

## **Balancing simplicity and complexity through corporate emissions benchmarking**

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**Standardised quantitative emissions benchmarking is essential for corporate climate accountability, a position that has been critiqued in recent literature. We argue for structured pluralism with budget compliance — balancing methodological flexibility while preserving the disciplining power of carbon budgets.**

The corporate climate reporting landscape is evolving rapidly. Companies are increasingly required to demonstrate alignment with the Paris Agreement, and international standards like IFRS S2 and ISO Net Zero are driving demand for clear, quantitative benchmarks. Yet some academic responses to these developments have grown increasingly critical — with several 2024 papers questioning whether standardised quantitative approaches can adequately capture the complexity of evaluating corporate climate commitments or performance.

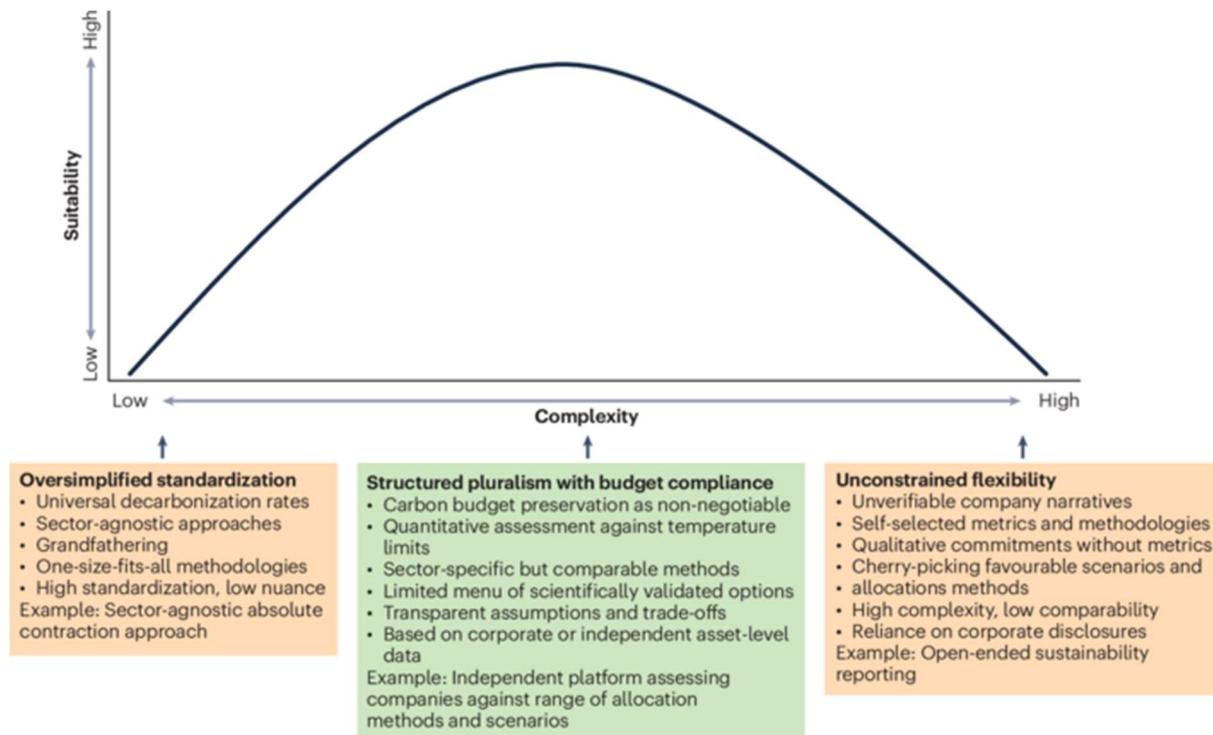
In this Comment, we caution against a move away from (standardised) forms of emissions benchmarking. While these calls arise from legitimate concerns, they risk undermining the integrity of corporate climate accountability and complicate the shift from plans to results. Our central argument is that effective benchmarking must strike a balance between simplicity and complexity across both allocation mechanisms and underlying pathway selection. At one end of the spectrum lie overly simplistic approaches, such as sector-agnostic targets using one decarbonisation pathway. At the other extreme we see open-ended, highly contextual narratives that resist standardisation. We argue that benchmarking is most suitable when it avoids both extremes and this middle ground should be the primary focus of further research (Figure 1).

Guided by principles of transparency, communicability, comparability, and resistance to gaming, we offer a compass for assessing and designing climate accountability frameworks. We argue that while recent methodological critiques raise legitimate concerns about current approaches, quantitative benchmarking — despite its imperfections — remains essential for credible, science-based corporate climate action. We maintain that a policy-dependent approach is insufficient, and that robust benchmarking is essential to assess corporate climate performance.

***Focus should continue to be on quantitative emissions reductions and carbon budgets***

There is emerging argument that rather than focusing on quantitative emission benchmarks, more dynamic approaches that incorporate broad baskets of indices should be used [1]. Such frameworks emphasise corporate innovation potential, alignment with national strategies, and potential activities in decarbonizing economies. However, we contend that such alternatives to emissions benchmarking are

vulnerable to greenwashing and vague narratives underpinned by optimism bias. It would be akin to companies reporting self-styled financial metrics, and forecasts built on narratives around opportunities that may not yet exist.



**Fig. 1.** Corporate climate performance assessment approaches.

The key question is not whether the current benchmarking is imperfect — it is. The existing system, which focuses predominantly on emission reduction requirements, was not established because its proponents are blind to its limitations. Simple, clear carbon emission metrics and targets were chosen because they provide certainty, galvanise action, and — if done right — are relatively hard to game.

Quantitative assessment frameworks create transparency by enabling direct comparison of corporate ambitions against scientific benchmarks. Without them, it would be near-impossible to evaluate the adequacy of corporate climate commitments or track progress towards global goals. Standardised quantitative targets create a common language for climate action that resists convenient reinterpretation by companies and enables consistent analysis across different contexts and timeframes.

We support approaches that offer 'a wider but transparent menu of options' with mandatory disclosure and justification<sup>2</sup>. However, we question the assumption that such methodological diversity will lead to 'every actor maximising their effort to reduce emissions'<sup>2</sup>. Corporate behaviour patterns suggest companies are more likely to select options that minimize obligations while maximizing apparent ambition. Additionally, while we see value in recognising climate impact across companies' wider spheres of influence, this should complement, not undermine accountability in corporate emissions inventories [3].

Without standardised benchmarks, companies can cherry-pick metrics, methodologies, and pathways that minimise required action while maximising apparent ambition. For example, companies can present unverifiable qualitative climate statements about green innovation and future technological solutions. This is exactly what happened to corporate engagement with the UN Sustainable Development Goals [4]. Narratives with or without numbers risk creating corporate obfuscation precisely when clarity is most needed.

### ***The case for imperfect but actionable labels***

Temperature-related labels for companies (e.g., “1.5 degree-aligned” or “well-below 2 degrees-aligned”) face criticism for obscuring important nuances [5]. This tension between scientific nuance and the need for actionable guidance places climate scientists in a challenging position as scientists must balance technical accuracy with the need to communicate clearly to non-specialists [6]. This challenge is particularly acute when translating global climate goals to the organisational level. Yet scientists cannot retreat from this responsibility, as the alternative — allowing non-scientific actors to fill the void with potentially misleading interpretations — would be worse [7].

All language necessarily simplifies. When we describe a company as “profitable” or “risky,” we condense complex accounting principles, temporal assumptions, and jurisdictional differences into a single term. These simplifications are not flaws, but features; they enable communication, decision-making, and comparison. In the same way, standardised climate labels distil complex underlying data. “Net-zero by 2050” or “halved emissions by 2030”, for example, communicate more effectively than lengthy explanations of conditions, uncertainties, and assumptions underpinning Paris Agreement alignment. However, spatial, temporal, and equity assumptions must be transparently communicated. Although imperfect, company labels are essential tools for aligning diverse actors around a shared understanding of progress and ambition.

### ***A research agenda for improving corporate emission benchmarking***

The diversity of corporate actors and decarbonization pathways necessitates methodological approaches that can accommodate differences while preventing companies from minimising obligation. High complexity and methodological sophistication often trade off against standardisation, comparability, and transparency [8, 9]. This tension demands a middle path that balances methodological rigor with practical applicability.

Current approaches represent two extremes on this spectrum. At one end, the sector-agnostic Absolute Contraction Approach Applies a universal decarbonization rate to all companies regardless of sector or circumstances: extremely simple, highly standardised and comparable, but lacking nuance. At the other extreme lies the approach implied by reporting frameworks like IFRS S2, where companies freely justify their Paris alignment through individualised narratives; highly flexible but resistant to meaningful comparison and vulnerable to cherry-picking.

In navigating these trade-offs, we propose three principles for effective Paris-aligned benchmarking:

1. *Sector-specific differentiation with cross-sector comparability:* Frameworks should acknowledge fundamental differences between industries while maintaining enough methodological consistency to enable meaningful comparison between sectors. The sectoral approach developed by Krabbe et al. [10], introducing sector-specific emission intensity indicators, provides a starting point but requires further refinement to balance sectoral uniqueness with cross-sector accountability. Recent advances in sectoral pathways demonstrate the feasibility of differentiated but comparable approaches (e.g. [11]).

2. *Methodological flexibility constrained by carbon budget preservation:* Companies should select from a limited, scientifically validated set of methodological options, clearly disclose which they have chosen, and justify why those choices are appropriate for their circumstances [12]. This requires scientists to make their benchmarking approaches available through accessible and educational platforms. Initiatives such as the Science Based Targets initiative are inadequate as they do not currently offer climate performance assessment, nor are their targets transparent or is it clear how they ensure preserving carbon budgets. Carbon budgets should always be preserved in any methodology [13], and frameworks should ensure regular reviews as the remaining carbon budget shrinks.

3. *Trade-offs and assumptions clearly communicated by scientists:* As there are a variety of climate pathways compatible with a specific temperature outcome, and different methods to allocate these

pathways to companies, it is important that key trade-offs and assumptions of these decarbonisation pathways and methods are communicated [14, 15]. These include assumptions for underlying pathways, such as carbon dioxide removals required at different time intervals, and trade-offs between sectors across different scenarios.

### ***Embracing imperfect but essential corporate climate benchmarks***

Current approaches to corporate emissions benchmarking have limitations that should motivate refinement rather than rejection. The carbon budget approach and benchmarking are both valuable because they are clear, concrete, and focus on the fundamental metric that matters for climate stability: cumulative emissions. To reject these because the currently available methods are imperfect undermines the decarbonization agenda and overlooks the significant role of corporations — some even exceeding that of nation-states — in driving emissions reductions.

Robust corporate emissions benchmarking requires standardised and independently verified emissions data. Without independent verification, benchmarking frameworks remain vulnerable to the very greenwashing they seek to prevent.

The principles we propose reflect neither rigid standardisation nor complete flexibility, but rather a structured pluralism that can accommodate diversity while preventing a “race to the bottom” that unconstrained methodological freedom would enable. The research community should focus on operationalising these principles into practical assessment frameworks that companies, investors, and regulators can apply consistently.

Perfect methodologies cannot be the enemy of necessary progress. As the climate crisis accelerates and corporate accountability remains weak, courts, policymakers, and investors need quantitative frameworks that enable accountable action now, even as we continuously improve them. By improving rather than abandoning Paris-aligned corporate benchmarking, scientists can support the urgent and unprecedented transformation required to address the climate emergency.

### **Competing interests**

S.R., K.A., A.B., R.H., M.I., M.R., and B.W. have been involved with advisory groups at the Science Based Targets initiative. S.R. and K.A. are involved in the development of the ISO Net Zero standard for Organisations. The other authors declare no competing interests.

### **Figure legends**

Fig 1. Corporate climate assessment approaches. The case for structured pluralism with budget compliance.

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