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TOPICAL REVIEW

A systematic review of the voluntary governance landscape for an urgent, high-integrity, and equitable transition to net zero

M Becker[1,2,*], A McGivern[1,2], K Axelsson[1,2], J P R Thorn[3,4,5], M Buytaert[2], M Collett[2], N Kamenkovich[2] and B Lee[2]

[1] Smith School of Enterprise and the Environment, University of Oxford, Oxford, United Kingdom
[2] School of Geography and the Environment, University of Oxford, Oxford, United Kingdom
[3] Centre for Environmental Policy, Imperial College London, London, United Kingdom
[4] Department of Environmental Sciences, University of Namibia, Windhoek, Namibia
[5] School of Geography and Sustainable Development, University of St Andrews, St Andrews, United Kingdom
[*] Author to whom any correspondence should be addressed.

E-mail: Matilda.becker@ouce.ox.ac.uk

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Abstract

This article systematically reviews guidance for non-state entities on transitioning to net zero. The voluntary governance system for corporate climate action consists of a competitive landscape with many documents setting the rules for alignment with 'net zero'. Our analysis considers the extent to which this landscape supports organizations to transition with integrity, urgency, and equity. Our review assesses the convergence and gaps between documents, and highlights areas of agreement that should urgently be translated into immediate action by organizations, formal standards, and regulations. These include interim targets, quantification and target-setting for Scope 3 emissions, and separate reporting of carbon credits from inventory emissions reductions. Where net-zero guidance is vague, lacking operational detail or contradictory (such as how to reduce Scope 3 emissions, phase out fossil fuels, or embed justice and equity into net-zero strategies) there is risk of weakened organizational action. We present key recommendations to reduce integrity risks and strengthen the net-zero voluntary governance landscape.

1. Introduction

Non-state entities such as companies, subnational governments, and cities must take responsibility to significantly reduce their carbon and greenhouse gas emissions (GHGs) to meet the Paris Agreement's goal of keeping warming to well below 2 °C above pre-industrial levels this century, and working to limit temperature increases even further to 1.5 °C [1]. Net-zero carbon emissions by 2050, accompanied by sustained reductions in other greenhouse gases thereafter now serves as a target to achieve the Paris Agreement's goal. To this end, a suite of voluntary initiatives and guidelines has emerged to help translate global net-zero goals into best practice for non-state entities. This includes specific guidance on, inter alia, how to quantify emissions, and how to set, meet, and report progress towards net-zero targets. This guidance has had tremendous uptake in recent years, with corporate net-zero targets increasing year-on-year [2]. Yet, current efforts by non-state entities to reduce their emissions and contribute to global net zero are inadequate for the pace of decarbonization needed to stay within 1.5 °C or even 2 °C [3, 4].

In this context, this research asks *what* documents exist to guide organizations' net-zero trajectories, and *how* organizations are being asked to decarbonize. It is as important to understand what is *left out* as what is *included* within guidance, both to provide a sentinel for where governance discourse on different matters stand, and to highlight the best practice guidance available. We deploy systematic review methodologies to examine the voluntary landscape of net-zero standards, initiatives, and orchestration campaigns. We establish how global net zero is being translated to the organizational level, and the major gaps or inconsistencies in existing guidance that threatens the development of "good" net-zero strategies and transition

plans, which we define as those aligned with the principles of urgency, integrity and justice [5]:

- **Urgency**: Frontloaded, comprehensive approach to emissions reductions that is compatible with a 28%–42% reduction in emissions by 2030 compared with 2023, and aligns with emissions pathways for either 2 °C or 1.5 °C warming [5, 6].
- **Integrity:** Alignment of science-based commitments with actions and investments; offsets must be verified by a third party [7]; and use of carbon dioxide removal should consider '[constraints posed] by cost considerations and geopolitical factors, as well as by biological, geological, technological and institutional limitations on our ability to remove carbon from the atmosphere and store it durably and safely' [5].
- **Equity:** A fair spread of burdens across geographies and sectors for meeting global net-zero targets, where equity is aligned with sustainable development objectives, efforts to eradicate poverty and broader systematic socio-ecological objectives [5, 8]. Equity incorporates procedural, distributive, recognitional and restorative justice [9].

Our work is conducted during a pivotal period for the voluntary standards landscape, when several major [10] standards are being updated, such as the Science Based Targets initiative (SBTi) Corporate Net Zero Standard and the Greenhouse Gas Protocol (GHG Protocol); or being formalized, including the formalization of the International Organization for Standardization's (ISO) Net Zero Guidelines into a standard. The landscape of voluntary governance initiatives is populated by global coalitions of state and non-state entities, bringing opportunities and risks associated with diverse agendas, intentions, and capacities. In this context, our research establishes existing expectations for net-zero good practice from non-state entities which should be included in any standard update, and the gaps that must be closed. These matter because the voluntary governance landscape increasingly informs net-zero regulations, including those on disclosure, procurement, and transition planning [11, 12].

Yet the negotiation and clarification of technical details raise political questions, and politics is deeply imbued in rule-setting processes [13, 14]. Two key tensions exist around how the "rules" of net-zero should be translated from physical science principle into socio-political and economic global organizational norms. The first relates to how decarbonization pathways and carbon budgets are translated from the global to the local/organizational scale, and the compromises and opportunities of these approaches; and second, whether and how decarbonization responsibilities should be differentiated between heterogenous organizations, and the level of urgency and ambition in different entities' net-zero transitions.

Tensions about how to apportion remaining responsibility for climate action are also informed by recent international legal rulings, including by the International Court of Justice and the Inter-American Court of Human Rights; the former reinforcing the obligation of states to protect the climate under international treaties, and the latter affirming the right to a stable environment and responsibility of nation states to regulate corporate emissions [15]. The International Court of Justice also stated that states' obligations include the regulation of non-state actors (including corporations), in assessing their due diligence on mitigation action. These rulings may increase the pressure from states on companies to decarbonize operations, particularly in jurisdictions that have historically contributed more to global warming. Questions about how non-state actors can be expected to manage differentiated responsibilities within a shrinking global carbon budget are therefore raised—a core question examined by this review. We explore a gap in current voluntary guidance as to how companies decarbonizing towards net zero should reflect principles of urgency, integrity and fairness in the ambition of their targets and the content of their transition plans. We explore the consequences of our results in the context of these principles in the discussion section of this paper.

In this paper, we evaluate the extent to which attributes of "good" net zero are accounted for within the current net-zero voluntary governance landscape, while recognizing that negotiating this governance system is a highly political process. We seek to bring clarity to these debates by identifying elements for which guidance is settled (i.e. where there is a high level of agreement between guidance documents); near settled (i.e. where there is fair level of agreement between guidance documents); and where there are gaps created by missing or divergent guidance between documents. We then discuss implications of these findings for resolving current tensions that overshadow governance-writing processes and identify opportunities for the net-zero governance landscape to ratchet ambition and rigor.

2. Method

We summarize the systematic review methodology used in this research, but detailed explanations of methods and rationale are found in Appendices 1–8. By employing a systematic review methodology, we take inspiration from environmental and health researchers [16, 17] who frequently assess the stringency of guidelines, protocols, and standards relating to high-stakes issues. This method is useful for climate governance researchers to assess the state of

Table 1. Description of approaches used to identify relevant documents for analysis.

Method	Description
Bibliographic review	Reference lists from prior standards-mapping studies (McGivern *et al* [21]) were examined to generate a preliminary corpus of governance documents. Each was verified for updates or superseded versions.
Web-based search	Google Search was systematically queried, retrieving the first 1000 hits for each search string.
Grey-literature databases	Records were screened in *OpenGrey* and *BASE* to capture non-academic but policy-relevant sources.
Expert consultation	Twenty-seven international experts were contacted via email, of whom eight provided additional recommendations.
Reference snowballing	The bibliographies of all included documents were examined for further eligible materials.

evidence and establish best-practice amongst different forms of guidance and enhance effective management. Systematic review approaches further allow researchers to identify inconsistencies in guidance that weaken safe practice and lead to unintended consequences. With the objective of contributing knowledge that closes loopholes in net-zero guidance, we apply this methodological focus on guidelines, standards and protocols.

The review follows the *Collaboration for Environmental Evidence Guidelines and Standards for Evidence Synthesis in Environmental Management* [18] and the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)* framework [19] to ensure rigor, reproducibility, and minimization of bias. Following Godin *et al* [20], five approaches were used to identify relevant documents (table 1). Searches were conducted between 26 and 29 January 2024, yielding 1027 unique results after deduplication. The list of search returns where duplicates have been removed is contained within Appendix 4. The PRISMA flow diagram summarizing screening stages is provided in Appendix 6.

Eligibility criteria were established *a priori* (table 2). The review covered documents published from 1 January 2015 to 1 February 2024, reflecting the post-Paris Agreement proliferation of voluntary net-zero initiatives. Two earlier foundational standards—the *Greenhouse Gas Protocol Corporate Standard* (2004) and the *GHG Protocol Scope 3 Standard* (2013)—were also included because they underpin subsequent frameworks globally [10].

Regulatory documents were excluded from the search because, as described by [22, 23], voluntary standards and guidelines are a unique and separate body of instruments from regulatory documents. While regulation can be defined as 'instruments by which governments set requirements on enterprises and citizens' [24]there is no single definitions of voluntary standard or guidance. However, for clarity, Hale's [22]descriptions for the voluntary sector were used, summarized as:

- *Standards* are auditable prescriptions of a minimum set of actions and practices, which create a common language for evaluating and determining performance.
- *Guidelines* are more flexible prescriptions of best practice for a set of actions and practices. A set of guidelines may help an entity to correctly implement standards.

The uptake or usership of each of the documents was not used as an inclusion/exclusion criterion, because most of the documents in our sample do not publicize a list or count of entities using, or reporting to, their guidance/initiative. Exceptions to this include SBTi, which recorded its 10,000th company with a validated science-based target in January 2026 [25]; CDP which captured climate disclosures from over 22,000 companies in 2025 [26]; Race to Zero, which lists 17,000 members [27]; and B Corp, which has 6000 certified B Corporation companies globally as of January 2026 [28].

Each document was assessed against seven stages representing a comprehensive net-zero strategy:

1. Prepare—organizational leadership, governance, and capacity for transition;
2. Quantify—emissions quantification, boundaries, and methodologies;
3. Target—design and scope of emissions-reduction targets;
4. Plan—operational and financial transition actions;
5. Counterbalance—carbon-credit use, permanence, and additionality;
6. Impact—social and environmental co-benefits, adaptation, and advocacy;
7. Report—disclosure, audit, and alignment with frameworks such as TCFD/IFRS.

Documents lacking relevant material for a given stage were coded 'not relevant' for that stage to avoid skewing summary statistics.

Three reviewers with expertise in sustainable business and climate policy (M. Bu., N. K., M. C.) independently screened all 1027 records at title, abstract, and full-text stages. Reasons for exclusion were documented in a master Excel database. To ensure inter-reviewer reliability, a Randolph Kappa analysis was conducted on a 10% random subsample

Table 2. Inclusion and exclusion criteria applied to the search returns to achieve the final documents for analysis, (see also Appendix 5 for rationale).

Search parameter 1 January 2015–1 February 2024	
Inclusion criteria	Exclusion criteria
• Voluntary guidance • Publicly available • Published in English • Applicable across two or more countries • Sector-agnostic • Cover at least one of the 'seven stages' of the net-zero strategy • Net zero guidance or standard.	• Mandatory regulation • Pay-to-use/behind a paywall • Not available in English • Applicable in only one country • Sector-specific • Limited to no coverage of at least one of the seven stages of the net-zero strategy • Academic, regulatory or policy documents.

(c. 100 records). The resulting free-marginal $\kappa = 0.97$ and fixed-marginal $\kappa = 0.85$ demonstrated excellent agreement (>0.7 threshold). Discrepancies were resolved through consensus discussions, overseen by three project leads (M. Be., A. M., K. A.). The final dataset comprised 36 eligible documents (appendix 7/table 3).

A structured codebook (Appendix 7) was designed to assess the presence and strength of guidance across the seven net-zero stages. Codebook development drew from three main sources:

1. Recommendations of the UN high-level expert group on net-zero emissions commitments of non-state entities [7];
2. Criteria articulated by [5, 21]—'The meaning of net zero and how to get it right' and 'Defining Net Zero for Organizations'.
3. Examples of best practice identified within the documents themselves during preliminary review.

Each document was systematically assessed against the codebook using closed categorical responses ('Yes', 'No', or 'Not Specified'). Additional intermediate options (e.g. 'Yes, with conditions') were introduced iteratively when necessary for clarity and specificity. Coding took place between 12 February 2024 and 14 March 2024, with twice-weekly calibration meetings among coders and project leads to maintain interpretive consistency. Following completion, the entire dataset was reviewed question-by-question to verify coherence in interpretation and assessment; any residual ambiguities were resolved through consensus discussion and additional review of documents as necessary.

Quantitative and qualitative analyses were performed to identify convergence and divergence across standards. Following [29], each criterion was evaluated both for the presence of a prescribed action ('yes' or 'no') and for qualitative detail on performance expectations ('how' and 'when'). Where guidance was vague or absent, the item was coded as 'not specified'. Frequency analyses were then used to summarize the proportion of documents meeting each criterion. Descriptive statistics and trend summaries were produced, and detailed results are presented in an accompanying white paper [30].

Readers should note that as the review was completed in early 2024, subsequent revisions to key standards including the 2025 draft updates to the SBTi Corporate Net Zero Standard, Greenhouse Gas Protocol, GRI Climate Change Standard, and BCorp Climate Action Standard were not captured. The findings should therefore be interpreted as a snapshot of the voluntary net-zero governance landscape as of the first quarter of 2024.

3. Results

The voluntary net-zero governance materials we sampled demonstrate convergence on high-level actions for urgent and equitable decarbonization. Yet, detail is often missing, weakening the integrity of those recommended actions. The documents provide guidance on high-level accounting, strategic decision-making and business operations in the following ways.

3.1. Urgency

Urgency in net-zero strategies is demonstrated by setting a science-based target in line with IEA or IPCC climate scenarios for limiting warming to between 1.5 °C and 2 °C. Setting a science-based target is recommended by over 80% or 28 of all documents, but the IPCC and IEA pathways are explicitly mentioned by only half or 14 of those documents. A target of 1.5 °C–2 °C is explicitly mentioned by 19 or 58% of all sampled documents. In this context, some documents lack specific detail on operationalization of these targets: one third of guidance does not provide a

Table 3. List of documents assessed in this review. Schemes and their documents are separated into three categories: guidance, disclosures, and assessment frameworks, which correspond to the documents' objectives. These distinctions are intended to demonstrate the ecosystem of documents constituting the net-zero voluntary governance landscape, and the interacting roles between them.

Scheme name	Scheme document name	Country
	GUIDANCE	
Cambridge institute for sustainability leadership (CISL)	Targeting net zero: a strategic framework for business action, 2020	United kingdom
Carbone 4 (CAR4)	Net zero initiative, a framework for Collective carbon neutrality, 2020	France
Ceres (CERES)	Ceres roadmap 2030	USA
Chapter zero (CHA0)	[1] Board toolkit [2] Transition planning toolkit scorecard	United kingdom
Climate action 100+ (CA100)	Climate action 100+ net zero company benchmark 2.0, March 2023	France/international partners (Asia investor group on climate change, CERES, PRI (United Nations), IGCC, IIGCC)
Exponential roadmap initiative (ERI)	THE 1.5 °C BUSINESS PLAYBOOK V3.0, Sept 2023	Sweden
Gold standard (GOLDS)	Corporate climate stewardship guidelines	Switzerland
Greenhouse gas protocol (GGPC)	The greenhouse gas protocol: a corporate accounting and reporting standard, 2004	USA
Greenhouse gas protocol (GGPS3)	Corporate value chain (Scope 3) accounting and reporting standard, 2011	USA
Institutional investors group on climate change (IIGC)	Investor expectations of corporate transition plans: from A to zero	United kingdom
International organization for standardization (ISO14064)	ISO 14064:2018-1—greenhouse gases	Switzerland (but with representation from 175 countries)
International organization for standardization (IWA42)	IWA42 2022: net zero guidelines (aka 'iso net zero guidelines')	Switzerland (but with representation from 175 countries)
Investors group on climate change (IGCC)	CORPORATE CLIMATE TRANSITION PLANS: a guide to investor expectations	Australia and New Zealand
OECD (OECD)	Guidelines for multinational enterprises on responsible business conduct	France (with 38 member countries)
Race to zero 3.0 (RTZ3)	Race to zero starting line and leadership practices 3.0, 2022	United nations—backed global campaign
Science based target initiative (corporate net zero standard criteria) (SBTIC)	SBTi corporate net-zero standard criteria, version 1.1, April 2023	United kingdom
The university of oxford (OOP)	The oxford principles for net zero aligned carbon offsetting, 2020	United kingdom
Transform to net zero (TNZ)	Climate transition action plans	Secretariat held by business for social responsibility (BSR), headquartered in the USA, but with global offices.
United nations high level Expert group on the net-zero Emissions commitments of Non-state entities (HLEG)	Integrity matters: net zero commitments by businesses, financial institutions, cities and regions	United nations
We mean business coalition (WMBC)	[1] THE 4A'S OF CLIMATE LEADERSHIP [2] CLIMATE TRANSITION ACTION PLANS	USA
World business council for sustainable development (WBCSD)	SOS 1.5 the road to a resilient, net-zero carbon future, 2020	Switzerland
World economic forum (WEF)	How to set up effective climate governance on corporate boards guiding principles and questions	Switzerland
	DISCLOSURE	
CDP (CDPGQ)	[1] CDP climate change 2023 questionnaire, v1.8, Aug 2023 [2] CDP climate change 2023 scoring methodology	United kingdom

(Continued.)

Table 3. (Continued.)

Scheme name	Scheme document name	Country
	GUIDANCE	
Glasgow financial alliance for net zero (GFANZ)	Expectations for real economy transition plans	United kingdom
Global reporting initiative (GRI)	GRI 305: emissions 2016, 2018	Netherlands
Global reporting initiative (GRI CED)	GRI topic standard project for climate Change—climate change exposure draft	Netherlands
IFRS/ISSB (IFRS)	IFRS S2 climate-related disclosures	United kingdom
SME climate hub (SMECH)	[1] SME climate hub report page— [2] About the SME climate commitment [3] Rules for reporting	Operated by WBCSD, ERI and Race to Zero
Transition plan taskforce (TPT)	Disclosure framework	United kingdom
	ASSESSMENT FRAMEWORK	
Assessing low-carbon Transition (ACT)	Assessing low-carbon transition, version 2.0, 2023	CDP and ADEME (french environment andenergy management agency),
B lab (BCORP)	DRAFT climate action standard for bcorp certification, Jan 2024	USA
Climate bonds initiative (CBI)	Climate bonds standard version 4.0	United kingdom
Integrity council for the voluntary carbon market (ICVCM)	Core carbon principles, assessment framework and assessment procedure, July 2023	United kingdom
New climate institute (NCI)	Corporate climate responsibility, guidance and assessment criteria for good practice corporate emission Reduction and net zero targets, version 3.0, Feb 2023	Germany
Transition pathway initiative (TPI)	TPI's methodology report: management quality and carbon performance v5.0, 2023,	United kingdom
Voluntary carbon market initiative (VCMI)	VCMI claims code of practice, Nov 2023, v.2	United kingdom

specific time frame for organizations to align with climate scenarios [31]. The IPCC emphasizes that carbon emissions must be net zero by around 2050 to meet global temperature goals, with non-CO2 gases going to net zero shortly thereafter. This omission has two implications: (1) that the urgency of reduction targets is not pressed upon users of the guidance and (2) that an open door is left to negotiate the urgency with which different organizations should decarbonize dependent on their capability and responsibility to do so (see Discussion section for more on this).

Front-loading emissions reductions (i.e. making large emissions reductions now, rather than later) is critical in preventing cumulative emissions tipping us further over planetary boundaries [5, 32]. Organizations can demonstrate this front-loading by setting robust interim targets on the path to a longer-term net-zero target date (largely 2050). Promisingly, 71% of documents recommend setting interim targets. However, only 40% specify requirements for those targets, including the frequency at which they should be reviewed.

Additionally, to meet organizational and global climate goals, there is urgent need for companies to support their value chains in decarbonizing, both upstream and downstream. Identifying Scope 3 emissions, which make up the bulk of most non-state entities' emissions profiles [33], is vital to understand hotspots for potential collaborative decarbonization interventions, as well as to understand regulatory, transition and physical climate risks [34]. Recognizing the importance of Scope 3 action, 89% of documents recommend quantifying Scope 3 emissions, while 85% advise setting Scope 3 reduction targets (figure 1). This indicates that the inclusion of Scope 3 in net zero targets is 'settled', widespread, and largely uncontested amongst the reviewed guidance for organizations.

However, guidance diverges regarding details of which Scope 3 emissions should be quantified and targeted. Over half of documents do not specify what proportion of Scope 3 emissions should be quantified, leaving organizations to define this themselves. Meanwhile, 20% of documents allow organizations to define their 'most relevant' Scope 3 emissions categories. Guidance on selecting emissions to be covered by targets varies across the documents, with differences in target timeframes and levels of stringency. This finding aligns with a previous systematic review [35] that suggested 'a high share of samples with heterogeneous application of reporting standards must be seen as problematic as it threatens comprehensiveness and comparability'.

Our research finds that 41% of documents recommend organizations' Scope 3 targets address the

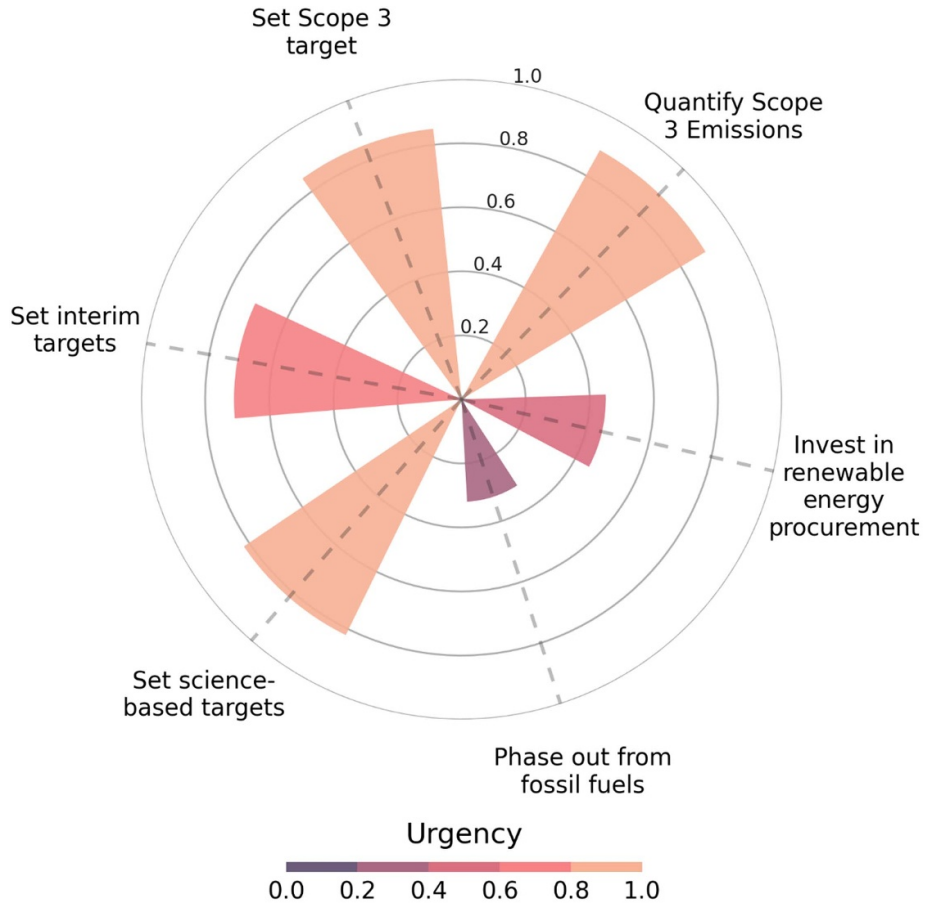

Figure 1. There is generally strong convergence on key criteria that promote urgent action towards net zero. However, major opportunities are missed for renewable energy procurement and phase out of fossil fuels.

most 'material' (i.e. important) emissions, where materiality is left for organizations to define. The Glasgow Financial Alliance on Net Zero (GFANZ), for example, asks member organizations to '*Disclose GHG emissions targets for Scope 3 emissions if Scope 3 emissions are material*' and '*Justify the exclusion of Scope 3 GHG emissions if omitted, and provide your definition of materiality (i.e. estimated % of total emissions)*'. Meanwhile, the Investor's Group on Climate Change (IGCC) asks organizations to disclose: '*Is there a comprehensive commitment to reducing emissions to net zero by 2050 or sooner, covering all relevant business areas and all material Greenhouse Gas (GHG) emissions scopes (1, 2 and 3)?*'. Under GFANZ's guidance, although materiality is not defined, organizations are at least asked to qualify *how* they have decided on materiality definitions, whilst in the IGCC, they are not. This loophole means that integrity varies between initiatives and organizations, when schemes do not ask for materiality definitions to be shared disclosed. Whilst we do recognize that it is challenging, nor necessarily desirable, for the voluntary governance landscape to define for all companies precisely what "materiality" might mean for them, lack of comparable principles or methods for doing so leads to inconsistent disclosure. This leaves a void, creates uncertainty for companies, obfuscates effort, and reduces the possibility of comparability between firms.

An additional critical gap in voluntary net-zero governance relates to minimal guidance regarding the kinds of interventions recommended to meet net zero and interim targets. For example, only a third (32%) of assessed documents recommend organizations set targets or action plans to phase out their use of fossil fuels, and less than half (43%) explicitly recommend organizations set renewable energy procurement targets. Of those documents recommending fossil fuel phase out (FFPO) plans, only one was a standard[6]—the Global Reporting Initiative (GRI), indicating that standards providing instruction (i.e. *how to* guidance) have not evolved to recommend or require organizations to make some of the very hardest of changes to their business operations. Other scholars have tracked the challenges of embedding some of

[6] The IWA42 which recommends targets for FFPO is not counted as full standard though it was developed through the ISO system. The document is an International Working Agreement (an early document representing expert convergence on a topic) upon which a full auditable standard on the definition of a net zero aligned organisation is in the process of being developed through ISO's full standardisation procedure.

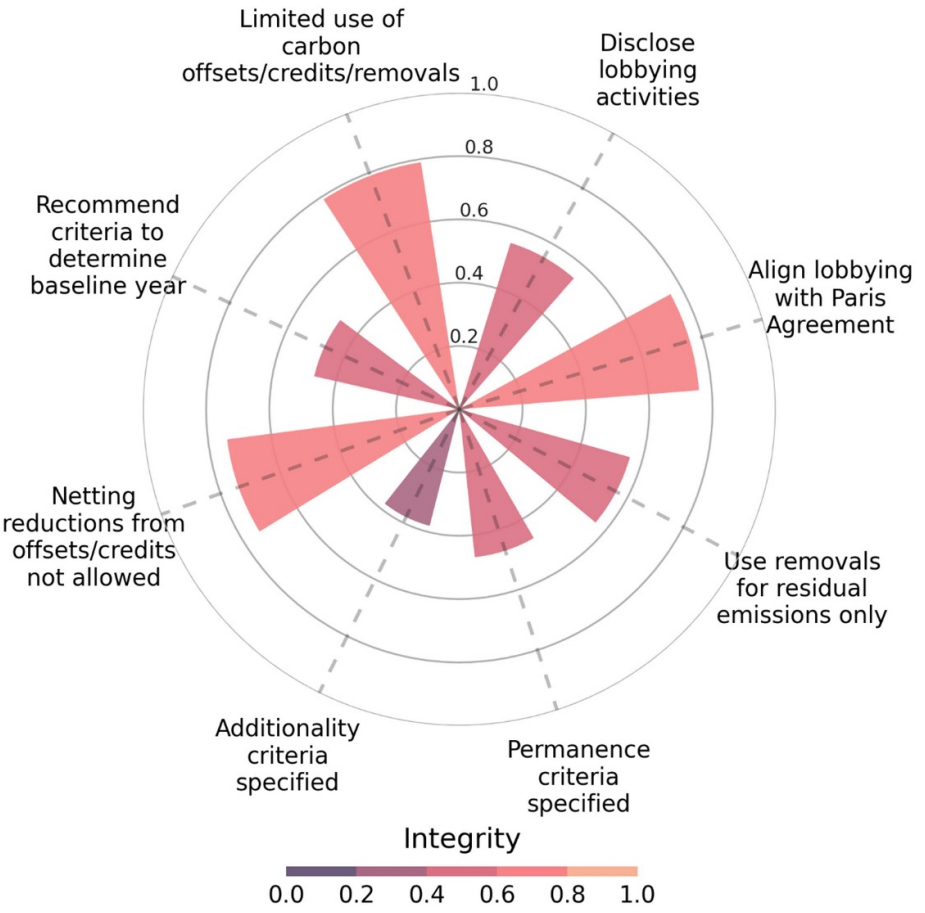

Figure 2. Guidance pertaining to the integrity of net-zero targets and transition plans exhibits some areas of strong alignment, but significant gaps exist around disclosing lobbying activities, details of how carbon credits should be used, and selection of baseline years.

the most ambitious text into guidance [36], demonstrating that the *process* by which guidance is written and *who* has influence over the final text strongly influences a document's ambition. Energy transition specific targets are just one example of an area in which action-specific or activity-specific targets, such as those recently proposed by SBTi, could be introduced to fill gaps in net-zero strategies and target key emissions sources [37].

3.2. Integrity

The integrity of corporate net-zero plans can be ensured through clear guidance as to how emissions should be quantified and accounted for (figure 2). One important aspect of this process is consistent recommendations on the selection of 'base years', which provide a snapshot of an organization's historical carbon emissions against which progress can be tracked over time. Our analysis shows that although two-thirds (68%) of documents require a base year to be selected and disclosed alongside targets, just over half (53%) of those provide no guidance for base year selection. Advice within the documents diverges as to whether base years should be most representative of business-as-usual emissions, or whether the year should be chosen for 'reliable' data. For example, the Greenhouse Gas Protocol requires organizations to '*choose and report a base year for which verifiable emissions data are available and specify their reasons for choosing that particular year*'; while the ISO14064 guidance expands on this, adding the requirement that a base year should be '*representative of the organization's current reporting boundary*'. The Investors Group on Climate Change recommends a year no earlier than 2019, while SBTi recommends a base year no earlier than 2015.

Base years matter because an organization *could* choose a higher-emitting year as its business-as-usual comparator, allowing it to more easily demonstrate emissions cuts. Some documents allow the selection of base periods or multi-year averages (e.g. ESRS), accounting for variation in annual emissions e.g. from the COVID-19 pandemic (Exponential Roadmap Initiative). Across all guidance, organizations are asked to explain how the chosen base year is representative and how external factors (e.g. COVID-19) affected data from that base year. Variation in *how* base years should be calculated and reported against hinders comparison between organizations and may weaken competition and pressure

Table 4. The implications of recognizing carbon credits as a means to counterbalance residual emissions in entities' inventories are explained. Guidance on how carbon credits should be utilized by entities is mixed, leading to lack of coherence in approaches and potential confusion around claims for GHG reductions.

	Of this 79%…	*This matters because*
79% of documents allow use of removals/carbon credits to counterbalance *some* of the emissions contained within an organization's inventory to meet net zero.	52% encourage early investment into net-zero aligned credits and removals	Early investment in removals is needed to scale carbon dioxide removal technologies for readiness by the net zero date of 2050 or earlier [40]
	48% specify criteria around 'additionality' in the use of credits, offsets and sinks	Additionality means that the benefits of a project would not be realized if credits had not been sold [41]
	59% recommend criteria for what 'permanent' removals mean, though this definition varies	Permanence speaks to how long a sink will hold CO2 before it is re-emitted into the atmosphere. This should not happen whilst humans are tackling the global warming crisis [42]
	37% restrict residual emissions to ∼10% at 2050 or the net zero target date, which may be addressed by removals.	Low residual emissions thresholds are needed to reduce over-reliance upon carbon dioxide removals [43]

to decarbonize. The importance of clear and comparable base years in relation to the global or sectoral science-based pathway the organization is choosing to align to has been an area of ongoing concern for the literature on net-zero standardization, and an area where translation of science has met practical barriers to implementation [38].

The integrity of net-zero strategies also rests on organizations taking actions that lead to material reductions in GHG emissions attributed to them. The use of carbon credits or removals to counterbalance *some* emissions within an organization's inventory is part of the 'settled' net-zero guidance, with nearly 80% of documents allowing this as part of a net-zero strategy. Three-quarters (74%) of our assessed documents also prescribe that any reductions in emissions from credits—including those used as offsets—should be reported separately from reductions in organizations' inventories. This means that any reductions from credits cannot be netted or aggregated with inventories. However, a gap exists in the definitions of quality requirements for credits or offsets used. While much of the guidance speaks to the need for permanence or additionality, especially with respect to the use of removals for residual emissions, definitions of these terms are often absent or inconsistent between documents. For example, ISO's IWA text on the permanence of offsets and removals provides some of the most detailed guidance: '*When counterbalancing residual emissions, the organization should ensure that removals, including through offsets and investments in credits are based on removals that are permanent or provide sufficiently long-term storage (especially when used to offset GHGs with long atmospheric lifespans such as carbon dioxide) and include plans to manage potential impermanence*'. Conversely, the OECD states that '*carbon credits or offsets should be of high environmental integrity*' with no explanation of what 'integrity' means. This lack of definition opens up integrity risks around ensuring credit use is consistent with credible net zero [39, 40]. Table 4 provides further summary statistics for how carbon credits are dealt with by the governance landscape, across issues of early investment, additionality, permanence, and the significance of residual emissions thresholds.

Another issue critical to the integrity of net-zero strategies is the alignment of advocacy activities with stated commitments. Lobbying and advocacy can either impede or advance climate policymaking by governments, which in some instances, can determine whether necessary climate policy and regulations are enacted. Our review finds that recommendations for organizations to align lobbying and trade affiliations or membership with their net-zero targets and with Paris-aligned climate futures are 'settled' as a key criterion for net-zero strategies, with 76% of documents recommending alignment. However, at present, only 48% of assessed documents recommend trade association affiliations be disclosed, and just under half recommend disclosure of actual policy and lobbying activities. Some detailed guidance is provided by e.g. We Mean Business Coalition (WMBC), which outlines how organizations should disclose their advocacy through memberships, financial contributions and direct engagement; organizations' spending allocations to advance rather than obstruct climate action; commitments to speak up and advocate for ambitious policy; and advocating within trade associations for pro-climate stances. WMBC provides voluntary guidance used by the most ambitious organizations, but more broadly speaking, integrity could be better promoted across the board by increasing requirements for disclosure of lobbying activities to increase transparency and consistency in reporting,

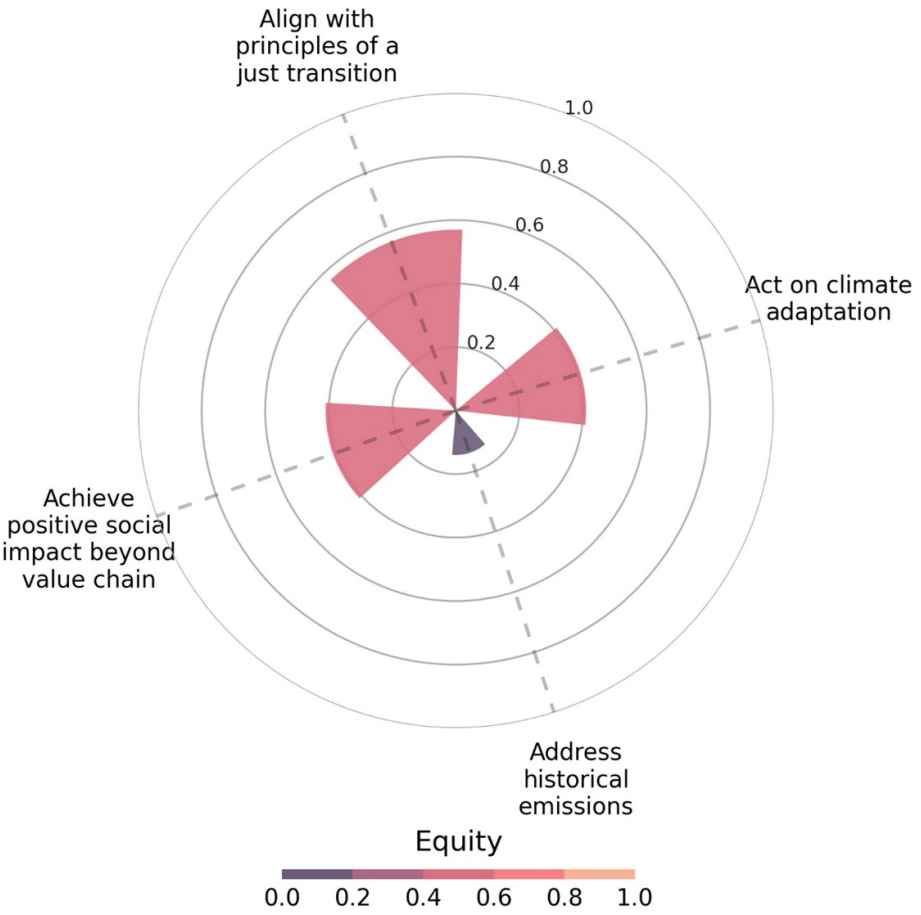

Figure 3. There is limited guidance for organizations as to how they should integrate 'equity' principles into their net-zero plans, whether in terms of addressing their historical emissions, or acting beyond organizational boundaries to compensate or contribute towards global net zero. Climate adaptation is seldom mentioned by assessed documents.

helping ensure that the public can assess and hold organizations accountable for any membership or advocacy activities.

3.3. Equity

An equitable and just transition must underpin net-zero strategies. An immediate concern that arises with the net-zero voluntary governance landscape is procedural equity, including who creates the standard and what their priorities are. Not only does this affect what actions are considered to *matter* in the guidance provided, it also affects the credibility of guidance beyond Western geographies. Of the sampled documents in this analysis, only one is from an institution based outside of Europe or North America (IGCC), one is Europe-based but with an Asian partner (Climate Action 100+), and two are Europe-based but with global memberships (OECD and ISO), and one—Race to Zero—is hosted by the United Nations. In section 4.2 we discuss in greater detail the implication on 'good net zero' that comes from the institutional context of guidance creation. However, what this geographic spread demonstrates is that it is guidance is overwhelmingly set by North American and European institutions. This matters for the legitimacy of guidance internationally, given that institutions in global minority countries are setting business rules that affect supply-chains beyond North America and Europe.

Beneath the layer of institutional equity, the documents assessed approach equity and justice as second-order concerns: a little over half (57%) of documents ask organizations to describe how their transition plans contribute to a just transition (figure 3). Where guidance on just transition alignment is offered in the documents, it is broadly limited to organizational-level interventions. This guidance is focused on engagement around and mitigation of negative impacts for workers rather than recommending wider, diversified action within organizations' broader spheres of influence including their supply chains and beyond [44]. Such activities could include advocacy for government policies that have system-wide impacts, or supporting economic diversification in carbon-economy dependent communities. A notable exception within this is BCorp, whose standard encompasses far more than reducing GHG emissions alone but also human rights and nature.

Any organization working towards BCorp certification must take more of a systems-approach to sustainable business, with business models that embed these priorities, rather than tackling them as discrete issues outside of operational models.

Related to systemic equity issues, there is limited guidance around if or how organizations should quantify and compensate for historical emissions, despite compensation being a key lever for achieving reparative justice [45]. Only five documents (BCorp, ERI, Race to Zero, ISO Net Zero Guidelines and NCI), recognize historical emissions as a distinct concern. Of these, one (BCorp) was in draft format at time of data collection in 2024, but has since dropped this recommendation in its finalized version published in April 2025. This behaviour highlights two challenges: first, of translating moral ambition from principle into practice, especially for initiatives that are written with consultation from a broader base of corporate stakeholders[7]; and second, where guidance is already be considered ambitious, how feasible such an approach is for most organizations. However, the remaining four documents making this recommendation and first-movers like Microsoft[8] [46]may provide test-cases for whether it is possible for governance systems to get broad swaths of organizations to address their historical emissions.

The impact that organizations have beyond their value chains, either directly or indirectly, affects global climate mitigation and adaptation ambitions. Just over 40% of documents recommend investment in decarbonization opportunities beyond an organization's boundaries, despite the key role of beyond-inventory action in overcoming systemic issues that cannot be addressed by one organization alone [44, 47]. Examples of recommended beyond-inventory actions include contributing to the UN sustainable development goals, compensating for wider-than-worker impacts of decarbonization, and ensuring positive impacts for marginalized and indigenous people.

Moreover, climate change adaptation is largely overlooked within the voluntary governance landscape. Only 41% of documents reviewed recommend organizations integrate adaptation considerations and efforts into their transition plans, with vague and differing approaches on what adaptation comprises, best practice and relevant actors. Adaptation is linked by some standards (i.e. BCorp, ISO Net Zero Guidelines and Gold Standard) to equity and justice concerns, particularly beyond the value chain; by others it is linked to adaptation *within* value chains—i.e. for suppliers and workers, which has justice implications. However, framing of adaptation is unclear and guidance does not set clear expectations of organizations.

[7] ERI and Race to Zero are not developed using global stakeholder consultation processes, and NCI is an assessment framework using high-ambition, in-house developed metrics. The ISO Net Zero Guidelines however were developed in concert with hundreds of global participants, including from global-majority countries, outside the ISO standard development process, and it remains to be seen whether these high ambition guidelines withstand the ISO negotiation process when it becomes a full standard in 2026.

[8] Microsoft has set a target to be carbon negative by 2030, and by 2050, to removal all historical emissions since its founding in 1975.

4. Discussion

While the number of companies making net-zero commitments has grown significantly, action on the delivery of these commitments is slow [2, 48], and the gap between pledges and action towards net zero demonstrates the challenges of real-world implementation of rules. In a geopolitical context where non-state actors increasingly see reputational, political and economic risks in taking action to decarbonize their emissions [49], it is even more important that guidance in the net-zero governance landscape is clear, achievable and scalable.

Four key concerns emerge from our findings: lack of operational detail and feasibility concerns, the impact of institutional governance on the ambition of guidance, the need to address human rights, climate change and nature together, and the need for accountability and regulation.

4.1. Operational detail and feasibility

Leaving significant operational detail for organizations to resolve weakens the urgency, equity, and integrity with which the voluntary governance landscape drives organizations towards net zero. Poorly detailed guidance creates an unlevel playing field of climate action, making comparing and holding organizations accountable for their inaction, or indeed praising their successes, more challenging [11]. Poorly detailed guidance could allow organizations to declare targets that might vary greatly in their quality, in a way that is potentially misleading to both investors and the public, and which also leads to increased reputational and operational litigation risks for firms [50].

The issue of 'missing guidance' is particularly apparent in Scope 3 target setting, an area of carbon accounting and target-setting that has attracted significant controversy for how it should be best managed [51]. Whilst we frame this issue as missing operational detail, other authors view this challenge as symptomatic of applying global decarbonization pathways to heterogenous organizations. For example, Reisinger *et al* [52] critique the broad-stroke application of decarbonization pathways to organizations with widely-varying operations and geographies as inappropriate and not strictly science-based. They suggest that 'simple rules and benchmarks embedded in science-based targets must be

opened up to allow and encourage more nuanced options and diverse paths for action' ([52] p 1). Their proposal de-emphasizes each organization's responsibility for its own value chain, and instead they suggest an industry-defined approach to delineating feasible decarbonization pathways. However, by the authors' own admission, this 'risks that each actor will pick the rules and justifications that minimize their individual obligations' (ibid). Though we disagree with Reisinger *et al* for their suggestion of how heterogeneity should be managed (at an industry level) it is clear that applying global norms to locally variable contexts presents practical challenges that must be addressed. Solutions must, then, involve integration of organizational net-zero transition plans and pathways with local and regional policy and industrial planning. However, we carry the concern that relying exclusively on industrial and sectoral benchmarks fails to incentivize sufficient innovation and delivery on climate opportunities *within* an organization. We therefore align with the majority of the voluntary guidance reviewed in this paper: that organizational reduction targets across scopes remain a critical boundary condition for corporate climate action. In the case of Scope 3, clarity must urgently be added to guidance in a way that balances the priorities of system-wide decarbonization with fairness and feasibility.

To do this, critiques of the current net-zero governance and target-setting approaches should be met with solutions to improve the system rather than start anew and lose valuable time in the fight for climate mitigation [53]. We consider that some debates around the feasibility of organizational-level decarbonization reflect a lack of imagination and gaps in current guidance to articulate the types of action organizations can take to enable emissions reductions across their value chain and sector. We agree, and have argued above and elsewhere, that additional targets and metrics to inventory decarbonization are needed to drive impact and innovation [44]. This aligns with several recent net-zero governance papers that have questioned whether emissions-only targets are sufficient for the scale of action required [54, 55]. The SBTi Corporate Net Zero Standard and the ISO Net Zero Standard—both under revision—are critical opportunities to tackle questions about differentiated targets for context variability, and to explore the inclusion of "other targets" in response to these critiques. In this context, balance is necessary as too far a departure from emissions metrics threatens to weaken the widespread organizational accountability system that has taken over the last decade to build [53]. Defining guidance for non-state entities is an iterative process [22] and requires learning from practice and implementation. Guidance-setting is a non-linear process, and rule-makers must grapple with consolidating guidance where agreement is widespread (e.g. setting a Scope 3 target), whilst also adopting experimental and innovative approaches to corporate decarbonization, that engage directly with roadblocks to meaningful widespread action.

4.2. Institutional governance and the ambition of guidance

A question that this research provokes is how the objectives and governance of institutions that create net-zero guidance affects the ambition of guidance they create. This question emerges from two places—first, indications that ambition may be written into early drafts of guidance, but removed after later consultation or external pressure (e.g. aspects of the BCorp standard and Race to Zero guidance); and second, that ambition is frequently found in documents that are used for reporting and disclosure, rather than those that direct target setting and transition planning.

Regarding the former, the removal of historical emissions from BCorp's standard suggests that although BCorp's technical teams may have had high-impact aspirations while drafting early versions of their revised standard, building support behind them so these ideas withstand the scrutiny of member consultation is not so easy. Ultimately, for standards to be impactful, they must be considered usable, and issues such as addressing historical emissions arguably sit low in the rankings of feasible actions for organizations like certified BCorps already going above and beyond their peers. Analysis by Valenzuela and Lezaun demonstrated other influences in standard setting [36]: early versions of the 2022 Race to Zero criteria included broad requirements for members to phase down and out all unabated fossil fuels. This detail was removed when GFANZ members implicated by the Race to Zero guidance challenged this, and required text to be watered down to include the phase-out of new, not existing, fossil fuel investments and development. It is worth noting that the main opponents to this text were JP Morgan, Bank of America and Morgan Stanley, key defectors of the net-zero banking alliance, leading to its collapse in 2025 [56, 57]. Therefore, a critical question in the integrity, urgency and equity of the net-zero transition is who can influence guidance, whether through their membership in technical committees, or through political pressure, and how can standards-setting be protected from these influences, yet still enable an open and inclusive process?

Whereas Race to Zero's approach of a small technical committee writing standards creates scope for ambition but also opportunity for disruption by actors with competing missions, other initiatives' approaches suggest that broadening stakeholder engagement can lead to improved ambition and quality of the standard that becomes harder for one set of actors alone to derail. For example, the ISO Net Zero Guidelines, which will soon be converted into a full standard, carry the weight of a global engagement process that included participation of a diversity

of stakeholders from over 100 countries globally [58]. The ISO Net Zero Guidelines also score highly in our mapping assessment. The standards-*making* process is therefore critical in ensuring credibility, but can also be pivotal in defining net-zero norms based on expectations from broad swaths of stakeholders, not just technocrats. Such an approach stems centrally from the governance structure, aims and objectives of the initiative, with schemes aiming to be go-to global standards prioritizing broad engagement with global business, civil society and academia (e.g. SBTi, ISO, GRI, BCorp), and schemes wanting to push the needle on urgent climate action relying on a much smaller pool of input from in-house experts or external partners (e.g. ERI or Race to Zero). Further research is needed to explore the connection between governance structure and the ambition and effectiveness of an initiative in helping achieve "good" net zero.

4.3. Addressing human rights, nature and climate change together

The findings of our research add further nuance to concerns about what is compromised in current approaches to rule-setting, while we disagree with Reisinger *et al* in their support for industry-determined decarbonization pathways, we do agree with their observation that social sciences and humanities have been largely neglected from standard-setting. The net-zero voluntary governance landscape relies significantly on technocratic, carbon accounting-focused experts to write its guidance [13, 14]. Inevitably, this leads to a narrowing in the type of criteria that are written in to standards, and the metrics that are considered valuable and reliable.

We see the impacts of this in our results. The net-zero governance landscape generally neglects the issues of just transitions, nature, and adaptation, which are deeply interconnected with the impacts and management of climate change. Meanwhile, our results show that the landscape has a preference for quantifiable interventions, reflecting a need for reporting to be quantifiable and meaningful for investors, senior leaders and reporting agencies. The result of these findings is that key issues such as the just transition or nature are generally weakly addressed or omitted from guidance, deepening the siloes with which these interconnected concerns are managed. This has direct impacts on the joined-up climate action of non-state actors, leading to missed opportunities, justice and equity risks, and business vulnerabilities from overlooked issues including biodiversity loss[9]. As recognized earlier in the discussion, it is neither possible nor preferable for the net-zero voluntary governance documents to cover *all* possible challenges of organizations operating in a changing climate, but opportunities are missed throughout the system to signpost more effectively to guidance elsewhere, whether from the UN, OECD or other reputable international organizations providing guidance such as the International Labour Organization.

Related to this concern is the question of where ambition is found within the ecosystem of guidance. While reporting frameworks (e.g. CDP, IFRS and GRI) differentially ask companies to report on e.g. adaptation, FFPO, and biodiversity and nature risks, reporting alone has limited impact on the ambition of companies' transition strategies [59]. Organizations use a suite of guidance and standards to direct their climate strategies, and it is therefore necessary for guidance that provides direction—i.e. SBTi and ISO—to ensure that issues around human rights and nature are embedded in this guidance so that organizations consider these matters early on.

4.4. Accountability and regulation

As long as the corporate net-zero governance system remains voluntary it requires internal accountability and engagement mechanisms to drive action. However, only three assessed documents clearly outline accountability mechanisms to enforce organizational action on pledges and targets, creating few sticks for missed targets and slow progress. We also find a lack of guidance in current initiatives as to how to deal with counterproductive activities such as anti-climate lobbying, which must also form part of this accountability landscape. Several recent studies have demonstrated the limited accountability of investors and the public to hold companies to account to their pledges, initiatives and climate targets [3], highlighting the need for internal engagement and governance mechanisms to incentivize action across non-state entities.

Setting up accountability system as a black and white, "in or out" games, can limit the effectiveness of accountability systems, providing little leverage over laggards, and can spook companies away from setting targets. However, ultimatums are not effective systems with little leverage [60]. Given that companies have little external consequence for withdrawal [3] voluntary initiatives and standards must rather serve the role of a critical friend, working with companies to develop comparable science-aligned pathways and to identify climate risks and opportunities. A critical friend, however, gains little from rejecting companies forever for missing targets. Voluntary initiatives should, therefore, design accountability mechanisms that work *with* companies to keep them involved and mutually accountable, by prescribing and tracking progress on interim and restorative actions to rejoin initiatives should companies fall off track.

[9] To demonstrate, recent findings from the World Benchmarking Alliance's 2026 Benchmark showed that only 20/2000 assessed companies considered supply-chain risks across human rights, climate and nature, demonstrating that an integrated approach to supply chain risk management is lacking [62].

However, even the most well-designed voluntary governance system alone cannot achieve the rate and scale of decarbonization needed to limit warming well below 2 °C. Legislative and regulatory interventions are needed to support the voluntary landscape to succeed [11], and for decarbonization at scale to unfold. First, it must give the voluntary governance landscape the confidence to make bold but necessary recommendations such as setting FFPO targets, by e.g. setting ambitious domestic policy, thus supporting an ambition loop of action [61]. Second, regulators, legislators and policy makers must de-risk ambitious climate action by reducing anti-trust risks, and by integrating e.g. FFPO targets into disclosure reporting regulations. Third, regulators globally should continue to translate voluntary standards into domestic and regional regulation (as has been happening with IFRS/ISSB), to both increase the ambition of regulation itself, and to demonstrate to firms the intention to move towards more rigorous requirements for operating in different markets.

5. Conclusion

The voluntary governance system for corporate net-zero action plays a critical role in shaping organizational decarbonization strategies. Our review of 36 net-zero voluntary governance documents reveals broad agreement on high-level recommendations, as well as crucial gaps and inconsistencies. Encouragingly, guidance on setting science-based targets incorporating some or most material Scope 3 emissions is largely settled, signaling readiness for immediate application to corporate net-zero strategies and potential regulatory adoption. However, details necessary for organizations to translate these commitments into action are underdeveloped. This includes clear guidance on currently "unsettled" areas, such as the cadence of interim targets, equity considerations for communities within and beyond organizations' value chains, and FFPO, will help to close the gap between pledges and action. Additionally, in response to recent critiques, some of the latest areas of development for corporate climate governance include sector and context-specific approaches, and metrics that capture innovation and impact. Some of these represent low-hanging-fruit updates to net zero guidance, while others represent more significant changes in approach as to how companies are measured and evaluated for their inventory reduction and impact. If the latest round of net-zero standards can fill these gaps and find solutions to these challenges and tensions, they have a powerful opportunity to revitalize private-sector climate action and help to front-load emissions reductions in line with the urgency of net zero.

In order to do this, standards must fill current gaps in the voluntary net-zero landscape by fore-fronting action metrics, embedding new constructive accountability and enforcement mechanisms, and addressing inconsistencies around lobbying or counter-productive climate action. Only a fraction of voluntary initiatives prescribe clear consequences for failing to meet commitments or a path to redemption. However, in a voluntary system, consequences must be met with constructive options for re-commitment. Additionally, as net-zero voluntary guidance increasingly informs regulation in jurisdictions across the world, now is a critical moment to update and strengthen net-zero standards [12]. To achieve a high-integrity, equitable, and urgent transition to net-zero, guidance for companies around the world must inspire immediate *action,* reflect principles of context-sensitivity, equity and justice, and hold organizations *engaged and accountable* for delivering on their net zero commitments.

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Data availability statement

The data that support the findings of this study are openly available at the following URL/DOI: https://netzeroclimate.org/oxford-net-zero-report-assesses-the-voluntary-standards-landscape/.

Appendix 1 - Methods available at https://doi.org/10.1088/1748-9326/ae5c21/data1.

Appendix 2 - List of Experts available at https://doi.org/10.1088/1748-9326/ae5c21/data2.

Appendix 3 - Web Search available at https://doi.org/10.1088/1748-9326/ae5c21/data3.

Appendix 4 - Search returns available at https://doi.org/10.1088/1748-9326/ae5c21/data4.

Appendix 5 - Incl. Criteria available at https://doi.org/10.1088/1748-9326/ae5c21/data5.

Appendix 6 - PRISMA available at https://doi.org/10.1088/1748-9326/ae5c21/data6.

Appendix 7 - Codebook available at https://doi.org/10.1088/1748-9326/ae5c21/data7.

Appendix 8 - Data Set available at https://doi.org/10.1088/1748-9326/ae5c21/data8.

Conflict of interest

K.A. and A.M. declare non-financial competing interests. These authors are unpaid members of expert working groups of three guidance documents that are currently being revised by standards bodies (K.A.: SBTi and ISO Net Zero Standard; A.M.: Greenhouse Gas Protocol). These roles have not had a bearing on the methods used or outcome of the Analysis conducted for the submitted manuscript.

Author contributions

M Becker 0000-0001-6199-8271
Conceptualization (lead), Data curation (equal), Formal analysis (lead), Funding acquisition (supporting), Investigation (lead), Methodology (supporting), Project administration (lead), Supervision (lead), Validation (lead), Visualization (lead), Writing – original draft (lead)

A McGivern
Conceptualization (equal), Data curation (equal), Formal analysis (equal), Funding acquisition (equal), Investigation (equal), Methodology (supporting), Resources (equal), Supervision (equal), Validation (equal), Writing – review & editing (equal)

K Axelsson
Conceptualization (equal), Data curation (supporting), Funding acquisition (lead), Methodology (supporting), Supervision (supporting), Writing – review & editing (equal)

J P R Thorn
Methodology (lead), Writing – review & editing (supporting)

M Buytaert 0009-0008-3756-0841
Data curation (lead), Formal analysis (supporting)

M Collett 0009-0009-4736-9458
Data curation (supporting), Formal analysis (supporting), Investigation (supporting), Writing – review & editing (supporting)

N Kamenkovich
Data curation (supporting), Formal analysis (supporting), Investigation (supporting)

B Lee
Conceptualization (supporting), Data curation (supporting)

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