Scientific Accuracy Complaint Against the Greenhouse Gas Protocol's Proposed Scope 2 Update: The Need for Additionality

The Greenhouse Gas Protocol's (GHG Protocol) proposed Scope 2 update[1] to the market-based method (MBM) introduces requirements for deliverable and time-matched energy but excludes the principle of *additionality,* which ensures that renewable energy procurement contributes to new build. This has been justified almost exclusively on the basis of studies that analyze the joint effect of deliverability, hourly-matched energy, *and* additionality constraints, collectively often referred to as the "Three Pillars" or sometimes "24/7." In doing so, the proposal contradicts broad academic consensus that unless time and location matching also includes additionality requirements, it is unlikely to achieve decarbonization. While we, the authors of this complaint, take no position on whether the GHG Protocol should adopt the Three Pillars, using studies of all three to justify adopting only two undermines the Protocol's stated decision-making criteria of integrity and impact.[2] The GHG Protocol is mis-applying academic research to mislead the public into supporting a proposal that lacks any scientific basis for driving real decarbonization.

The Proposed Update Contradicts Academic Consensus

The current proposal to replace the MBM now released for public comment[3] adds strict hourly matching and deliverability (location-matching) requirements. Specifically, proposed Criteria 4 and 5 would require that "all contractual instruments used in the market-based method shall be issued and redeemed for the same hour as the energy consumption to which the instrument is applied [with exemptions]" and "sourced from generation that is deemed deliverable to the consuming load." The Scope 2 proposal assumes deliverability using zonal regions where pricing zones are used, market power regions, or country boundaries where pools are not used.

The GHG Protocol announced that these revisions were proposed to address key concerns, two of which are "scientific integrity" and "decision-usefulness of market based claims."[4] They write that "in aggregate and over time, reported scope 2 emission reductions should approximate actual changes occurring on the grids that supply reporters' electricity. Closer alignment between changes in reported and actual emissions is crucial for maintaining public trust in inventory reporting and avoiding widespread claims of greenwashing." Later, they write that the proposed updates are meant to improve "scientific integrity," and support "ambitious climate

[1] Greenhouse Gas Protocol. (2025). *Public Consultations – Scope 2 and Electricity Sector Consequential Accounting*. https://ghgprotocol.org/ghg-protocol-public-consultations
[2] Greenhouse Gas Protocol. (2024, September 19). *Governance Overview* (Version 1.0). Retrieved from https://ghgprotocol.org/sites/default/files/2024-09/Governance-Overview.pdf
[3] Greenhouse Gas Protocol. (2025, October). *Scope 2 Public Consultation – Proposed Revisions to Scope 2 Guidance*. https://ghgprotocol.org/sites/default/files/2025-10/GHG-Protocol-Scope2-Public-Consultation.pdf
[4] Greenhouse Gas Protocol. (2025, July 14). *Upcoming Scope 2 Public Consultation: Overview of Revisions.* Retrieved from https://ghgprotocol.org/blog/upcoming-scope-2-public-consultation-overview-revisions

action by aligning claims with conditions... showing these conditions are more likely to deliver grid decarbonization over time than annual matching in broad markets." This sentiment is also reflected in the consultation materials.

However, the proposed provisions fail to address these priorities because they include *no* requirements for additionality. In fact, the term "additionality" does not appear anywhere in the survey, signaling that the concept has been deliberately omitted. This omission is deeply concerning, as nearly all published research on hourly matching and deliverability concludes that the effectiveness of such frameworks depends on the inclusion of additionality. Without any additionality requirements, this proposal merely increases the accounting burden on reporting entities without protecting against low-quality RECs that do not correspond to real emissions reductions—which is in direct conflict with the GHG Protocol's stated goals for this revision.

As written, a reporting entity could purchase low-quality, non-additional RECs from *existing* resources, provided they are in the same hour and deliverability region as the entity's load, and claim 100% clean energy with no actual impact on grid emissions. Google[5] and Amazon[6] have already begun executing deals in line with this strategy—contracting with old clean energy facilities to claim existing power that may not reduce emissions.

Academic and Market Consensus: Additionality is Key to Climate Impact

A substantial body of research finds that additionality is a decisive factor distinguishing genuine decarbonization from paper compliance:

- Xu et al. (*Joule*, 2024)[7] demonstrates that while deliverable, hourly matching "does drive real system-level emission reductions," this conclusion is based on the assumption "that participating consumers procure power only from newly built carbon-free resources located in the same model zone as the demand being matched."
- Even the original architects of 24/7 carbon-free energy recognize that additionality is indispensable. When Google first articulated its 24/7 strategy in 2016[8], it explicitly emphasized the importance of supporting *new* renewable projects.

[5] Utility Dive. (2025). "Google, Brookfield Renewables partner on hydro-power project." https://www.utilitydive.com/news/google-hydro-power-brookfield-renewables/753039/
[6] Utility Dive. (2025?). "Talen, Amazon AWS partner on Susquehanna nuclear data-center." https://www.utilitydive.com/news/talen-amazon-aws-susquehanna-nuclear-data-centert/750440/
[7] Xu, Q., et al. (2024). System-level impacts of voluntary carbon-free electricity procurement by corporations. *Joule*, 8(2), 374-400). https://doi.org/10.1016/j.joule.2023.12.007.
[8] Google LLC. (2016, December). *Achieving Our 100% Renewable Energy Purchasing Goal and Going Beyond*. https://static.googleusercontent.com/media/www.google.com/en//green/pdf/achieving-100-renewable-energy-purchasing-goal.pdf

- More recent analysis by Riepen and Brown (Energy Strategy Reviews, 2024)[9] defines 24/7 procurement as "investment and operational decisions mixing procurement of additional generation and storage resources so that CFE supply meets electricity demand 24/7."
- Bjørn et al. (*Environmental Research Letters*, 2025)[10] underscores the fact that without additionality, time matching and deliverability continues to enable corporate greenwashing by allowing companies to claim credit for existing renewable generation rather than driving new capacity, stating "there is no point in purchasing RECs that do not cause an increase in the deployment of renewables or reduce emissions. It is clearly misleading if large publicly facing companies can use RECs to give the impression that they are progressing well against their net-zero targets without actually reducing power emissions and instead effectively shifting these emissions to other electricity customers who are under less pressure to report emissions reductions, such as small companies and individual households." Furthermore, they note that time matching and deliverability are *not* proxies for additionality. They write that from an attributional perspective, "...even if there is time and location matching...Reporting the emission rate associated with a specific generator will only be accurate if the company can show that it caused the power from that generator to exist, i.e. prove additionality." They later emphasize that "temporal deliverability does not necessarily ensure additionality, as it is possible for a company to buy RECs from facilities whose time of production matches the time of consumption without causing these facilities to exist."
- Similarly, Galzi's (*Energy Policy*, 2023)[11] study of the GO market in France demonstrates that despite deliverability requirements, "...in practice, the GO system benefits almost exclusively [go] to large old French hydro plants." "To make the GO system more effective in raising renewable energy capacity," Galzi recommends "limiting the issuing of GOs to new production devices only or informing consumers *via* additionality criteria labelling."
- The International Energy Agency's 2024 report *Advancing Decarbonization Through Clean Energy Procurement*[12]—which was reviewed by WRI—further emphasizes this, noting that "ensuring that corporate procurement makes a real contribution to deploying more clean generation (also referred to as additionality) is vital—from both policy and corporate perspectives." Later, it further underscores the importance of additionality in deliverable time

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[9] Riepen, I., & Brown, R. (2024). On the means, costs, and system-level impacts of 24/7 carbon-free energy procurement. *Energy Strategy Reviews*, 54 101488. https://www.sciencedirect.com/science/article/pii/S2211467X24001950

[10] Anders Bjørn *et al, 2025.* Untangling deliverability, additionality and double counting related to renewable energy certificates for improved scope 2 emissions accounting. *Environ. Res. Lett.* Volume 20(5), 051006. https://iopscience.iop.org/article/10.1088/1748-9326/adc941/meta

[11] Galzi P-Y 2023 Do green electricity consumers contribute to the increase in electricity generation capacity from renewable energy sources? Evidence from France. *Energy Policy* 179, 113627 https://www.sciencedirect.com/science/article/abs/pii/S0301421523002124

[12] International Energy Agency. (2024). *Advancing decarbonisation through clean electricity procurement*. https://iea.blob.core.windows.net/assets/4a07d1b5-1beb-4611-874d-7acd4f21d9eb/AdvancingDecarbonisationthroughCleanElectricityProcurement.pdf

matching, stating "it is essential to assess additionality and ensure the certificates for meeting 24/7 goals do not come from existing generation without increasing flexible supply."

- Langer et al (*Journal of Cleaner Production*, 2024)[13] synthesize the research on additionality's role in annual and hourly matching, and finds that only hourly matching paired with additionality and deliverability has meaningful decarbonization benefit. They write "Our results suggest that assuming the implementation of recent government policies, annual volumetric and emissions matching do not lead to significant emission reductions relative to a counterfactual without a REC market. This is because investments are almost exclusively made in the cheapest available renewable energy resource, thereby cannibalising market-driven projects that would also have been built without a REC market. On the other hand, we find that hourly matching (with PPAs involving local and new RE generators) leads to significant reductions in system emissions."

The pattern is clear: *additionality is required for hourly time matching and a deliverability requirement to yield real climate benefits*. The GHG Protocol has put forward a proposal that fails to align with the published research.

Policy and Market Evidence Reinforce the Need for Additionality

The conclusions reached by this wide body of research are also echoed in policy discussions on the global development of green hydrogen:

- In their discussion of electrolytic hydrogen from renewable sources, Zeyen, Riepin, and Brown (*Environmental Research Letters*, 2024)[14] highlight that "local additionality is required to guarantee low emissions."
- Ricks et al. (*Environmental Research Letters*, 2023)[15] reach the same findings. In their study modeling grid-connected hydrogen production during the development of the United States 45V green hydrogen tax credit, they find that "emissions can be minimized by requiring grid-based hydrogen producers to match 100% of their electricity consumption with physically deliverable, additional clean generation." When additionality was removed, hourly time matching "lost all of its consequential impact."

[13] L. Langer, K. Bruninx & A. Bjørn (2024). Does the purchase of voluntary renewable energy certificates (RECs) by companies lead to meaningful reductions in system-level emissions? *Journal of Cleaner Production*, 478, 143791.. https://doi.org/10.1016/j.jclepro.2024.143791.

[14] Zeyen, E., Riepin, I., & Brown, T. (2024). Temporal regulation of renewable supply for electrolytic hydrogen. *Environ. Res. Lett.* 19(1), 024034. https://iopscience.iop.org/article/10.1088/1748-9326/ad2239.

[15] Wilson Ricks et al (2023). Minimizing emissions from grid-based hydrogen production in the United States. *Environ. Res. Lett.* 18(1), 014025. https://iopscience.iop.org/article/10.1088/1748-9326/acacb5.

- Similarly, Giovanniello et al.'s[16] study of time-matching requirements for green hydrogen production finds that the emissions impact of annual and hourly matching scenarios depends heavily on how additionality is defined and applied. Crucially, the authors emphasize that time matching alone is insufficient, noting that effective decarbonization requires coupling all three principles: "Besides temporal matching, a second important qualifying requirement is additionality... A third key qualifying requirement is spatial matching."
- This academic alignment was reinforced by prominent NGOs as well. In February 2023, 18 organizations– including NRDC, EDF, EnergyTag, the Clean Air Task Force, and the Union of Concerned Scientists—submitted a joint letter[17] on the 45V tax credit stating that "a robust body of research consistently identifies all three principles—deliverability, hourly matching, and additionality—as necessary to guard against substantial emissions increases and to drive deployment of truly low- or zero-emitting projects."

Global policy now also reflects this broad agreement on additionality. Both the European Union and the United States have embedded additionality into clean-energy regulations.

- The U.S. §45V hydrogen tax credit[18] requires that renewable electricity used for hydrogen production come from additional sources, typically operational for less than 36 months. In response to requests to extend the 36-month period, the International Revenue Service writes, "Further extending that lookback period beyond 36 months risks induced grid emissions, as such clean power facilities may not be truly incremental."
- The EU's Additionality Delegation Act,[19] which defines the conditions under which hydrogen and hydrogen-based fuels can be considered renewable, goes further, mandating that qualifying generation be both "new" and "unsubsidized," and backed by long-term power purchase agreements.

Implementing Additionality: Feasibility and Precedent

Furthermore numerous credible, academically validated proxies have been developed to assess additionality. While additionality cannot be known with

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[16] Giovanniello, M.A., Cybulsky, A.N., Schittekatte, T. *et al.* The influence of additionality and time-matching requirements on the emissions from grid-connected hydrogen production. *Nat Energy* 9, 197–207 (2024). https://doi.org/10.1038/s41560-023-01435-0.

[17] Natural Resources Defense Council (NRDC). (2023, February 23). *Joint letter on 45V implementation*. https://www.nrdc.org/sites/default/files/2023-03/joint-letter-45v-implementation-20230223.pdf

[18] Internal Revenue Service. (2025, January 10). *Credit for Production of Clean Hydrogen and Energy Credit* (Final Rule, 90 FR 2224) (TD 10023; RIN 1545-BQ97). Federal Register. Retrieved from https://www.federalregister.gov/documents/2025/01/10/2024-31513/credit-for-production-of-clean-hydrogen-and-energy-credit

[19] European Union. (2023, June 20). *Commission Delegated Regulation (EU) 2023/1184 of 10 February 2023 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin. Official Journal of the European Union* L 157, 11. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2023.157.01.0011.01.ENG

complete certainty, these tools provide a strong basis for ensuring projects truly contribute to new clean energy capacity. Schäfer, Herlev Gebara, Bjørn, & Brander, (*Carbon Management*, 2025)[20] provide an extensive review of available additionality tests, including a regulatory test, 'first-of-its-kind' test, common practice test, an investment test, a timing test, a barrier test, a performance standard test, a positive list test, and a quasi-experimental test. While each of these tests has its own set of advantages, the authors note that "Combinations of tests are likely to be necessary in the context of renewable energy projects and EACs." These criteria are clear, testable, and aligned with leading market practices. They prevent the use of low-impact RECs from already-operational facilities while maintaining flexibility for diverse procurement models.

The *Marginal Impact Method* (MIM)[21], developed by GHG Procotol's own Scope 2 consequential subgroup, was informed by this academic guidance and contains a combination of additionality tests meant to ensure the positive grid impact of procurement. Any and all carbon accounting frameworks that are sincerely committed to decarbonizing local grids and catalyzing emissions reductions should follow suit. By not doing so within the Scope 2 proposal, the GHG Protocol is disregarding best practices endorsed by a wealth of scholarly research.

Conclusion

The GHG Protocol stands at a pivotal moment in global carbon accounting. A deliverable, time-matched framework without additionality does not measure, much less drive, decarbonization. The academic literature, policy frameworks, and market evidence are aligned: *additionality is essential for credibility, effectiveness, and public trust.* Even the WRI itself has endorsed research affirming the importance of additionality to ensuring climate impact.[22]

The authors of this letter strongly object to the GHG Protocol's attempt to misrepresent the academic integrity and true carbon impact of the proposal it has put forward.

Signed,

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[20] Anders Bjørn, Caroline Herlev Gebara & Matthew Brander. (2025) Untangling deliverability, additionality and double counting related to renewable energy certificates for improved scope 2 emissions accounting. *Carbon Management*, 16, 051006. https://www.tandfonline.com/doi/full/10.1080/17583004.2025.2473910#abstract

[21] Greenhouse Gas Protocol. (2025, May 1). *Scope 2 Consequential Subgroup — Meeting #5 Presentation*. Retrieved from https://ghgprotocol.org/sites/default/files/2025-05/S2-consequential-Meeting5-Presentation-20250501.pdf

[22] World Resources Institute. (2025). *45V Hydrogen Production Tax Credit Guidance*. Retrieved from https://www.wri.org/technical-perspectives/45v-hydrogen-production-tax-credit-guidance