA, 2024).

Environmental attribute certificate	Instrument that certifies and communicates the environmental and/or climate-related attributes associated with commodities, activities or projects.
Fungibility	Being of such a nature that one part or quantity may be replaced by another equal part or quantity in the satisfaction of an obligation. In the context of offsetting, fungibility typically refers to the physical equivalence of unabated emissions and the mitigation outcomes with which they are being offset. Physical equivalence refers to the condition where different emissions reduction or sequestration activities are considered to have the same net effect on atmospheric greenhouse gas (GHG) concentrations. This implies that one unit of emissions reduced or sequestered through an offset project is considered equivalent to one unit of emissions produced, thus achieving a balance that maintains overall atmospheric GHG levels constant.
Identity preservation (IP) chain of custody model	Chain of custody model in which the materials or products originate from a single source and their specified characteristics are maintained throughout the supply chain (GHG Protocol, 2022).
Insetting / supply chain interventions	Used to describe climate mitigation projects or programs wholly contained within the scope 3 value chain boundary of a company or projects partially within its scope 3 supply chain boundary (spanning their supply chain and other companies' supply chains).
Intervention (or project or consequential) accounting	Accounting method that quantifies systemwide impacts of a specific action or intervention on GHG emissions and removals relative to a counterfactual baseline scenario that represent the conditions most likely to occur in the absence of the action or intervention (GHG Protocol, 2022).
Inventory (or attributional) accounting	Inventory accounting, also known as attributional accounting, tracks GHG emissions and removals within a defined organizational and operational boundary over time. It is the primary method used by corporations and other organizations to report emissions from their operations and value chains (GHG Protocol, 2023a).

Leakage	When a mitigation activity associated with a carbon crediting project or program displaces emission-creating activities outside the project or program boundary rather than halting them in actual terms. Leakage of GHG emissions can occur when mitigation activities: a) shift location (activity-shifting leakage); b) indirectly affect areas that are hydrologically connected (ecological leakage); c) impact the supply or demand of an emissions-intensive product or service (market leakage); or d) impact upstream or downstream emissions (upstream/downstream emissions leakage).
Life cycle assessment (LCA)	Compilation and evaluation of the inputs, outputs, and potential environmental impacts of a product system throughout its life cycle (ISO, 2006). LCA is a tool for the analysis of the environmental burden of products at all stages in their life cycle - from the extraction of resources, through to the production of materials, product parts and the product itself, and the use of the product to the management after it is discarded, either by reuse, recycling or final disposal (Guinee, 2002).
Mass balance chain of custody model	Chain of custody model in which materials or products with a set of specified characteristics are mixed according to defined criteria with materials or products without that set of characteristics (GHG Protocol, 2022).
Mitigation	A human intervention to reduce emissions or enhance the sinks of GHGs (IPCC, 2018).

Mitigation outcome	The IPCC defines mitigation as a human intervention to reduce emissions or enhance the sinks of GHGs (IPCC, 2018). In the context of this report, and consistent with current practice, the term mitigation outcomes refers to human-induced activities that contribute to climate mitigation in one or more of the following ways: a) preventing the release of GHGs into the atmosphere compared to a counterfactual baseline scenario (avoided emissions), b) reducing the amount of GHGs previously released into the atmosphere from a given activity, usually compared to emissions from a given source in a reference or base year (emissions reductions), or c) removing and storing carbon from the atmosphere (carbon sequestration or carbon dioxide removal). Article 6 of the Paris Agreement allows countries to sell and transfer emissions reductions and/or removals to other countries to achieve their nationally determined contributions (NDCs) thereby becoming Internationally Transferred Mitigation Outcomes (ITMOs). In June 2024, at the Bonn Climate Conference, national delegations reconvened formal negotiations on the design of UNFCCC carbon markets (Article 6), where it was agreed to postpone discussions on whether emission avoidance could qualify for crediting in Article 6.2 and 6.4 until 2028, while clarifying that emission avoidance is not currently permitted under Article 6.
Offsetting	The term offsetting refers to purchasing carbon credits from activities outside of a company's value chain as a substitute for abating emissions within its value chain.
Registry	A structured database or system that records, tracks, and manages the issuance, transfer, and retirement of EACs. They may be operated by governments, international organizations, or private entities.
Residual mix	"The unallocated or unclaimed electricity generation and associated emissions in a certain area over a certain period of time. […] In general, a residual mix is used to characterize the generation and emissions for those not buying specified power, for consumption that is not met by specified purchases, and where resource-specific information is not available." (Center for Resource Solutions, 2024)

Science-based target	Corporate targets to mitigate GHG emissions that are in line with what the latest climate science says is necessary to meet the goals of the Paris Agreement – to pursue efforts to limit warming to 1.5°C.
Segregation chain of custody model	Chain of custody model in which specified characteristics of a material or product are maintained from the initial input to the final output (GHG Protocol, 2022).
Temporal matching	The time scale at which purchased EACs correspond to an activity. In the context of electricity, temporal matching is currently often done on an annual basis but may also be done on smaller time scales, such as monthly or hourly.
Unbundled	An energy attribute certificate or other instrument that is separate, and may be traded separately, from the underlying energy produced (WRI & WBCSD, 2015).
Vintage	The year in which the carbon emissions reduction or removal associated with a carbon credit or an environmental attribute certificate took place. Because the verification process can take two to three years from project/program inception, projects/programs may generate credits for already-reduced or removed emissions. In the context of scope 2 accounting, vintage reflects the date of energy generation from which the contractual instrument is derived (WRI & WBCSD, 2015).
Voluntary (carbon) market	Per ICVCM, “a decentralised market where private actors voluntarily buy and sell carbon credits that represent removals or reductions of greenhouse gases (GHGs) in the atmosphere” (ICVCM, 2024). Compare with the compliance (carbon) market.

3. INTRODUCTION

The SBTi 2023 call for evidence on EACs

As part of the SBTi's research into how it could assess whether or not a company has achieved its science-based target, the SBTi is exploring the role that environmental attribute certificates (EACs) currently play in corporate decarbonization strategies, and the impact that these certificates have had or may have, if any, to overall emission reduction goals.

As an input to this research effort, the SBTi issued an open Call for Evidence on the Effectiveness of Environmental Attribute Certificates in Corporate Climate Targets from September 21 to November 24 2023. This paper is Part 2 of the synthesis of the responses to the call for evidence. A full description of the original call for evidence can be found Part 1.

In publishing both the evidence submitted to the SBTi and this summary report, the SBTi seeks to contribute a valuable synthesis of submitted evidence on this important topic. Any corresponding updates to SBTi standards are subject to formal consideration and approval in line with the SBTi's Standard Operating Procedures and governance, including public consultation and approval by the SBTi Technical Council.

Overview of evidence review methodology

The Call for Evidence survey invited respondents to provide evidence and their individual opinions about the relevance and findings. To ensure objective evaluation, the SBTi developed a standardized methodology to systematically review and assess the evidence submitted (full description of methods for compiling this report can be found in Annex A). The review and synthesis of evidence for the chapters related to EACs for electricity, other fuels, and commodities was based on this methodology and was completed by an external consultant (ERM).

The assessment methodology comprised five steps:

1. Initial evidence cleaning and categorization
2. Detailed evidence review
3. Categorization of evidence into final tiers and relevance levels
4. Evidence synthesis and report writing
5. Quality review

Each piece of evidence was first assigned a default tier based on the evidence type, whether it was published in a peer-reviewed journal, and whether it was published by a governmental entity. The tiers are not intended to strictly represent a hierarchy of quality, but are meant to aid general prioritization of evidence in terms of bias and relevance.

Figure 1 shows the total number of evidence received for each EACs type. Across all EAC types, a total of 406 unique pieces of evidence were submitted via a survey form and 32 additional unique pieces of evidence were submitted via email. Specifically, there were:

- 220 unique pieces of evidence that were submitted to the SBTi's Call for Evidence that submitters tagged as being relevant to electricity certificates;
- 190 unique pieces of evidence tagged as being relevant to fuels certificates;
- 44 unique pieces of evidence tagged as being relevant to commodities certificates.

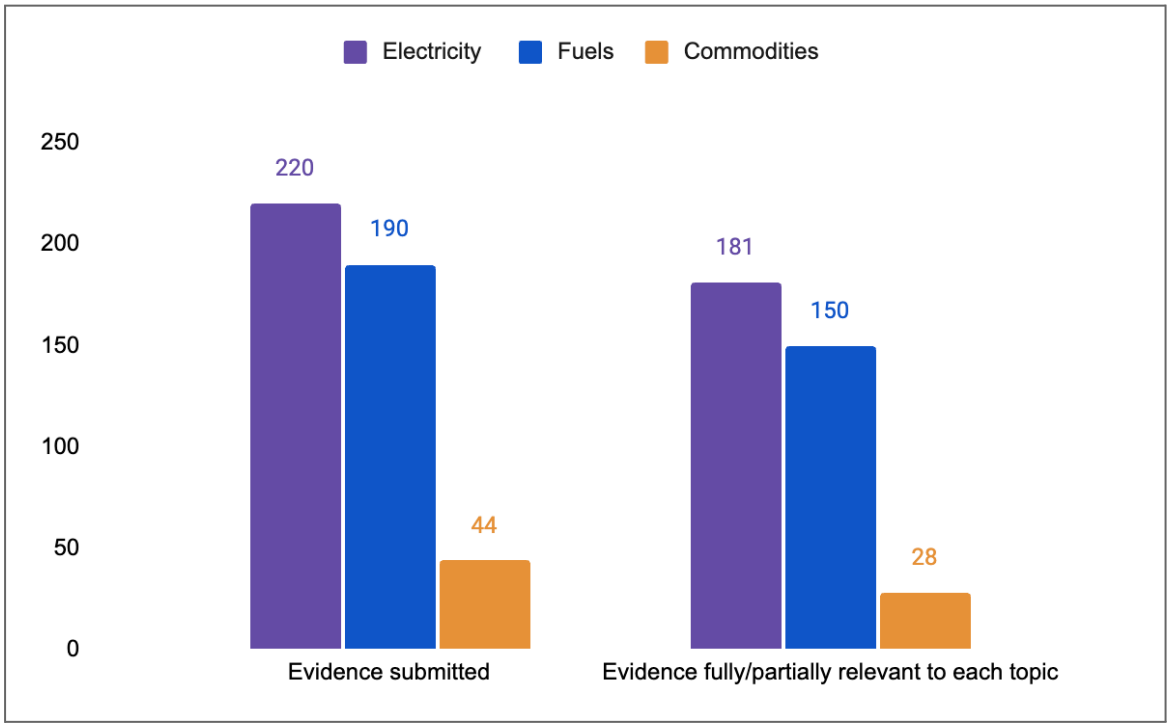


Figure 1. Unique pieces of evidence submitted, including those fully or partially relevant, for each EACs type

The SBTi has published a table compiling the evidence submitted and the aggregated survey response results of the evidence submitted via the survey form.

As noted in Part 1, this report reflects the process established by SBTi and thus only reviews the papers submitted under the Call for Evidence on this topic. Due to the time elapsed between the closure of the Call for Evidence and the publication of this report, the SBTi is aware there may be other relevant evidence that has been developed or published that is not mentioned in this report. While relevant to the topic, they are out of scope of this publication.

The purpose and structure of this report

The purpose of this report is to provide an overarching overview of the process, methodology, key concepts, cross-cutting take-aways, and limitations of the review of evidence submitted to the SBTi during the 2023 Call for Evidence related to electricity, other fuels, and commodity level EACs. The process, methodology, key concepts, cross-cutting

take-aways, and limitations of the review of evidence relating to carbon credits were covered in Evidence Synthesis Report Part 1: Carbon Credits).

Full evidence synthesis reports per topic can be found here:

- EVIDENCE SYNTHESIS REPORT PART 2 - CHAPTER 1: Electricity
- EVIDENCE SYNTHESIS REPORT PART 2 - CHAPTER 2: Fuels
- EVIDENCE SYNTHESIS REPORT PART 2 - CHAPTER 3: Commodities

4. KEY CONCEPTS WITHIN THE EVIDENCE

To provide clarity on the concepts used in this report, this section reviews the definitions used for EACs and explores several key terms relevant to the evidence submitted. Many of the terms used in the evidence lack consistent definitions, which reflects the relatively early stage of their usage. This means these definitions may be subject to change in the future.

EACs

EACs encompass a diverse range of instruments that certify and communicate specific environmental or sustainability attributes of a given activity e.g. power generation, or commodity e.g. tonne of steel. By verifying that certain environmental standards or sustainability criteria have been met, when purchased, these certificates enable companies to substantiate their environmental claims and support compliance with voluntary or regulatory schemes.

Generally speaking, certificates used to enable climate-related claims by corporates can be classified into two broad categories:

3. **Instruments that convey the mitigation outcome(s) of an intervention:** These instruments, referred to herein as carbon credits, are used to measure and communicate the mitigation outcomes of an intervention. Carbon credits can be issued from a wide number of activities and are often measured in tonnes of carbon dioxide equivalent (tCO_2e) associated with the intervention. The main categories of activities that can issue carbon credits based on the type of mitigation outcome include emissions avoidance credits, emissions reductions credits and carbon removal/sequestration credits.

4. **Instruments that convey the climate-related performance of an activity:** These instruments are used to establish the emissions profile of an activity, such as the production or processing of a given commodity. The emissions profile can be established directly through the emissions intensity of the activity, or indirectly by conveying attributes that help determine the emissions profile of the activity. This could include whether the commodity was produced using zero-carbon technologies or from activities or areas that result in no deforestation and/or no conversion.

Part 1 of the SBTi's call for evidence process synthesised the responses covering carbon credits. This report covers instruments that convey the climate-related performance of an activity:

- **Electricity certificates**, also known as energy attribute certificates, generally convey the emissions profile of a unit of electricity generation (or less commonly, heat, steam or cooling). Instruments within this category include renewable energy certificates and guarantees of origin.
- **Fuel certificates,** these instruments are generally used to certify that a unit of fuel was produced in a manner that reduces its overall climate impact. Instruments within this category include sustainable aviation fuel certificates (SAFc), renewable gas certificates and green hydrogen certificates.
- **Commodity certificates**, these instruments certify and convey sustainability information about the production process of different commodities, such as "green" steel or "green" cement.

Accuracy of EACs

A recurring theme in this report is the 'accuracy' of EACs, typically used to mean how close the link is perceived to be between the characteristics stated on an EAC and the physical production and/or consumption of the product. For example, the GHG Protocol's Scope 2 Guidance for EACs states "temporal accuracy" can be achieved by ensuring the generation of which the emissions factor is based on is "close in time to the reporting period for which the certificates (or emissions) are claimed".

However, it is important to note that use of the term accuracy in this way raises several issues:

- The word accuracy is also needed to describe use of more precise data, such as the use of a measured value rather than one from literature
- Higher accuracy is generally interpreted to be preferable. However, in the sense used here, meaning with higher correlation or representativeness, this is not necessarily the case. For example, interest in EACs as a concept is driven by the ability to link willingness to pay for a low carbon product to those with ability to supply it, who may be separated geographically. As such there is tension between increasing the degree of geographical specificity to increase the representativeness of the EAC's emissions and stifling the ability of EACs to provide a market demand signal.

Bundled/unbundled EACs

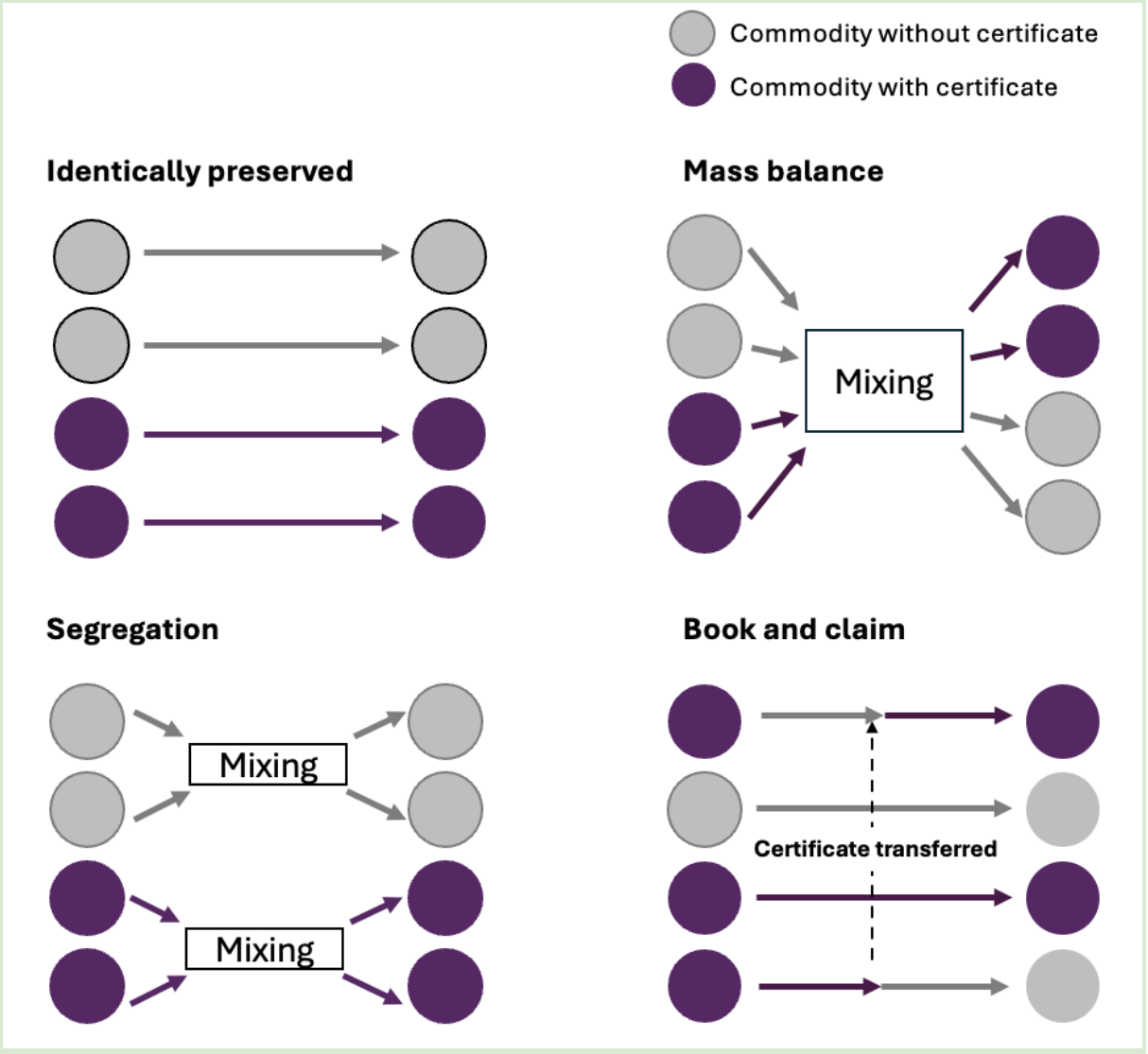
EACs can be procured in the same purchase as ('bundled with') the associated physical product (e.g. electricity, fuels, commodities) or 'unbundled' from the associated physical product. For example, in electricity, bundled EACs can be purchased through a power purchase agreement (PPA). Unbundled EACs are not tied to physical electricity and can be purchased with or without long term contracts. For example, renewable electricity certificates

(RECs) may be traded on spot markets (e.g. EAC marketplaces), or via longer term contracts through virtual power purchase agreements (vPPAs) (RMI, 2019). In fuels and commodities, a bundled EAC transaction is highly similar to directly purchasing a physical product with a defined GHG intensity from a known source. In fuels and commodities, unbundled EACs can be purchased through guarantees of origin (GOs) systems or other contractual instruments via different types of chain of custody models like mass balancing or book-and-claim mechanisms.

Chain of custody models

There are four types of chain of custody model commonly used to trace sustainability attributes throughout supply chains, shown in Figure 2. Note that the ISO standard 22095 specifies five chain of custody models, with the addition of “controlled blending”. Separately, the draft ISEAL chain of custody definitions and models guidance includes six models, with the addition of “controlled blending”, and “controlled mass balance” (ISEAL, 2024).

Figure 2. Common chain of custody models



It is generally recognised that CoC models can be placed on a 'spectrum' of flexibility and physical traceability, with identity preserved the least flexible (but highest in traceability), followed by segregation, then mass balance, with book-and-claim the most flexible (but lowest in traceability).

- The most stringent level of assurance regarding the origin and attributes of the product is provided by the **identity preserved** chain of custody model. This model ensures that a product's specific attributes and origin are maintained throughout the supply chain and each batch of the product is kept separate from other batches. Products from different sources cannot be physically mixed and must be documented accordingly
- The **physical segregation** model ensures that the certified product is kept separate from non-certified sources but does not prohibit mixing products from different sources certified to the same standard. The characteristics of a product are maintained from the initial input to the final output, but there is no unique identification of the source.

- **Mass balance** is a model where certified and non-certified products can be physically mixed. Under this model, a certain volume of certified products enters the physical supply chain and an equivalent volume of product that leaves the operations can be sold as certified. This relies on there being a plausible physical connection between the entry and exit point of the system: for example, the same electricity network, gas network, fuel tank, or storage depot.

- **Controlled blending** is regarded to be a specific case of mass balance in which the materials or products with a set of specified characteristics (e.g. emission profiles) are mixed according to certain criteria with materials or production without that set of characteristics resulting in a known proportion of the specific characteristics in the final output (ISO, 2020). In the evidence assessed, controlled blending was not explicitly mentioned.

- According to ISEAL, **controlled mass balance** is a variation of the mass balance chain of custody model, where the physical material associated with a mass balance output meet minimum defined performance, data and verification requirements
- Under the **book and claim** model, there is no requirement for this plausible physical connection. Instead, certificates or credits are traded separately according to the amount of certified product fed into the supply chain, ensuring that the quantity of certificates purchased matches the quantity entered into the system.

Other forms of mechanisms were also mentioned in the evidence assessed. These included, “Carbon Bank” approaches, which are being applied for the generation of certain commodity EACs. Instead of using CoC models to track the movement of materials through the supply chain, an internal ‘carbon bank’ approach is being used by some companies to aggregate GHG savings from project interventions and then allocate these savings (the carbon bank) to a proportion of their output in the form of certificates. While some companies call this approach a form of mass balancing, it is fundamentally different in concept to a mass balance CoC model, and is not captured as part of the definition of mass balancing by any of the references cited above.

Underlying GHG emission accounting methods

There are different approaches to GHG emission accounting, which could have a significant impact on GHG inventory results.

- **Location-based and market-based accounting**: The location-based accounting method calculates scope 2 emissions from the average energy generation emissions factors for defined locations, including within local, subnational, or national boundaries. The market-based accounting method calculates the scope 2 emissions of a reporter based on GHG emissions emitted by the generators from which the reporter contractually purchases electricity bundled with contractual instruments, or contractual instruments on their own (e.g. such as EACs). These terms are currently defined in the SBTi glossary for the specific purpose of scope 2 emissions reporting. This report,

however, extends these definitions to also discuss EACs in the context of emission reporting for scope 1 and 3.

- **Attributional and consequential accounting**: An attributional accounting method tracks GHG emissions and removals within a defined organizational and operational boundary over time. It is the primary method used by corporations and other organizations to report emissions from their operations and value chains (183, GHG Protocol, 2023b) *[Tier B].* By contrast, a consequential accounting method quantifies systemwide impacts of a specific action or intervention on GHG emissions and removals relative to counterfactual baseline scenario (183, GHG Protocol, 2023b) *[Tier B].* Note that the terms attributional and consequential are also used in lifecycle analysis (LCA). An attributional LCA approach assesses the impacts of the processes within the lifecycle of a product, whilst a consequential LCA also considers indirect effects arising from production of the product that are outside the product's lifecycle.
- **Offsetting and insetting**: The SBTi defines offsetting as the practice of purchasing carbon credits from activities outside of a company's value chain as a substitute for abating emissions within its value chain. Insetting, also referred to as Supply Chain Intervention, is used to describe climate mitigation projects or programs that are either wholly contained within the scope 3 value chain boundary or partially within its scope 3 supply chain boundary (spanning their supply chain and other companies' supply chains). The use of these definitions requires defining what constitutes a company's value chain, and therefore what is inside or outside of it, which is not always clearly defined in the submitted evidence.

Double counting

The term 'double counting' is used in different ways across multiple pieces of evidence. Generally, double counting refers to a situation in which a single emission profile is counted more than once in emission inventory accounting. Double counting can occur between different accounting systems (e.g., corporate accounting overlaps with government accounting) or within a system (e.g., different companies under the same EAC program account for the same emission profile more than once.). Generally, safeguards have been developed to avoid erroneous double counting of emission profiles, but not all double counting is erroneous (345, Smith and Lewis, 2023) *[Tier C].*[2]

Erroneous double counting can occur when there is a **double issuance** (which occurs if more than one certificate is issued/booked for the same emissions profile) or **double use** of the same emission profile (which occurs when the same issued certificate is claimed twice) (288, Piris-Cabezas, n.d.) *[Tier C]*.

Double claiming can occur if the same emissions profile is claimed against different types of climate goals in different accounting systems (e.g. emission profile is claimed towards a company's emission targets, while the same credit is claimed towards the NDC target of a

[2] "Erroneous double counting" is a term coined by the Smart Freight Centre (345, Smith and Lewis, 2023)

country) (VCM Primer, 2023). Double claiming can also occur within scope 3 emission when multiple entities in the same value chain account for the scope 3 emissions from a single emission source (though should be reported in different scope 3 categories). This practice is recognized by the GHGP (375, SustainCERT, 2023) *[Tier C]*, and is not considered as erroneous double counting.

As far as possible, the report provides additional context to clearly differentiate between the double counting and double claiming risks being described.

5. CROSS-CUTTING TAKE-AWAYS FOR ALL CERTIFICATE TYPES

Creating cross-EAC themes from the evidence submitted was challenging due to the nascent nature of the various types of EACs, which often meant there was a shortage of rigorous evidence, and within evidence there was a lack of consistency in methodologies and definitions. This notwithstanding, there were few common concepts that arose from the evidence submitted.

One major discussion centers on whether EACs should solely represent emissions performance or also account for emissions reductions. While attributional methods dominate current practices, some pieces of evidence argue for consequential approaches that reflect broader system-wide effects. Additionally, there is no conclusive evidence on the best GHG accounting methodologies for different types of EACs, as sector-specific variations complicate standardization. Finally, the review has highlighted various mechanisms that could be adopted to ensure EACs contribute to drive positive impacts at the system level, but further research is needed to assess their validity and applicability in different regional and sectorial contexts.

There are opposing views in literature on whether or not EACs should represent emissions performance or also emissions reductions

EACs are widely regarded as tools that convey the climate-related performance of a product, assessed using an attributional approach that considers only lifecycle GHG emissions within the supply chain. This is the standard practice for physical product sales, even when EACs are unbundled due to co-mingled infrastructure constraints. Some argue, however, that EACs should also represent emissions reductions by incorporating consequential accounting that reflects the broader system-wide emissions impact. For instance, Gillenwater (182, GHG Management Institute, 2023) [Tier C] suggests adopting a consequential approach that measures emissions reductions, as environmental attributes should not be conveyed through financial contracts without a physical transfer of the product.

In contrast, the Environmental Markets Association (2023) [Tier C] warns that moving away from market-based accounting could discourage investment in emissions reduction activities, ultimately hindering progress towards climate goals.

Further debate exists on whether EACs should drive systemic decarbonization. Some submissions propose additional mechanisms, such as eligibility rules, additionality criteria, and correlation requirements, to ensure EACs lead to real emissions reductions rather than just reallocating existing low-carbon attributes.

There is no conclusive evidence on the appropriate GHG accounting methodologies to be used per EAC type

There is no universally accepted methodology for attributing emissions to EAC and different sectors apply distinct approaches, leading to inconsistencies in how emissions are assigned and accounted for.

Electricity EACs use an attributional approach (e.g., market-based scope 2 accounting), which allows entities to claim zero emissions for procured renewable electricity. However, evidence highlights that this approach does not systematically account for the emissions impact of time- and location-based grid variability. Some sources argue that marginal emissions factors should be incorporated to better reflect the actual impact of renewable electricity procurement.

Fuel EACs incorporate regulatory lifecycle analysis (e.g., EU RED, California LCFS), but there is ongoing debate over whether indirect emissions, such as those from land-use change and feedstock production, should be included. Some policies, like California's Low Carbon Fuel Standard, factor in displacement credits, while others exclude these considerations.

Commodity EACs exhibit the highest level of inconsistency, with some frameworks relying on sectoral benchmarks while others propose intervention-based accounting approaches. Unlike electricity and fuels, there is no widely accepted method for defining emissions reductions, and evidence remains insufficient to determine best practices.

There is no consensus on how to ensure positive impacts of EACs on the wider system

There is debate over whether EACs should ensure positive impacts on the wider system or simply avoid negative impacts, leading to discussions on rules linking EAC claims to the physical use of low-carbon products. These rules could require temporal or geographical correlations, ensuring EACs lead to positive impacts without fully shifting to a consequential approach. Overall, the discussions found in the evidence are mainly focusing on geographical and temporal correlation, policy additionality, and financial additionality and

reflect ongoing debates about how EACs should represent emissions performance and reductions across different sectors.

For electricity EACs, some evidence suggests that limiting EAC claims to the same grid or region could better align renewable energy generation with local demand, improving system-wide decarbonization outcomes. Some submissions mention that introducing geographical constraints would incentivize the development, production, and consumption of renewables at more efficient locations (ENTSO-E (2022) [Tier B]) while also improving emissions accounting accuracy (Clean Incentive (2023) [Tier C]). Other pieces of evidence argue that without geographic restrictions, renewable deployment occurs in the least-cost areas rather than in regions where emissions reductions could be greater (IEA (2022) [Tier B], Sumner et al. (2023) [Tier B]).

Temporal correlation is also mainly relevant to electricity, where a lack of it could lead to EACs being claimed at times of high fossil generation. To prevent this, rules are being developed to better align the timing of EAC generation and consumption. In fuels, temporal correlation could be addressed by setting vintage periods to enhance transparency.

Policy additionality is another area of debate. It concerns whether EACs should represent emissions reductions beyond what is required by policy. In fuels, EACs used for compliance are typically non-additional, while those supported by grants or tax credits are considered additional. In electricity, policy additionality varies by region. This debate is also linked to concerns about double counting emissions under different GHG accounting methods. Setting rules on additionality could prevent double counting but might raise EAC costs, affecting their market demand signal.

Financial additionality questions whether EACs should only be generated when the revenue is necessary for the intervention. This would require supply chain transparency, impacting claims of emissions reductions. Concerns exist about oversupply from profitable hydropower in Norway，and overcompensation in biomethane EACs in the UK. In commodities, financial additionality is linked to the "carbon bank" approach for green steel certification.

LIMITATIONS

As outlined in Part 1, there are a number of limitations associated with the SBTi's Call for Evidence on the role of EACs in corporate climate targets. Firstly, across EAC types the respondent pool was largely made up of businesses, with minimal input from academia, community groups, or cultural organizations, limiting the diversity of perspectives. Furthermore, the accepted evidence base was relatively small (±440 submissions) and likely does not fully represent the broader body of relevant research. This could be in part due to the stringent conditions around acceptance of evidence (see full conditions here), ambiguities in terminology, scope, and research question phrasing may have deterred relevant submissions.

Another reason for the evidence base being small was due to the nascent nature of EACs and the relatively low level of research carried out on this topic, for example, there was 0 tier A evidence submitted on commodity EACs. SBTi recognizes that this is a rapidly evolving area of research and therefore it is important to acknowledge that this report does not include any literature that was published after the closing of the Call for Evidence in 2023. Another core challenge in synthesizing the evidence is the heterogeneity of different EAC types and methodologies referenced in the evidence submitted to the SBTi and therefore it is challenging to generalize the findings. Full description of the limitations around the Call for Evidence of process are outlined in Part 1.

AREAS FOR FURTHER RESEARCH

The evidence submitted for the different commodity types highlighted that while electricity certificates are widely used, fuel and commodity level certificates are still at a relatively early stage of their development.

The evidence revealed that there is still a lack of clear guidance on key conditions under which EACs become effective, such as **treatment of activity pools and associated CoC models, GHG accounting approaches and appropriate labelling**. The potential of EACs to facilitate system-wide decarbonisation is expected to depend significantly on the exact conditions through which these certificates are generated and procured. Hence there is a need for clearer guidance, before practices that are ineffective for driving system-wide decarbonisation become entrenched.

Moreover, there are several areas of debate in EACs that were notably not mentioned in any of the evidence submitted;

- Any consideration of the interaction between EACs and **alignment targets**[3] as being considered as an option by SBTi. SBTi's work on this topic was published after the call for evidence.
- **Non-renewable energy EACs**: There was no evidence submitted discussing how the emission profiles of non-renewable energy sources (e.g. blue hydrogen, nuclear electricity, etc.) should be assessed for EACs.
- **Negative emissions**: Some technologies such as BECCS (bioenergy with carbon capture and storage) and more have the potential to produce a product with negative lifecycle GHG emissions. No evidence was provided on whether EACs should be able to represent emission profiles less than zero (note that emission profiles less than zero would be possible if consequential LCA approaches are used in some products today e.g. biomethane).
- **Emission threshold**: In fuels, many existing EAC programs and standards have set maximum emission thresholds (e.g. SAF must meet 60% emission savings compared to

[3] SBTi Research: Scope 3 Discussion Paper. Aligning Corporate Value Chains to Global Climate Goals, 2024

fossil comparators). The impact of this and whether it is important that EACs should have a maximum level of emissions have not been discussed.

- **Long term contracts**: No evidence discussed the conditions under which the use of EACs towards meeting SBTi targets should be allowed. For example, will companies need a long-term contract for EAC purchase to demonstrate that EACs could be used for meeting SBTi targets? If this is not the case, it is possible that the planned spot purchases of EACs by multiple companies could outstrip supply, and therefore not be credible collectively.

REFERENCES

Center for Resource Solutions. 2024. Guidance for Calculating Residual Mix. https://resource-solutions.org/wp-content/uploads/2024/03/030624.pdf

Clean Incentive. 2023. Power Emissions Certificates: A New Registry to Maximize the Carbon Impact of Renewable Energy, Version 1.3

ENTSO-E. 2022. Views on a Future-Proof Market Design for Guarantees of Origin

Environmental Markets Association. 2023. Primer: REC Financing Mechanics for Renewable Energy Projects

GHG Management Institute. 2022. What is a baseline? https://ghginstitute.org/2022/03/14/what-is-a-baseline/

GHG Management Institute. 2023. What is greenhouse gas accounting? Fitting to purposes. https://ghginstitute.org/2023/03/08/what-is-greenhouse-gas-accounting-fitting-to-purposes

Greenhouse Gas Protocol (GHG Protocol). 2005. A corporate accounting and reporting standard. https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

GHG Protocol. 2022. Draft Land Sector and Removals Guidance: Part 2: Calculation guidance. https://ghgprotocol.org/sites/default/files/2022-12/Land-Sector-and-Removals-Guidance-Pilot-Testing-and-Review-Draft-Part-2.pdf

GHG Protocol. 2023. Inventory and Project Accounting: A comparative review. https://ghgprotocol.org/blog/inventory-and-project-accounting

GHG Protocol. 2023b. Scope 2 Guidance webpage. https://ghgprotocol.org/scope-2-guidance

Guinee, J. B. 2002. Handbook on life cycle assessment operational guide to the ISO standards. Int J LCA, (7), 311-313. https://doi.org/10.1007/BF02978897

ICVCM. 2022. ICVCM Public Consultation: Part 5: Terms and Definitions. https://icvcm.org/wp-content/uploads/2022/07/ICVCM-Public-Consultation-FINAL-Part-5.pdf

ICVCM. 2024. The Voluntary Carbon Market Explained. https://icvcm.org/voluntary-carbon-market-explained/

International Energy Agency. 2022. Methodology to assess the system value of different corporate procurement strategies in developing economies

IPCC. 2018. Annex I: Glossary. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change. Cambridge University Press, pp. 541–562. https://doi.org/10.1017/9781009157940.008

ISEAL. 2024. Consultation draft – Revised ISEAL Chain of Custody Definition and Model Guidance (Nov 24). https://isealalliance.org/get-involved/resources/consultation-draft-revised-iseal-chain-custody-models-and-definitions

ISO. 2006. Environmental management Life cycle assessment Principles and framework (ISO 14040:2006). https://www.iso.org/standard/37456.html

ISO. 2020. Chain of custody — General terminology and models. https://www.iso.org/obp/ui/#iso:std:iso:22095:dis:ed-1:v1:en

Kreibiehl, S., Yong Jung, T., Battiston, S., Carvajal, P.E., Clapp, C., Dasgupta, D., Dube, N., Jachnik, R., Morita, K., Samargandi, N., Williams, M. 2022. Investment and finance. In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Chapter15.pdf

Piris-Cabezas. n.d. The High-Integrity Sustainable Aviation Fuels Handbook. https://www.edf.org/sites/default/files/2022-08/EDF%20HIGH-INTEGRITY%20SAF%20HANDBOOK.pdf

RMI. 2019. Virtual Power Purchase Agreement. https://rmi.org/insight/virtual-power-purchase-agreement

Smith and Lewis. 2023. Voluntary Market Based Measures Framework for Logistics Emissions Accounting and Reporting.

Sumner et al. 2023. Status and Trends in the U.S. Voluntary Green Power Market (2021 Data). https://www.nrel.gov/docs/fy23osti/86162.pdf

SustainCERT. 2023. Environmental Attribute Certificates from Value Chain Interventions: A transport case study.

University of Calgary (2024). Energy Education. https://energyeducation.ca/encyclopedia/Dispatchable_source_of_electricity

UN-REDD Programme. 2021. Glossary. https://www.un-redd.org/glossary/compliance-regulatory-market

US EPA. 2024. Energy attribute certificates (EACs). https://www.epa.gov/green-power-markets/energy-attribute-certificates-eacs

VCM Primer. 2023. The Voluntary Carbon Market Explained. https://vcmprimer.org/wp-content/uploads/2023/12/vcm-explained-full-report.pdf

World Bank. 2023. What you need to know about abatement costs and decarbonisation. https://www.worldbank.org/en/news/feature/2023/04/20/what-you-need-to-know-about-abatement-costs-and-decarbonisation

WRI and WBCSD. 2015. GHG Protocol Scope 2 Guidance. https://ghgprotocol.org/sites/default/files/2023-03/Scope%202%20Guidance.pdf

ANNEX A: DETAILED METHODOLOGY

Call for Evidence scope and structure

The SBTi issued an open Call for Evidence on the Effectiveness of Environmental Attribute Certificates in Corporate Climate Targets from September 21 to November 24, 2023.

The following types of environmental attribute certificate were defined as within the scope of the Call for Evidence:

- Energy attribute certificates for electricity
- Other energy carrier certificates, e.g. green hydrogen, green gas, sustainable aviation fuel certificates (SAFc)
- Emissions reduction credits
- Certified commodities conveying a specific emission factor, e.g. green steel

The SBTi specified the types of evidence sought through the open call, including: empirical data and research studies, reports and white papers, statistical information, case studies and examples, surveys/polls and legal and regulatory analysis.

Respondents to the Call for Evidence were given the option to submit evidence via direct upload to a SurveyMonkey form, or by email to the SBTi. Each SurveyMonkey submission could include up to five pieces of evidence, but respondents were not limited in the number of times they could respond to the SurveyMonkey form.

Respondents were asked to provide information about themselves (e.g. stakeholder category and contact information) and about the evidence (e.g. evidence type, potential conflicts of interest inherent within the evidence, the perceived relevance of the evidence to the four types of certificates, and the perceived relevance of the evidence to a set of eight research questions).

Respondents that submitted evidence via the SurveyMonkey form were asked to indicate the position that the evidence supports (in their opinion) across each of the eight research questions below:

1. What evidence exists about the effectiveness or ineffectiveness of environmental attribute certificates in delivering measurable emission reductions? (Response options: Effectiveness; Ineffectiveness; Not sure/Other)
2. What evidence supports or opposes a causal link between specific operating conditions (geographies, regulatory schemes, presence or absence of tracking mechanisms or registries, etc.) and the effectiveness of environmental attribute certificates to deliver emission reductions? Which conditions? (Response options: Supports; Opposes; Not sure/Other)
3. What regulatory safeguards and market infrastructure, if any, would need to be put in place for environmental attribute certificates to be effective and sustainable? (Response options: Regulatory and/or safeguards market infrastructure needed; No safeguards infrastructure needed; Not sure/Other)

4. What evidence supports or opposes the ability of environmental attribute certificates to accurately reflect and quantify emission reductions in the context of corporate climate abatement targets? (Response options: Supports; Opposes; Not sure/Other)
5. What evidence exists that uptake of attribute certificates leads to or hinders the transformation needed to reach climate stabilization? (Response options: Leads to transformation; Hinders transformation; Not sure/Other)
6. What specific evidence-based claims can and cannot be made when employing environmental attribute certificates to corporate decarbonization? (Open text box question)
7. Is there evidence that supports or undermines that the market value of this type of instrument is commensurate with the abatement costs of the underlying activity? (Response options: Supports; Undermines; Not sure/Other)
8. Is there evidence that shows that the use of these instruments (i.e. procurement of the attribute certificate) could contribute to scale-up of climate finance compared to alternative interventions? Or could it result in climate finance dilution? (Response options: Scale-up finance; Climate finance dilution; Not sure/Other)

Respondents also had the option to provide an explanation as to how and why the evidence they were submitting was relevant to the research questions, and to include a cover letter to accompany each piece of evidence.

Evidence submissions – data input

Evidence was submitted by a total of 421 individuals in the Call for Evidence response period. Some evidence was submitted by more than one respondent and therefore the SBTi team had to de-duplicate evidence submissions. A total of 406 unique pieces of evidence were submitted via the SurveyMonkey form and 32 additional pieces of unique evidence were submitted via email. Evidence that was deemed ineligible, for example if the submitter was anonymous or it was sent to the SBTi outside of the Call for Evidence period, is excluded from the SBTi's review.

Respondents classified 206 pieces of evidence as relevant to energy attribute certificates for electricity, 159 pieces of evidence as relevant to other energy carrier certificates, 111 pieces of evidence as relevant to emission reduction credits,[4] 43 pieces of evidence as relevant to certified commodities conveying a specific emission factor and 15 pieces of evidence as relevant to other unspecified types of EACs. Since some pieces of evidence were relevant to more than one type of EAC, the summed numbers in this paragraph do not equal the total unique pieces of evidence.

A table listing the eligible evidence submitted to the SBTi and the evidence which is not available online in the links provided in the table can be accessed here. Where the evidence submitted to the SBTi is protected by copyright the citation is provided and, where relevant, links to where the documents can be downloaded upon subscription and/or payment.

[4] This includes carbon credits that represent emissions reductions and avoided emissions.

Assessment of evidence

While the Call for Evidence SurveyMonkey respondents provided their own opinions about the relevance and findings of the evidence that they submitted, the SBTi developed a standardized methodology to systematically review and assess the evidence submitted. This more thorough examination was performed to summarize the findings of the evidence in relation to the research questions in a way that provides additional credibility to the information submitted by the respondent.

The assessment methodology comprises five steps:

1. **Initial evidence cleaning and categorization** which was conducted by the SBTi research team and comprises:
    a. Data cleaning
    b. Revision of the evidence type classification
    c. Categorization of evidence by "general leaning".
2. **Detailed evidence review** which was conducted by the review panel and comprises:
    a. Reading of the evidence and related information
    b. Categorization of evidence type
    c. Categorization of evidence based on its relevance to the research question
    d. Categorization of evidence according to the research question findings
    e. Determination of the risk of bias.
3. **Categorization of evidence into final tiers and relevance levels** which was conducted by the SBTi research team and comprises:
    a. Designation of evidence into tiers
    b. Designation of evidence according to overall relevance.
4. **Evidence synthesis and report writing** which was conducted by the SBTi research team and comprises:
    a. Final screening of review panel assessments
    b. Report writing.
5. **Quality review** which was conducted by the SBTi quality team and comprises:
    a. Ensuring that the strategic objectives of the research align with its outputs
    b. Conducting conflict of interest checks for authors, the review panel, and the review team
    c. Verifying scientific references and citations in the document
    d. Ensuring that proper research methodology and transparency is applied in the review process and ensuring fair, balanced information is provided
    e. Ensuring appropriate documentation, data handling procedures, and data privacy measures are followed.

Assessment step 1: Initial evidence cleaning and categorization

This first step of the assessment methodology includes data cleaning, revision of the evidence type classification, categorization of evidence into "default tiers" and categorization of evidence by its "general leaning". This phase of the assessment was conducted by the SBTi research staff that authored this report.

1.1 Data cleaning

The SBTi team collated the SurveyMonkey form submissions and the email submission data into a spreadsheet.

Each evidence submission was then screened against the eligibility requirements defined in the Call for Evidence. The Call for Evidence defined the following types of evidence that would be considered ineligible:

- Standalone submissions of anecdotal evidence, individual expert opinions or testimonials, or opinion pieces, as well as social media posts, unverified internet sources and biased or commercial sources will not be considered as acceptable evidence. Other unacceptable types of evidence include copyrighted, confidential or sensitive materials.
- Information that is behind paywalls, subscription barriers, or other access restrictions that may limit its availability.

Despite the inclusion of these eligibility requirements, there were a number of submissions that were copyrighted, marked as confidential or were behind paywalls or subscription barriers. Where the SBTi was not given permission to publish copyrighted, confidential or paywalled evidence, the citation of the evidence is provided only (see the full evidence list here).

Given the volume of peer-reviewed literature that was behind a paywall, the SBTi made a decision to include the discussion of this evidence in this report, despite having stated this evidence would be considered ineligible. Similarly, the SBTi chose to include published opinion pieces where they were considered relevant to the research questions.

The Call for Evidence also specified that anonymous submissions will not be considered and therefore evidence was considered ineligible where submitters did not complete their identification details. Evidence submitted by individuals via the SurveyMonkey that did not agree to the terms of the submission, and evidence that was submitted outside of the Call for Evidence period were also excluded.

Evidence was also considered ineligible where submissions were clearly marked as test submissions or where there was no evidence attached to the SurveyMonkey submission.

Each piece of eligible evidence was then reviewed to retrieve basic bibliographic information and to identify unique evidence, since several pieces of evidence were submitted more than once.

1.2 Revision of “evidence type” characterization

The next step was to refine the classification options for evidence type for each piece of evidence to aid the overall review process based on initial review of the responses received.

Table 5 below shows the revised categorization that was applied to evidence types, based upon the categorization originally provided by the evidence submitters according to the response options provided in the Call for Evidence survey.

The final categorization scheme included the introduction of the categories “Law or regulation”, “Controlled research study”, “Commentary or opinion” and “Literature review”; and removal of the “Empirical data or research study” category. Evidence that was submitted as “empirical data or research study” was recategorized by reviewers into the final categorization scheme, including “Statistical information”.

This categorization was developed after an initial review of the evidence submitted, in order to improve the granularity with which evidence was described and to facilitate the review process. For example, the original evidence types in the SurveyMonkey included the broad categories “Empirical data or research study”, but it was decided that empirical data alone, in the absence of a research study, would have a different default tier than a research study.

The SBTi identified during the review process that each submission of a piece of evidence might contain multiple nested types of evidence. For example, a white paper could contain a table that presents statistical information, which itself is derived from one or multiple controlled research studies. For these cases, each piece of evidence was classified as its overall type. Where one evidence file submitted to the SBTi contains multiple separate publications, they were disaggregated and classified and reviewed separately.

Table 5. Categorization of evidence type

Category	Definition
Report or white paper	An informative publication, containing data, observations, and/or policy proposals, that is not published in the academic literature.
Case study or example	A publication describing a case or “a number of cases of an intervention and outcome, with no comparison against a control group” (Bilotta et al., 2014).
Legal or regulatory analysis	A document that contains recommendations for policy or regulation or an assessment of the actual or expected impacts of a specific policy or regulation. This category includes policy or regulation proposals from the government authority that have not yet, and may not yet, be enacted into law.
Statistical information	“Data that has been recorded, classified, organized, related, or interpreted within a framework so that meaning emerges” (Statistics Canada, 2021). This category excludes statistical information derived from other types of evidence, such as from a survey or poll, or a controlled research study; these are categorized under those types.
Survey or poll	Results of a survey or poll that was not conducted as part of a controlled research study.
Law or regulation	Legal document that describes a statute, regulation, or ordinance that has been enacted into law.

Controlled research study[8]	A document presenting an inquiry undertaken to understand the effects of an intervention. This category may include randomized controlled trials, modeling studies, and observational studies.
News coverage[8]	Press releases, news releases, and/or pieces of journalism related to events. This category does not include opinion articles.
Commentary[8]	A publication where one or more authors express their subjective viewpoints, which may be informed by data or research. This category includes commentary articles published in peer-reviewed academic literature.
Literature review[8]	A critical, comprehensive evaluation of existing research on a specific topic. Reviews and meta-analyses published in peer-reviewed academic literature are included in this category. It may also include non-peer-reviewed publications.

1.3 Categorization of evidence by "general leaning"

As mentioned, respondents that submitted evidence via the SurveyMonkey form were asked to indicate whether the evidence that they submitted was (in their opinion) relevant or not to each of the eight research questions. They could also specify that they were "not sure" whether it was relevant or not. Respondents also stated the position that the evidence supports (in their opinion) across each of the eight research questions.

The following research questions had three survey response options which could generally be classified as "supportive of the EAC", "unsupportive of the EAC", and "not sure":

- Research question one: What evidence exists about the effectiveness or ineffectiveness of environmental attribute certificates in delivering measurable emission reductions? (Response options: Effectiveness; Ineffectiveness; Not sure/Other)
- Research question four: What evidence supports or opposes the ability of environmental attribute certificates to accurately reflect and quantify emissions reductions in the context of corporate climate abatement targets? (Response options: Supports; Opposes; Not sure/Other)
- Research question five: What evidence exists that uptake of attribute certificates leads to or hinders the transformation needed to reach climate stabilization? (Response options: Leads to transformation; Hinders transformation; Not sure/Other)
- Research question eight: Is there evidence that shows that the use of these instruments (i.e. procurement of the attribute certificate) could contribute to scale-up of climate finance compared to alternative interventions? Or could it result in climate finance dilution? (Response options: Scale-up finance; Climate finance dilution; Not sure/Other)

Research question two and three were not relevant for assessing the general leaning of evidence since they relate to the operating conditions under which EACs can be effective; research question six was not relevant because it did not have categorical response options;

and research question seven was not relevant on the basis that it relates to cost, not mitigation effectiveness directly.

As such, the survey submission results for research questions one, four, five and eight were used to define the "general leaning" of each unique piece of evidence – i.e., whether it was relevant to the research questions and supportive or unsupportive of the EAC.

If a piece of evidence was submitted by just one respondent then their survey response determined the "general leaning" alone. However, for pieces of evidence that were submitted by multiple respondents, the number of "supportive of the EAC", "unsupportive of the EAC", and "not sure" classifications for that piece of evidence were tallied up from all respondents across research questions one, four, five and eight.

The general leaning of each piece of evidence was then based on the following categorization:

- The evidence was categorized with a general leaning of "Other" where all respondents classified the evidence as irrelevant to all of research questions one, four, five and eight.
- The evidence was categorized with a general leaning of "Supportive" where at least 75% of classifications are, according to submitters, supportive of the EAC.
- The evidence was categorized with a general leaning of "Unsupportive" where at least 75% of classifications are, according to submitters, unsupportive of the EAC.
- The evidence was categorized with a general leaning of "Mixed" where none of the above conditions were met.

Assessment step 2: Detailed evidence review

This second step of the assessment methodology comprises the following steps:

- Reading of the evidence and related information
- Categorization of evidence type
- Categorization of evidence based on its relevance to the research question
- Categorization of evidence according to the research question findings
- Determination of the risk of bias
- Identification and collation of additional useful information

This phase of the assessment was conducted by ERM. Members of the review panel attested that they had no conflict of interest that would affect their review of each piece of evidence.

The evidence to be reviewed was split among the reviewers according to their areas of expertise, and with an effort to ensure that each reviewer reviewed a mix of evidence types and a mix of evidence according to its general leaning (as described in step 1.3 above). This was done to avoid the bias that could be introduced if, for example, all of one evidence type was reviewed by a single individual.

2.1 Reading of evidence and the related submission information

The first step was for each member of the review panel to read the evidence that was assigned to them for review. Where the submitter of the evidence indicated that only a section of the evidence was relevant, the reviewers read just this section. The reviewer also reviewed the supporting information – the survey response(s) and, where relevant, the cover letter(s), that related to that evidence submission.

2.2 Categorization of the evidence type

For each piece of evidence, the review panel categorized each piece of evidence according to the evidence types listed in Table 3 above. The categorization of the evidence according to the submitters was used to inform this, but it was ultimately down to the review panel to assign the final evidence type categorization.

As part of this categorization, the review panel also indicated whether the evidence was peer-reviewed and published in a journal, or a preprint for a peer-reviewed journal, and/or whether it was published by a government agency.

2.3 Categorization of evidence based on its relevance to the research question

For each piece of evidence, the review panel categorized each piece of evidence as “relevant”, “partially relevant” and “not relevant” to each research question in the context of electricity, fuel, and/or commodity EACs. The categorization of the evidence according to the submitters was used to inform this, but it was ultimately down to the review panel to assign the final categorization of relevance.

2.4 Categorization of evidence according to the research question findings

For each piece of evidence, the review panel considered the conclusions that can be drawn from the evidence in relation to each of the eight research questions (except research question six which was an open text question). For example, for research question one on the effectiveness or ineffectiveness of environmental attribute certificates in delivering measurable emission reductions, the review panel stated whether (in their opinion) the evidence supports their a) effectiveness, b) ineffectiveness, c) not sure/other. The responses provided by the evidence submitters were available to the reviewers as contextual information, but it was ultimately down to the review panel to draw conclusions from the evidence. The review panel members were able to provide information in an open text box to justify their response.

2.5 Determination of the risk of bias

Members of the review panel characterized the risk of bias in each piece of evidence – that is, the risk that a bias in the design of the inquiry affected the findings of the evidence. This characterization was only related to the evidence itself and did not consider the risk of bias relating to the submitter(s) of the evidence or risk of a biased body of evidence due to the format of an open call for evidence (although submitters were asked to declare any potential conflicts of interest through the survey). The reviewers selected from the following options to categorize each piece of evidence:

- Low/no apparent risk of bias

- Unclear/potential risk of bias
- Clear/high risk of bias

Examples of unclear or potential bias include:

- It was unclear how the observations being compared in an observational study were selected, and they may have been cherry-picked.
- The study was funded or conducted by an entity that appears to have a conflict of interest regarding the results of the study, and the authors have not included a conflict of interest statement.
- Statistical information compared two figures that were generated from different studies with different methodologies or other material characteristics, where the effect of these differences on the comparison was not apparent.

Examples of clear or high risk of bias include:

- An observational study did not account for obvious confounding variables between two groups or observations, such as observations situated in different regulatory, ecological, or economic contexts.
- An observational study drew conclusions based on a sample size that is insufficient to demonstrate statistical significance.
- A survey or poll had responses from a biased sample of the population, in relation to the topics and conclusions.
- Statistical information compared two figures that were generated from different studies with different methodologies or other material characteristics, where the effect of these differences on the comparison was apparent.
- Credible claims have been made that the study is fraudulent.

The review panel members used their expert judgment when deciding whether there were any additional features of the evidence that would mitigate any potential or clear risk of bias.

-

Assessment step 3: Categorization of evidence into final tiers and relevance levels

The information submitted by the review panel was collated into a spreadsheet and used to categorize each piece of evidence according to its risk of bias and overall relevance to the research questions and the type of EAC in question. This part of the assessment was completed by ERM.

This part of the assessment methodology draws from the quality of evidence framework proposed by Bilotta et al. (2014). Bilotta et al. apply best practice from the medical field to environmental decision-making, identifying three main domains that influence the quality of evidence: the risk of bias, the relevance of the evidence to the area of interest, and the chance of random error.

While the approach of Bilotta et al. was designed for meta-analysis of research studies, the SBTi research team extended the approach, broadening it to be applicable to the much broader range of evidence types that were submitted to the Call for Evidence. The third domain, chance of random error, was not considered for this assessment because the vast

majority of evidence was not suited for assessing or discerning this information in that they were not controlled studies of the effects of an intervention. Therefore the SBTi condensed from the original three to two main factors that influence the quality of evidence: risk of bias and relevance.

3.1 Designation of evidence into tiers

Each piece of evidence was first assigned a default tier based on the evidence type, whether it was published in a peer-reviewed journal, and whether it was published by a governmental entity. These tiers are not intended to strictly represent a hierarchy of quality, but are meant to aid in general prioritization of evidence that is likely to be least subject to bias and most relevant to this research inquiry. Table 6 below shows the default tiers for each combination.

Individual evidence was then reviewed and the tier could be adjusted if issues were detected in either of the two domains. Each domain could result in one adjustment, and severe or multiple issues could result in two adjustments due to any domain. Where the type of evidence was not listed in the table, the default tier was manually assigned and validated by another reviewer. Furthermore, certain publications from international organizations (e.g. IPCC reports) are reviewed by experts according to well documented review protocols. These documents, although not published in peer-reviewed journals, were initially classified into Tier A.

Note that generalizability is not a factor in determining placement into the tiers but is relevant for examining the entire body of evidence and how generalizable it is overall to the EACs of interest.

Table 6. Default evidence tiers

Evidence type	Definition	Peer-reviewed journal	Published by a gov. organization	Default tier	Notes
Case study or example	A publication describing a case or "a number of cases of an intervention and outcome, with no comparison against a control group" (Bilotta et al. (2014)).	Yes	Any	B	
		No		C	
Commentary	A publication where one or more authors express their subjective viewpoints, which may be informed by data or research. This category includes commentary articles published in peer-reviewed academic literature.	Any	Any	C	
Controlled research study	A document presenting an inquiry undertaken to understand the effects of an intervention. This	Yes	Any	A	

	category may include randomized controlled trials, modeling studies, and observational studies.	No		B	
Law or regulation	Legal document that describes a statute, regulation, or ordinance that has been enacted into law.	Yes	Any	N/A	
		No		A	
Legal or regulatory analysis	A document that contains recommendations for policy or regulation or an assessment of the actual or expected impacts of a specific policy or regulation. This category includes policy or regulation proposals from the government authority that have not yet, and may not yet, be enacted into law.	Yes	Any	A	
		No	Yes	B	
			No	C	
Literature review	A critical, comprehensive evaluation of existing research on a specific topic. Reviews and meta-analyses published in peer-reviewed academic literature are included in this category. It may also include non-peer-reviewed publications.	Yes	Any	A	
		No		C	
News coverage	Press releases, news releases, and/or pieces of journalism related to events. This category does not include opinion articles.	Yes	Any	N/A	
		No		C	
Report or white paper	An informative publication, containing data, observations, and/or policy proposals, that is not published in the academic literature.	Yes	Any	N/A	
		No	Yes	B	
			No	C	
Statistical information	“Data that has been recorded, classified, organized, related, or interpreted within a framework so that meaning emerges” (Statistics Canada, 2021). This category excludes statistical information derived from other types of evidence, such as from a survey or poll, or a controlled research study; these shall be categorized under those types.	Yes	Any	N/A	Would be categorized in another evidence type
		No	Any	C	
Survey or poll	Results of a survey or poll that was not conducted as part of a controlled research study.	Yes	Any	N/A	Would be categorized in another

					evidence type
		No		B	

3.2 Designation of evidence according to overall relevance

In assessment step 2.3, the review panel categorized each piece of evidence as “relevant”, “partially relevant” and “not relevant” to each research question in the context of electricity, fuel, and/or commodity EACs.

The next step was then to determine the overall relevance of each piece of evidence across all eight research questions. Each piece of evidence was initially assumed to be “relevant”. Evidence could then be downgraded to an overall relevance rating of “partially relevant” or “not relevant” if it was considered “partially relevant” or “not relevant” by the review panel for all eight of the research questions (in the context of electricity, fuel, and/or commodity EACs). One downgrade level, i.e. from relevant to partially relevant, could be imposed for reasons such as: the evidence discusses issues with types of credits or certificates that may be applicable to the type of EAC in question, or the evidence discusses the use of EACs for the purposes of compliance with regulations where the conclusions may be applicable to voluntary use by companies.

Two downgrade levels, i.e. from “relevant” to “not relevant”, could be imposed for reasons such as: the evidence is not related to emissions or climate, or the evidence is not relevant to any of the research questions.

Assessment step 4: Evidence synthesis and report writing

4.1 Final screening of review panel assessments

The report authors performed a final screening of review panel assessments for consistency and performed spot checks on categorizations of evidence into tiers. The report authors also identified evidence that was entirely irrelevant to our research inquiry and excluded these from the body of evidence discussed in this research report. Please see Annex A of each chapter for a list of evidence that was considered not relevant.

4.2 Report writing

The report authors reviewed the information collated by the review panel and read the relevant and partially relevant papers to identify the key themes across the full body of relevant evidence. In writing each chapter of this report, the research questions were grouped into five or six themes that cover common findings across the body of evidence.

Several pieces of evidence were relevant to more than one research question and more than one theme, and are therefore mentioned more than once in a chapter.