

GHG Protocol Scope 2 Update

Technical Working Group Discussion Topic Overview

Version: November 26, 2024

Working Draft; do not cite

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1. Purpose and Organization of This Paper

This discussion paper expands from the Statement of Work provided in the [Scope 2 Standard Development Plan](#) (Scope 2 SDP). Importantly, it provides only a *starting point* intended to help facilitate Technical Working Group (TWG) discussions on Phase 1 updates to the scope 2 accounting and reporting standards. All outputs of this revision process including any changes to scope 2 requirements will be developed in full consultation with the TWG and approval by the Independent Standards Board (ISB), following GHG Protocol process as described in the [Standard Development & Revision Procedure](#) (SDRP).

As outlined below each section of this paper seeks to highlight core issues identified by stakeholders, any proposed solutions, and provide preliminary questions for scope 2 TWG discussion based on feedback and evidence received through over 400 survey submissions, 70 proposal submissions, and conversations held with over 1,000 stakeholders. Comprehensive feedback previously provided by stakeholders is summarized in the [Detailed Summary of Responses from Scope 2 Guidance Stakeholder Survey](#), documented in the publicly available [stakeholder proposals](#), and further summarized in the [Scope 2 Proposal Summary](#). For a complete list of Phase 1 and 2 topics, including the timeline for addressing topics, are described in the [Scope 2 SDP](#). Additional discussion paper(s) will be published for Phase 2 topics as needed.

For each section, the Secretariat has used the GHG Protocol [Decision-Making Criteria and Hierarchy](#) (termed throughout this document as ‘Decision-Making Criteria’) to develop a preliminary straw proposal illustrating a comparative analysis of stakeholder proposals. The content within each analysis is based on stakeholder feedback and relevant research provided as described above. Please see the full [Decision-Making Criteria](#) for further a complete overview and additional information on the Decision-Making Criteria.

Informed by this public feedback, Phase 1 of the scope 2 standard revisions process will focus on two topic areas which are deemed necessary to address prior to evaluating subsequent Phase 2 topics identified by stakeholders. These priority topics are:

- A. Evaluation of the scope 2 reporting methods**
i.e., which methods generally are required or recommended to report and how to report them
- B. Analysis of potential improvements to the location- and market-based methods**
i.e., improvements and clarifications to methodologies, data usage, quality criteria, etc.

To provide a structured evaluation these topics, this discussion paper is organized as follows:

- **Section 2** - A comparative analysis of the existing scope 2 dual reporting requirement relative to proposed changes to what methods are required or recommended by the scope 2 accounting and reporting standard.
 - a. This section only compares options for changing which methods are required or recommended across the location-based & market-based inventory methods, and additional project-based methods.
 - b. Comparisons of the existing scope 2 methodologies relative to proposed updates to each method are evaluated in subsequent sections.

- **Section 3** - Introduction to technical improvements
- **Section 4** - Comparisons of the existing scope 2 location-based method to proposed options to update this methodology
- **Section 5** - Comparisons of the existing scope 2 market-based method to proposed options to update this methodology

A series of questions are presented following each of these comparisons *as a starting point* for discussion in TWGs. Note that this analysis identifies there may at times be insufficient information to comprehensively assess all proposals. Further discussion and development with TWG members of each Decision-Making Criteria evaluation is planned as part of the Phase 1 revision process. Please see the presentation “*Scope 2 TWG - Meeting #1 Presentation Slide Deck - 16 October 2024 FINAL*” for details on timeline and workplan in addition to the [Scope 2 SDP](#).

Generally, this paper follows the proposed sequence of discussion topics that will be conducted through the TWG consultation process. TWG members are encouraged to review this material in advance, be prepared to improve whether and how this information is relevant and appropriately characterized under the Decision-Making Criteria for the proposals in each section, identify what information is missing, share perspectives to help answer questions for discussion, and contribute to the development of revised scope 2 standards and guidance for the Independent Standards Board’s consideration and subsequent public consultation as detailed in the [SDRP](#).

2. Changes to the Required Reporting Methods

This section presents a comparative analysis of proposed changes to which scope 2 accounting and reporting methods are *required or recommended*.

The GHG Protocol Decision-Making Criteria are used to evaluate the existing scope 2 requirements – i.e., dual reporting of both the location-based and market-based methods and optional, separate reporting of emissions impacts of individual projects – relative to proposed changes for what methods are required or recommended in an updated GHG Protocol scope 2 accounting and reporting standard. For additional context on the options evaluated as changes to the required reporting methods, please see the [Scope 2 Proposal Summary](#).

Comparisons of specific changes to the location- and market-based methods are evaluated in subsequent sections 4 and 5 (*to be provided*).

Overview

Currently, the GHG Protocol Scope 2 Guidance provides details on accounting and reporting information using three different methods. Two are required, the location-based and market-based methods, and the third is an optional disclosure of avoided emissions information calculated using project accounting methods.

Extensive stakeholder feedback has identified a range of proposals to maintain or improve the details of each of these three methods, as well as suggest which methods are required to report. Further, a preliminary review of the evidence presented through the public consultation process has indicated the likely need for improvements to be made to existing accounting methods to improve their scientific integrity and alignment with Decision-Making Criteria. These improvements will be discussed in detail in the Technical Improvements section of this document.

To support facilitation of Scope 2 TWG discussion, this paper first presents an overarching analysis of changes to which methods organizations “shall”, “should”, “may” or “should not” include in an emission report (Section 2) using the Decision-Making Criteria. Following this evaluation, subsequent sections (3-5) provide a comparative analysis of the proposed technical changes to each of these methods using the Decision-Making Criteria.

Extensive public consultation, including over 400 survey responses, 80 detailed proposals, and engagement with over a thousand stakeholders revealed interest in several possible combinations of required scope 2 reporting methods. While more combinations of reporting methods, and additional iterations of shall/should/may language, are possible, the following four combinations of reporting methods represent the feedback from stakeholders.

Details can be found in in sections B and E of the [Detailed Summary of Responses from Scope 2 Guidance Stakeholder Survey](#) and the [Scope 2 Proposal Summary](#).

Broadly, the proposals highlighted four possible combinations of reporting structures (i.e. options):

- A. **Maintain dual reporting requirement, with potential updates; Optional project accounting:**
 - o Organizations shall report both the location- and market-based inventory methods, potentially incorporating updates to one or both methods as described in sections 4-5
 - o Organizations may report emission impacts from projects and interventions, separately from the inventory.

- B. **Report only the market-based method, with potential updates; Optional project accounting:**
 - o Organizations shall report the market-based inventory method, potentially incorporating updates as described in section 5; organizations should not report the location-based method
 - o Organizations may report emission impacts from projects and interventions, separately from the inventory.

- C. **Report only the location-based method, with potential updates; Recommend or require project accounting:**
 - o Organizations shall report the location-based inventory method, potentially incorporating updates as described in section 4; organizations should not report the market-based method
 - o Organizations [shall or should] (to be discussed with the TWG) report emission impacts from projects and interventions, separately from the inventory.

- D. **Maintain dual reporting requirement, with potential updates; Recommend or require project accounting:**
 - o Organizations shall report both the location- and market-based inventory methods, potentially incorporating updates to one or both methods as described in sections 4-5
 - o Organizations [shall or should] (to be discussed with the TWG) report emission impacts from projects and interventions, separately from the inventory.

Analysis of Options According to Decision-Making Criteria

The GHG Protocol Secretariat evaluated these four generalized options proposed by stakeholders using the Decision-Making Criteria and Hierarchy, as outlined below in Table 1. To enable a comprehensive evaluation of all required and recommended reporting options, this evaluation considers the GHG Protocol accounting and reporting principles, as appropriate, from both the Corporate Standard and Project Accounting Protocol. *This evaluation is preliminary.* Further revision and refinement of this initial analysis will be one of the first topics addressed by the Scope 2 TWG using the Decision-Making Criteria.

Table 1: Preliminary evaluation of options for changes to the required accounting and reporting methods

		Option A: Maintain Dual Reporting Requirement w/ Potential Updates; Optional Project Accounting	Option B: Report Only Market- Based w/ Potential Updates; Optional Project Accounting	Option C: Report Only Location- Based w/ Potential Updates; Recommend or Require Project Accounting	Option D: Maintain Dual Reporting Requirement w/ Potential Updates; Recommended or Require Project Accounting
Scientific integrity		NA	NA	NA	NA
GHG accounting and reporting principles Corporate Standard & Project Accounting Protocol	Relevance	Mixed / Yes	Mixed / No	Mixed / No	Yes
	Completeness	Mixed / Yes	Mixed / Yes	Yes	Yes
	Consistency	Mixed	Mixed	Mixed / Yes	Yes
	Transparency	Mixed / Yes	Mixed / Yes	Yes	Yes
	Accuracy	NA	NA	NA	NA
	Comparability¹	Mixed / Yes	Mixed	Mixed	Mixed / Yes
Supports decision making that drives ambitious global climate action		Mixed / Yes	Mixed	Mixed	Yes
Supports programs based on GHG Protocol and uses of GHG data		Mixed / Yes	No	No	Yes
Feasibility to implement		Yes	Yes	Mixed / Yes	Mixed / Yes

The following analysis compares each of the four options for changes to the required accounting and reporting methods against the Decision-Making Criteria. Due to the nature of this aggregation of stakeholder proposals, specifically only evaluating which accounting methods should be required, not how each method should be implemented, it is not possible to evaluate each criterion fully. Additionally, there is significant overlap in the analysis below as each option consists of one or several accounting methods, and some combinations of methods are similar.

This evaluation of suggested “required accounting and reporting methods” is inclusive of the GHG Protocol accounting and reporting principles, as appropriate, from both the Corporate Standard and Project Protocol.

¹ See GHG Protocol [Decision-Making Criteria and Hierarchy](#)

A. Maintain Dual Reporting Requirement, with Potential Updates; Optional Project Accounting:

Details of the proposed approach:

- Organizations shall report both the location- and market-based inventory methods, potentially incorporating updates to one or both methods as described in the Technical Improvements sections.
- Organizations may report emission impacts from projects and interventions (i.e. the project-based method, or project-based assessments), separately from the inventory.

For a detailed assessment of this approach using the full Decision-Making Criteria, see Appendix A.

Scientific integrity

The concept of scientific integrity can be more specifically applied to proposed technical improvements in subsequent sections of this document. A growing body of research has identified potential challenges with both the existing location- and market-based methods while also providing potential options to increase the scientific integrity of each method. Preliminary analysis suggests that improvements to the location- and market-based methods may be required to ensure the scientific integrity of each method. The level of scientific integrity each method can achieve will depend on the specifics of how they are implemented. See the Technical Improvements section for more details on these improvements.

GHG accounting and reporting principles

A majority of the GHG Protocol accounting and reporting principles are met or partially met through the application of required dual reporting and optional project-based reporting. In particular, the principles of relevance, completeness, and transparency are well supported through this approach. The additional principle of comparability is also supported by this approach. The principle of accuracy cannot be fully assessed without knowing the technical details of each reporting method, however the requirement to report two accounting methods may increase the likelihood that inventories calculated with this approach communicate GHG data that better aligns with the principle of accuracy. The principle of consistency is similarly dependent on the extent to which the details of the accounting methods facilitate a consistent application of accounting approaches, and both the location- and market-based methods have the potential to deliver consistent inventories given the availability of data and reporting tools. However, the principle of consistency may be challenged by the requirement to report market-based emissions year over year given that implementation of the quality criteria can significantly vary region-to-region. The continued optional treatment of project-based assessments, without clear guidance and standardization, may lead to project-level data that is inconsistent over time.

Support decision making that drives ambitious global climate action

Dual reporting of location- and market-based emissions, with optional disclosure of project-based emissions, can incentivize a range of mitigation actions necessary to address climate goals. These mitigation actions may include facility siting decisions, energy efficiency measures, time of use decisions (potentially more so with certain technical improvements), policy advocacy, and energy supply decisions. The impact and alignment of the actions incentivized by these reporting methods with global climate science will depend on the specific details of how the location-, market-, or project-based methods are implemented. However, this option of dual reporting combined with optional project-based reporting may expand the range of potential actions, offering more opportunities for impactful

and science-aligned initiatives compared to options that restrict reporting methods to one or two categories.

Support programs based on GHG Protocol and uses of GHG data

The required dual reporting of location- and market-based emissions provides users of GHG data with a range of information to assess a company's overall climate risks, energy use, and emissions mitigation actions. This data is currently relevant for existing mandatory reporting frameworks including IFRS Climate-Related Disclosures (IFRS S2), European Sustainability Reporting Standards: Climate Change (ESRS E1), ISO 14064-1:2018, The Enhancement and Standardization of Climate-Related Disclosures for Investors Rule (U.S. SEC Rule), and California Climate Corporate Data Accountability Act (CA SB 253), as well as voluntary programs including SBTi, RE100, GRI, and CDP, among others. While the optional reporting of project-based emissions assessments can provide a means to share additional relevant information for stakeholders, its status as an optional method without robust guidance may disincentivize reporting of emissions using this method. Further, the required or regular usage of project-based emissions assessments into mandatory and voluntary disclosure frameworks may be hindered by the perception that most organizations do not evaluate emissions using this method regularly or through a consistent, credible methodology. Keeping project-based emissions assessments as an optional category would therefore hinder adoption by other programs.

Feasibility to implement

There is a strong track record of implementation of the existing dual reporting framework globally and across a wide range of organizations, however, technical improvements to these methods may support or hinder feasibility globally. Further, some regions of the world lack high quality data (for both location- and market-based reporting) and/or the ability to make, track, and support supply choices (for the market-based method). While the project-based method generally has a track record of implementation in carbon markets to quantify project-level GHG reductions and removals, its feasibility and use as part of organizations' overall emission reporting, decision-making, and target-setting efforts appears to be limited. As an optional method it can be used by organizations as needed and would not impact the overall feasibility of this approach.

B. Report Only the Market-Based Method, with Potential Updates; Optional Project Accounting:

Details of the proposed approach:

- Organizations shall report the market-based inventory method potentially incorporating updates as described in the Technical Improvements section; organizations should not report the location-based method.
- Organizations may report emission impacts from projects and interventions (i.e. the project-based method, or project-based assessments), separate from the inventory.

For a detailed assessment of this approach using the full Decision-Making Criteria, see Appendix A.

Scientific integrity

See discussion of the concept of scientific integrity in Option A.

GHG accounting and reporting principles

The accounting and reporting principles of relevance and completeness are only partially met by this approach, with both suffering from the elimination of the location-based method as a required reporting category. The additional principle of comparability is also partially met by this approach, as the elimination of the location-based method removes some useful data to be used in comparisons between companies. Emissions data may be less relevant to both internal and external users of data from this approach without the location-based method, as it omits some key information, such as an organization's overall exposure to electricity consumption, provided by the location-based method. Inventories are also less comparable using only a market-based method, since the availability of clean energy supply options, market boundaries, EAC tracking systems, etc. can vary significantly by location. While a market-based method can be viewed as a means to completely allocate electricity related emissions within a specified boundary, in reality the significant variability in application of the quality criteria may mean that system-wide emissions are not accurately reported in the aggregate. The principle of consistency is mostly met by the proposed approach, assuming a consistent application of quality criteria over time, however in practice the variability in application of this method may impact its ability to produce consistent inventories over time. The market-based method may meet the principle of transparency in theory but may be less easily auditable than the location-based method. For this reason, an approach that eliminates the location-based method may be less transparent than one that retains it, and its communication of an emissions inventory may be less easily understood by the public.

Support decision making that drives ambitious global climate action

In principle, the market-based method can provide reporting organizations with a means to account for and report progress toward climate actions and goals related to their procurement and usage of electricity through incentivizing specific supply choices and potentially managing consumption of electricity based on the availability of clean energy generated on the grid. However, details of the market-based method, including aspects of the quality criteria (vintage, market boundaries, granularity of data, etc.), are important in assessing whether these actions contribute meaningfully toward a net-zero electricity grid. Further, by relying solely on reporting of market-based emissions, this approach may disincentivize some decarbonization actions compared with other approaches that additionally require reporting of location-based method and recommend or require project-based assessments.

Support programs based on GHG Protocol and uses of GHG data

The market-based method can generate useful GHG data as evidenced by its use in many voluntary (e.g., SBTi, RE100, GRI, CDP) and mandatory (e.g., IFRS S2, ESRS E1, ISO 14064-1:2018, U.S. SEC Rule, and CA SB 253) reporting frameworks. However, the lack of location-based method data creates a significant gap in climate risk information used in many mandatory disclosure frameworks, including IFRS S2 and ISO 14064-1 which require location-based emissions disclosures. Relying exclusively on the market-based method, and on inventory accounting generally, may omit relevant information quantified and separately reported using a standardized approach to project-based accounting and reporting.

Feasibility to implement

While many companies in many regions of the world currently report market-based emissions, in some cases the lack of sufficient information to meet the quality criteria (supply-specific emissions rates, EAC tracking systems, residual mix data) or lack of electricity supply choices in certain regions results in companies reporting market-based emissions totals that include some portion of regional grid-average emission factors. Although grid-average emission factors are included in the market-based emission factor hierarchy, further discussion is necessary to assess whether their use for market-based calculations truly aligns with the spirit of the feasibility criteria.

C. Report Only the Location-Based Method, with Potential Updates; Recommend or Require Project Accounting:

Details of the proposed approach:

- Organizations shall report the location-based inventory method potentially incorporating updates as described in Technical Improvements section; organizations should not report the market-based method.
- Organizations [shall or should] (to be discussed with TWG) report emission impacts from projects and interventions (i.e. the project-based method, or project-based assessments), separate from the inventory.

For a detailed assessment of this approach using the full Decision-Making Criteria, see Appendix A.

Scientific integrity

See discussion of the concept of scientific integrity in Option A.

GHG accounting and reporting principles

The GHG accounting and reporting principles of consistency and transparency are met or mostly met by this approach. The principle of relevance is partially met by this approach, as the elimination of the market-based method removes relevant information related to an organization's energy supply and renewable energy procurement actions and decisions from the GHG inventory. The principle of completeness is met by this approach, as the location-based method is a complete allocation of electricity related emissions within a defined boundary. It is worth noting that the completeness principle as defined in the Project Accounting Protocol refers to a complete assessment of inputs for a particular project, and therefore the principle of completeness is assumed to have been met by this approach. The additional principle of comparability is partially met through this approach; however, the elimination of the market-based method provides fewer options for comparability between organizations.

Support decision making that drives ambitious global climate action

The required use of the location-based method would incentivize organizations to lower their emissions by reducing their overall electricity purchases and consumption, investing in onsite clean energy projects, and improving energy efficiency. It may also be used to inform facility siting decisions, though research has pointed to potentially significant inaccuracies in using annual average emission factors to make decisions relating to adding or removing load from a grid and related energy usage considerations (see further discussion in the technical improvements to the location-based method). The location-based method does not incentivize nor provide a means to account and report on clean energy procurement actions other than onsite clean energy projects. Without the reporting of market-based emissions, decarbonization decisions related to an organization's electricity procurement choices are absent from this inventory accounting approach. Regarding the project-based method, this could provide a means to further incentivize decarbonization actions that have a net positive emissions impact, reported separately from an organization's emissions inventory. These actions could include contracting with carbon free generation, load shifting, energy storage applications, and electric vehicle infrastructure among others. However, as the exclusive means to evaluate this information it is notable that it can both be highly complex and no target-setting or mandatory disclosure programs currently recognize project accounting metrics. Incentives to take decarbonization action that rely on reporting of

emissions impacts separately from the inventory may not be as strong as those that can directly reduce the emissions inventory.

Support programs based on GHG Protocol and uses of GHG data

The location-based method provides users of GHG data with relevant climate risk information, and has been incorporated in mandatory (IFRS S2, ESRS E1, ISO 14064-1:2018, U.S. SEC Rule, and CA SB 253) and voluntary (CDP, GRI) programs globally. However, several mandatory reporting frameworks have also adopted the market-based method, and corporates participating in voluntary programs like SBTi and RE100 rely largely on the market-based method to signal achievement of goals and targets. While the reporting of project-based emissions assessments can provide additional relevant information for stakeholders, whether this method remains an optional category or is elevated to required or recommended has implications for its use by external programs. Elevating the project-based method to required or recommended could support its adoption by these programs, pending the feasibility of implementation for organizations.

Feasibility to implement

There is a strong track record of implementation of the location-based method globally, and across a wide range of organizations, however, technical improvements to this method may support or hinder feasibility globally. Some regions of the world lack high quality data for location-based calculations, though in general location-based data is readily available. While the project-based method has a long track record of implementation in carbon markets to quantify project-level GHG reductions and removals, its feasibility and significant reliance on the method as part of organizations' overall emission reporting, decision-making, and target-setting efforts is unknown. As such, the decision of whether to maintain it as an optional method or elevate it to a required or recommended reporting method has significant implications for the feasibility of this approach. This added emphasis on the project-based method may lead to a development and refinement period during the initial implementation as organizations build reporting capacity, ultimately increasing long-term feasibility as tools and resources are developed to support implementation. Further discussion and evaluation of this dynamic are needed.

D. Maintain Dual Reporting Requirement, with Potential Updates; Recommend or Require Project Accounting:

Details of the proposed approach:

- Organizations shall report both the location- and market-based inventory methods, potentially incorporating updates to one or both methods as described in the Technical Improvements sections.
- Organizations [shall or should] (to be discussed with the TWG) report emission impacts from projects and interventions (i.e. the project-based method, or project-based assessments), separate from the inventory.

For a detailed assessment of this approach using the full Decision-Making Criteria, see Appendix A.

Scientific integrity

See discussion of the concept of scientific integrity in Option A.

GHG accounting and reporting principles

All five accounting and reporting principles are met or partially met through this approach. While details of each reporting method are necessary to determine full alignment with some principles (accuracy, transparency, consistency), in general required dual reporting and required or recommended project-based reporting provides the most comprehensive quantification of emissions data to meet these principles.

Support decision making that drives ambitious global climate action

Similar to option A, required dual reporting of location- and market-based emissions, but with required or recommended disclosure of project-based emissions, can incentivize a broad range of mitigation actions necessary to address climate goals. These mitigation actions may include facility siting decisions, energy efficiency measures, time of use decisions (potentially more so with certain technical improvements), policy advocacy, energy supply decisions, and a myriad of possible interventions that reduce system-wide emissions as measured by the project-based method. The impact and alignment of the actions incentivized by these reporting methods with global climate science will depend on the specific details of their implementation. However, the presence of dual reporting and required or recommended project-based reporting broadens the range of potential actions, offering opportunities for more impactful and science-aligned initiatives compared to approaches that limit reporting to one or two categories. The elevation of the project-based method to a required or recommended reporting category could support the broader reporting ecosystem surrounding this method, and better incentivize these actions compared with approaches that maintain it as an optional reporting category.

Support programs based on GHG Protocol and uses of GHG data

Similar to option A, required dual reporting of location- and market-based emissions provides users of GHG data with a range of information, and is currently used by mandatory (IFRS S2, ESRS E1, ISO 14064-1:2018, U.S. SEC Rule, and CA SB 253) and voluntary (SBTi, CPD, RE100, GRI, etc.) disclosure programs alike. Project-based method reporting would add to this suite of relevant data, and by elevating it to a required or recommended reporting category with a more rigorous and standardized methodology this approach would likely increase the availability of this data compared with other approaches that exclude it or maintain it as only an optional reporting category with little guidance. However, it is important to note that few existing external reporting frameworks currently require or make use of emissions impacts quantified using a project-based method.

Feasibility

The feasibility of this approach shares many of the same themes already discussed in option 1, with an important difference being the elevation of the project-based method to a required or recommended reporting category instead of optional. While the project-based method has a long track record of implementation in carbon markets to quantify project-level GHG reductions and removals, its feasibility as part of organizations' overall emission reporting, decision-making, and target-setting efforts is unknown. As such, the decision of whether to elevate it to a *required* or *recommended* reporting method has significant implications for the feasibility of this approach. This added emphasis on the project-based method may lead to a development and refinement period during the initial implementation as organizations build reporting capacity, ultimately increasing long-term feasibility as tools and resources are developed to support implementation. Further discussion and evaluation of this dynamic are needed.

Observations

- Several aspects of the Decision-Making Criteria, such as scientific integrity, the principle of accuracy, and supporting decision making that drives ambitious global climate action, are not possible to assess for reporting *categories* alone. See the options discussed in the Technical Improvements section for a discussion of the implications of changes to the reporting categories.
- A reporting option that integrates both inventory and project accounting assessments may have the potential to more credibly and comprehensively align with all of the Decision-Making Criteria and hierarchy compared to relying on a subset of methods. The level of scientific integrity and accuracy that each method can achieve depends on its specific implementation, with certain options possibly demonstrating higher integrity from the outset. This suggests that the proposed combination of reporting options could offer a more robust and accurate outcome compared to other approaches. Further exploration of these considerations is provided in the Technical Improvements section.
- Approaches (option A, option D) with multiple required and recommended reporting categories will provide the most relevant information for users of GHG data and will be the most interoperable with existing voluntary and mandatory reporting and disclosure programs. Limiting reporting categories runs the risk of creating gaps in the broader reporting ecosystem.
- Approaches (option A, option D) with multiple required and recommended reporting categories will likely incentivize a larger portfolio of decarbonization actions. While the details of these reporting categories (to be discussed in the Technical Improvements section) will be important in assessing whether the actions they incentivize are impactful, the number and type of incentivized actions is relevant to consider.

Questions for Technical Working Group Discussion

- Are there evaluations of the Decision-Making Criteria for any of the four options that require further discussion and potential revision?
- Options A and D incentivize the largest suite of potential decarbonization actions by corporates. Is this increased number of actions inherently positive, or is it necessary to evaluate the specific actions and their decarbonization impact(s) before reaching a conclusion on these criteria?
- What is the current rate of corporations using project accounting methods compared to inventory accounting methods, and how would making the project-based method optional, recommended, or required affect the number of companies reporting consequential emissions impacts and the inclusion of such reporting in target-setting programs or mandatory disclosure initiatives?
- Evaluating the project-based method against the Decision-Making Criteria relies in part on assumptions about the broader reporting landscape, and the potential that programs external to GHG Protocol adopt consequential impact assessments at some level. What conclusions can we make about the effectiveness of the project-based method without understanding future adoption by these external groups?

3. Technical Improvements: Introduction

The following sections 4 and 5 discuss proposed options to maintain or update technical requirements of both the location- and market-based methods, including updates to requirements and recommendations for activity data, emission factors, and quality criteria.

The location- and market-based methods were developed to improve the relevance, completeness, consistency, transparency, and accuracy of reported scope 2 totals, and provide individual consumers with greater clarity about the decisions they can make to reduce emissions associated with their purchased and consumed electricity as well as contribute to emission reductions in the grid. This information can help reporting organizations to identify and understand the risks and opportunities associated with emissions from their purchased and consumed electricity and can support decision making that drives ambitious global climate action. Increasingly this data is also useful for general consumers of GHG emission data mandated through regulatory climate disclosure rules.

As outlined in the Corporate Standard and Scope 2 Guidance, there is not always a direct cause-and-effect relationship between a single activity of the reporting organization (purchasing and consuming energy) and the resulting GHG emissions on the grid. However, activities that the Scope 2 Guidance recognize as contributing to a reduction in a reporting organization's indirect emissions should, in aggregate, correspond to reductions in global emissions over time. The Guidance states, *"as long as the accounting of indirect emissions over time recognizes activities that in aggregate change global emissions"*.²

Feedback and research provided to the Secretariat through the global survey process highlighted that the current technical requirements of the location- and market-based methods may not be or are now less suited to meet the needs of today's markets. Specifically, these methods may fall short in consistently ensuring that reported scope 2 emissions offer relevant and accurate information necessary to inform ambitious climate actions and goals that genuinely contribute to overall emission reductions in the grid. Various options were proposed to update the technical requirements of the location- and market-based methods emphasizing how revised methods could more effectively capture the link between reported emissions and actual system-wide progress toward decarbonization goals. The following sections discuss these options in detail; the location-based method is discussed in section 4 and the market-based method in section 5.

Across the scope 2 proposals and survey responses submitted, various perspectives were offered on the integration of inventory (or attributional) accounting and project-based (or consequential) accounting methodologies. Some stakeholders suggested that both methodologies be used and reported separately, while others advocated for a variety of hybrid approaches that combine the two methods into a single metric.

As detailed in the [Scope 2 SDP](#), the focus of the current revision process is to update the scope 2 inventory accounting and reporting requirements within the context of the GHG Protocol Corporate

² Corporate Standard, p. 59 and Scope 2 Guidance, p.28

Standard. Specifically, this process aims to update inventory accounting methods within scope 2 to better reflect indirect emission allocations associated with purchased and consumed electricity.

The GHG Protocol Corporate Accounting and Reporting Standard and the GHG Protocol for Project Accounting currently offer distinct frameworks: entity-level GHG inventory accounting quantifies and allocates an organization’s share of emissions to the atmosphere—including the location- and market-based methods in scope 2—while project-based GHG accounting evaluates the emissions impacts of specific projects or actions against a counterfactual baseline scenario. Within the Corporate Standard, Scope 2 Guidance, and the Scope 3 Standard, project-based accounting remains as an additional disclosure outside of the inventory boundary.

The current GHG Protocol revision process will address questions related to clarifying interactions and distinctions between inventory and project accounting, as well as evaluating whether and to what extent methodologies like project-based accounting may supplement the reporting and assessment of GHG impacts within scope 2. As stated in the [Scope 2 SDP](#), this includes determining the role and relationship of consequential methods described in [Guidelines for Quantifying the GHG Reductions from Grid-Connected Electricity Projects](#) relative to the scope 2 inventory.

For further information on the background and intended uses of these inventory and project-based methodologies, please refer to the [Inventory and Project Accounting: A Comparative Review](#).

4. Technical Improvements: Location-Based Method

Background

As detailed in Chapter 4 of the Scope 2 Guidance and Chapter 4 of the Corporate Standard, calculating scope 2 emissions requires an allocation method to quantify the emissions from power generation associated with purchased and consumed energy. The Guidance presents the location-based method as a means to allocate the GHG emissions generated by electricity production to end consumers based on the average emission intensity of the grid where the energy consumption occurs.

This is done by applying emission factors to each unit of energy purchased and consumed, reflecting *“the average emissions intensity of grids on which energy consumption occurs (using mostly grid-average emission factor data).”*³ The Scope 2 Guidance states that *“[c]ompanies should use the most appropriate, accurate, precise, and highest quality emission factors available for each method.”*⁴ When available, average emission factors should represent *“all electricity production occurring in a defined grid distribution region that approximates a geographically precise energy distribution and use area. Emission factors should reflect net physical energy imports/exports across the grid boundary.”*⁵ The *“most appropriate spatial boundaries for emission factors serving the location-based method are those that approximate regions of energy distribution and use, such as balancing areas. All generation and emissions data within this boundary should be aggregated and any net physical energy imports/exports and their related emissions should be taken into account.”* Options are also provided to use larger boundaries when necessary.⁶

Advanced grid study estimations

The Scope 2 Guidance also recognizes that some companies may have access to detailed studies or software solutions linking their facilities’ time-of-day energy use patterns to the GHG emissions from local generation dispatching during those times. Section 6.10 of the Scope 2 Guidance notes that, at the time of publication in 2015, such studies or analyses had not been widely available or used, however, these advanced grid studies may *“help inform specific demand-side actions more than grid-average emission factors, which may only incentivize overall demand reduction rather than targeted actions.”*⁷ Where advanced studies (or real-time information) are available, companies may optionally report scope 2 estimations using this data separately as a comparison to location-based grid average estimations, and companies can document where this data specifically informed efficiency decision making or time-of-day operations. *“Because these studies or analyses may be more difficult to use widely across facilities or to standardize/aggregate consistently without double counting, companies should ensure that any data used for this purpose has addressed data sourcing and boundaries consistent with the location-based method.”*⁸

Throughout the Scope 2 Guidance, the location-based method is described as: 1) useful for demonstrating, and 2) providing decision-relevant information in the following areas:

³ Scope 2 Guidance, section 1.5, p. 8

⁴ Scope 2 Guidance, section 6.5, p. 45

⁵ Scope 2 Guidance, Table 6.2, p.47

⁶ Scope 2 Guidance, section 6.10.1, p. 54

⁷ Scope 2 Guidance, Box 6.2, p.53

⁸ Scope 2 Guidance, section 7.3, p.61-62

1. Estimating and reflecting emissions based on grid data

- Providing a simple method of estimating the pro rata share of total system emissions according to electricity consumed within a defined geographic area and time period using a grid-average emission factor.⁹
- Reflecting GHG intensity of grids where operations occur, regardless of market type.¹⁰
- Reflecting that a consumer is served by all the energy resources deployed on their regional grid.¹¹
- Reflecting the role of “balancing” resources and their emissions.¹²

2. Risk and opportunity assessment related to grid emissions

- Showing risks/opportunities that are better evaluated based on average emissions in a grid (e.g., regulatory).¹³
- Reflecting risks related to grid operation and maintenance (e.g., maintaining regional grid reliability).¹⁴
- Highlighting a company’s exposure to geographic risks, including (a) air pollution such as sulfur dioxide (SO_x) or mercury from coal combustion; (b) the impact of hydropower on local waterways and aquatic life; and (c) the risks from nuclear waste disposal or emergencies.¹⁵

3. Enabling decision-making for consumers and companies

- Enabling facility-siting decisions based on carbon intensities of standard grid-delivered electricity in different regions.¹⁶
- Enabling facility-siting decisions based on natural features of a location (e.g., areas with low-carbon natural resources, or additional benefits such as natural ambient cooling or heat).¹⁷
- Highlighting opportunities for reduced energy consumption.¹⁸
- Reflecting the cumulative effect of consumer or supplier choices over time that change the grid-average emission factor.¹⁹

4. Improving comparability

- Improving comparability across a reporting organization’s operations across multiple markets over time.²⁰

⁹ Scope 2 Guidance, section 4.1.1, p. 25-26

¹⁰ Scope 2 Guidance, section 4.1.1, p. 26

¹¹ Scope 2 Guidance, section 2.5, p. 19

¹² Scope 2 Guidance, Box 4.1, p. 27

¹³ Scope 2 Guidance, section 6.4.1, p. 45

¹⁴ Scope 2 Guidance, section 2.2, p. 16-17

¹⁵ Scope 2 Guidance, section 2.2, p. 17

¹⁶ Scope 2 Guidance, section 4.3, p. 28

¹⁷ Scope 2 Guidance, section 4.3, p. 28

¹⁸ Scope 2 Guidance, section 2.2, p. 17

¹⁹ Scope 2 Guidance, section 4.3, p. 31

²⁰ Scope 2 Guidance, section 6.4.1, p. 45

- Comparing the aggregate GHG performance of energy-intensive sectors (e.g., comparing electric train transportation with gasoline or diesel vehicle transit).²¹

Feedback and research provided to the Secretariat highlighted that the current technical requirements of the location-based method may not be or are now less suited to demonstrate or provide relevant and accurate decision-making information for all these use cases.

Various options have been proposed to update the technical requirements of the location-based method, either to better link reported emissions with actual system-wide progress toward decarbonization goals or to revise the method's stated purpose and use cases. The following section provides a preliminary evaluation of options, though additional variations may exist. Importantly, this analysis serves as a *starting point* for the Scope 2 TWG to refine and expand upon during the first phase of the [Scope 2 SDP](#).

Location-Based Method Technical Improvements Under Consideration

The current Scope 2 Guidance Chapter 7, "Accounting and Reporting Requirements" details the required information for reporting the scope 2 location-based method, and Chapter 6, "Calculating Emissions" details the scope 2 location-based emission factor hierarchy. Different options were proposed as technical improvements to the location-based method or to revise the stated purpose and use cases associated with the location-based method. Below we describe three proposed options focusing on the location-based method emission factor hierarchy along with further clarification and guidance on how more granular data within the location-based method can produce more appropriate, accurate, precise, and highest quality accounting and reporting outcomes.

A. Maintain the current location-based method accounting and reporting requirements

- Maintain current broad flexibility of the scope 2 location-based method emission factor hierarchy.
 - Companies **should** use the most appropriate, accurate, precise, and highest quality emission factors available for each method.²²
 - Organizations **should** first try to use **regional or subnational emission factors**: *"Average emission factors representing all electricity production occurring in a defined grid distribution region that approximates a geographically precise energy distribution and use area. Emission factors should reflect net physical energy imports/exports across the grid boundary."*²³
 - When such information is unavailable, organizations **may** use **national production emission factors**: *"Average emission factors representing all electricity production information from geographic boundaries that are not necessarily related to dispatch region, such as state or national borders. No adjustment for physical energy imports or exports, not representative of energy consumption area."*²⁴

²¹ Scope 2 Guidance, Table 4.1, p. 26

²² Scope 2 Guidance, section 6.5, p. 45

²³ Scope 2 Guidance, Table 6.2, p. 47

²⁴ Scope 2 Guidance, Table 6.2, p. 47

- Maintain broad temporal requirements
 - An annual grid average emission factor is described as an indicative example for an appropriate regional or subnational emission factor.”²⁵
 - When analyzing location-based scope 2 results, organizations are encouraged to take into account “*temporal representativeness due to time delays between the year in which energy generation and resulting emissions occurred, and the year in which the data is published.*”²⁶

B. Refine reporting requirements for the location-based method to require temporal and geographic granularity

- Building on the current location-based method requirements, organizations **shall** account and report their location-based method inventory using more temporally and geographically granular accounting and reporting requirements for the location-based method:
 - Organizations **shall** account for and report the location-based method inventory using hourly grid average emission factors and activity data.
 - Organizations **shall** account for and report the location-based method inventory using emission factors that reflect ‘deliverable’ geographic boundaries.
 1. In this option ‘deliverable’ geographic boundaries are considered in two ways:
 - a. Deliverable boundaries **shall** use granular geographic boundaries (to be discussed and defined in TWG consultation).
 - b. Deliverable boundaries **shall** use grid-average emission factors that include energy imports/exports across grid boundaries.

C. Revise location-based method emission factor hierarchy to include power flow modeling

- Revise the location-based method emission factor hierarchy²⁷ to include emission factors calculated using a ‘power flow modeling’ approach as the highest (most precise) emission factor. This revision could also include changes to how advanced grid study estimations²⁸ are reported.

²⁵ Scope 2 Guidance, Table 6.2, p. 47

²⁶ Scope 2 Guidance, section 6.10.1, p. 54

²⁷ Scope 2 Guidance, Table 6.2, p. 47

²⁸ Scope 2 Guidance, section 7.2, p. 61

The Scope 2 TWG and the GHG Protocol Secretariat will continue to review the various options to update or maintain the location-based method relative to the stated objectives and principles in the Scope 2 Guidance and the GHG Protocol Decision-Making Criteria. To this end, an initial assessment is provided in the following table and expanded below. These draft considerations are provided as a *starting point* for further discussion by the Scope 2 TWG.

Table 2. Preliminary evaluation of changes to the location-based accounting and reporting method

		Option A: Maintain the Current Location-Based Method Accounting and Reporting Requirements	Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity	Option C: Revise Location-Based Method Emission Factor Hierarchy to Include Power Flow Modeling
Scientific integrity		Mixed	Mixed / Yes	<i>Further discussion with TWG needed.</i>
Corporate Standard GHG accounting and reporting principles	Relevance	Mixed	Mixed / Yes	
	Completeness	Yes	Yes	
	Consistency	Yes	Yes	
	Transparency	Yes	Mixed / Yes	
	Accuracy	Mixed	Mixed / Yes	
	Comparability²⁹	Mixed	Mixed / Yes	
Supports decision-making that drives ambitious global climate action		Mixed / No	Mixed	
Supports programs based on GHG Protocol and uses of GHG data		Mixed	Mixed / Yes	
Feasibility to implement		Yes	Mixed / No	

Further Location-Based Method Considerations

Additional options or combinations of options may be possible for the location-based method, and the Scope 2 TWG is encouraged to raise further options and refinements to build upon this starting point.

For example, the current requirements could remain, with added *recommendations* that organizations should use more granular temporal and geographic data when feasible but may use the existing requirements. This approach could help organizations align their location-based reporting more closely with the principles of relevance and accuracy, supporting decision-making for ambitious climate action in a way similar to Option B. However, because this granularity would only be recommended, not

²⁹ See GHG Protocol [Decision-Making Criteria and Hierarchy](#)

required, it would not necessarily demonstrate greater overall alignment with these criteria than the current location-based method (Option A).

Further consideration may be necessary to determine if recommending, rather than requiring, more granular emission factors might inadvertently reduce alignment with the principles of consistency and comparability. If organizations vary in their use of emission factors depending on the level of data granularity available at reporting time, this could impact consistency, comparability, and performance tracking of scope 2 emissions over time. Conversely, by encouraging more granular reporting, this recommendation may, over time, improve data access as tools and resources are developed.

Analysis using the Decision-Making Criteria could be undertaken by the Scope 2 TWG to evaluate this among other options. Based on a preliminary analysis, without adding new mandatory reporting requirements, this option appears to closely align with Option A, with potential impacts on the criteria of consistency, comparability, and feasibility as noted above.

Option A: Maintain the Current Location-Based Method Accounting and Reporting Requirements

Details of the proposed approach:

- Maintain current broad flexibility of the scope 2 location-based method emission factor hierarchy (see full text above).
- Maintain broad temporal requirements (see full text above).

For a detailed assessment of this approach using the full Decision-Making Criteria, see Appendix B.

Scientific integrity

The current location-based method provides a simplified estimation of the reporting organization's indirect emissions associated with their purchased and consumed electricity. This estimation is determined by allocating a pro rata share of total system emissions within a defined geographic area and time period according to the amount of electricity purchased and consumed by the organization using a grid average emission factor. Under the current location-based method, the emissions reported in an organization's scope 2 location-based inventory will increase or decrease as result of either corresponding increases or decreases in their activities (i.e., purchased and consumed electricity) or changes in the grid-average emission factor used by the reporting organization. Some research has identified that closer consideration of both the time and location where energy is purchased and consumed in relation to energy generation on the grid may improve the scientific integrity of how average system emissions are accurately allocated across different organizations.³⁰

³⁰ Miller, Gregory J., Kevin Novan, and Alan Jenn. "Hourly accounting of carbon emissions from electricity consumption." *Environmental Research Letters* 17, no. 4 (2022): 044073;
de Chalendar, Jacques A., John Taggart, and Sally M. Benson. "Tracking emissions in the US electricity system." *Proceedings of the National Academy of Sciences* 116, no. 51 (2019): 25497-25502;
Ji, Ling, Sai Liang, Shen Qu, Yanxia Zhang, Ming Xu, Xiaoping Jia, Yingtao Jia et al. "Greenhouse gas emission factors of purchased electricity from interconnected grids." *Applied Energy* 184 (2016): 751-758;

By its mathematical design, the current location-based method, using annual grid-average emission factors, is poorly suited or unable to reflect any direct or precise causal responsibility between an organization's energy usage or actions and the emissions assigned via the location-based method to the reporting organization. This does not compromise the legitimacy of the method as a means to simply allocate emissions using a grid-average emission rate, however it indicates the method does not fully align with the scientific integrity criteria when it comes to enabling decision-making for reporting organizations. If decisions are made based on the current location-based method using annual average emission factors they may inaccurately reflect the actual emissions outcomes of an organization's actions, potentially misrepresenting the effectiveness of efforts to reduce emissions. There are mixed views in research on whether improving the spatiotemporal granularity of average emission factors could result in improved decision-making utility. Further research is required to evaluate this dynamic. See the discussion under Option B for further analysis of the impact of increased granularity.

GHG accounting and reporting principles

The GHG accounting and reporting principles of completeness, consistency, transparency, and the additional principle of comparability, are well supported through the current location-based method. The principle of relevance is not fully met as the current location-based method using annual average emission factors is largely incompatible with risk and opportunity assessments related to grid emissions, and poorly suited for informing decision-making by internal users seeking to reduce emissions or assess performance. However, the current location-based method may provide relevant information for external decision-makers as a simple and easily understood methodology to make comparisons of average allocation of grid emissions across markets and time. The principle of accuracy is also not fully met as research indicates that in some regions the current location-based method using annual average emission factors may misallocate emissions to individual organizations due to its lack of temporal and spatial granularity, including not requiring accounting for electricity imports/exports across regions³¹. Additionally, while the current location-based method provides an accurate means to allocate the pro rata shares of total system emissions based on electricity consumed within a defined geographic area and time period, the use of annual average grid emission factors introduces significant uncertainty for users to make decisions with reasonable confidence related to facility siting, increases or decreases in electricity consumption, timing of demand shifts, deployment of new technologies, and other related risk or opportunity assessments.

Support decision-making that drives ambitious global climate action

The current Guidance indicates the location-based method using annual average emission factors may incentivize organizations to:

- Report GHG emissions using a simple and comparable allocation method

Qu, Shen, Sai Liang, and Ming Xu. "CO2 emissions embodied in interprovincial electricity transmissions in China." *Environmental science & technology* 51, no. 18 (2017): 10893-10902;

Schäfer, Mirko, Bo Tranberg, Dave Jones, and Anke Weidlich. "Tracing carbon dioxide emissions in the European electricity markets." In *2020 17th International Conference on the European Energy Market (EEM)*, pp. 1-6. IEEE, 2020.

³¹ Miller, Novan, and Jenn, "Hourly Accounting," 044073;

de Chalendar, Taggart, and Benson, "Tracking Emissions," 25497-25502;

Ji et al., "Greenhouse Gas Emission Factors," 751-758;

Qu, Liang, and Xu, "CO2 Emissions," 10893-10902;

Schäfer et al., "Tracing Carbon Dioxide Emissions," 1-6.

- Reduce overall grid electricity consumption and improve energy efficiency as a means to reduce reported activity data.
- Make facility-siting decisions based on the annual average grid emission intensity of different regions.
- Make facility-siting decisions based on natural features of a location.
- Make time-of-use decisions based on the average grid emission intensity at different hours of the day.
- Rely on incremental changes in grid emission intensity to reduce reported emissions. Some organizations may attempt to accelerate this change through indirect actions such as grid decarbonization advocacy and lobbying.

Some of these actions, including reporting GHG emissions using a simple and comparable allocation method, advocacy and lobbying efforts, and decisions that reduce overall electricity purchases and consumption in aggregate, may contribute to ambitious climate actions. However, the current location-based method may not provide accurate information to inform decisions that add, remove, or shift electricity load nor develop clean energy generation resources, due to the limitations inherent in the use of annual average emission factors.

Support programs based on GHG Protocol and uses of GHG data

The location-based method provides a simplified estimation of the reporting organization's indirect emissions associated with purchased electricity. The current location-based method is used by several key programs, including IFRS Climate-Related Disclosures (IFRS S2), European Sustainability Reporting Standards: Climate Change (ESRS E1), ISO 14064-1:2018, The Enhancement and Standardization of Climate-Related Disclosures for Investors Rule (U.S. SEC Rule), and California Climate Corporate Data Accountability Act (CA SB 253), as well as voluntary programs including GRI and CDP, among others.

The effectiveness of the current location-based method in generating data for general users is mixed, as it is highly dependent on the intended use of such data. As described in the sections above, while the location-based method may provide an allocation of system-wide emissions based on total consumption, the use of annual data or large geographic boundaries may introduce limitations for the use of the data to assess a reporter's risks and opportunities related to grid emissions or inform decision-making.

Feasibility to implement

The current location-based method has a strong track record of implementation. Organizations at varying levels of maturity can access the activity data and emission factors required to implement this method. The widespread availability of annual average grid emission factors has facilitated the adoption of location-based reporting globally.

Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity

Details of the proposed approach:

Building on the current location-based method requirements, organizations **shall** account and report their location-based method inventory using more temporally and geographically granular accounting and reporting requirements for the location-based method:

- Organizations **shall** account for and report the location-based method inventory using hourly grid average emission factors and activity data.
- Organizations **shall** account for and report the location-based method inventory using emission factors that reflect 'deliverable' geographic boundaries (see full text in *Location-Based Method Technical Improvements Under Consideration*).

For a detailed assessment of this approach using the full Decision-Making Criteria, see Appendix B.

Scientific integrity

Similar to the current location-based method outlined above, this proposed approach seeks to provide a simplified, albeit more granular, estimation of the reporting organization's indirect emissions associated with their purchased and consumed electricity. This estimation is determined by allocating a pro rata share of total system emissions within a defined geographic area and time period according to the amount of electricity purchased and consumed. Research has identified that closer consideration of both the time and location where energy is purchased and consumed in relation to energy generation on the grid may improve the scientific integrity of how average system emissions are allocated across different organizations.³² This option reflects this research by requiring that organizations *shall* use an hourly grid average emission factor matched with hourly activity data and *shall* use 'deliverable' geographic boundaries inclusive of imported/exported energy. Improving the granularity of how system emissions are allocated is not necessarily required for the location-based method to meet its purpose to provide a simple, accessible means to allocate emissions using a grid-average emission rate. However, by improving the accuracy of how emissions are estimated, the location-based method could more closely align with the scientific integrity criteria when it comes to its other stated purposes and use cases as outlined in the Scope 2 Guidance (i.e., assessing risks and opportunities related to grid emissions, enabling decision-making for consumers and companies, and improving comparability).

As discussed earlier, the current location-based method, using annual grid-average emission factors, is poorly suited or unable to reflect any direct or precise causal responsibility between an organization's

³² Miller, Gregory J., Kevin Novan, and Alan Jenn. "Hourly accounting of carbon emissions from electricity consumption." *Environmental Research Letters* 17, no. 4 (2022): 044073;
de Chalendar, Jacques A., John Taggart, and Sally M. Benson. "Tracking emissions in the US electricity system." *Proceedings of the National Academy of Sciences* 116, no. 51 (2019):25497-25502;
Ji, Ling, Sai Liang, Shen Qu, Yanxia Zhang, Ming Xu, Xiaoping Jia, Yingtao Jia et al. "Greenhouse gas emission factors of purchased electricity from interconnected grids." *Applied Energy* 184 (2016): 751-758;
Qu, Shen, Sai Liang, and Ming Xu. "CO2 emissions embodied in interprovincial electricity transmissions in China." *Environmental science & technology* 51, no. 18 (2017): 10893-10902;
Schäfer, Mirko, Bo Tranberg, Dave Jones, and Anke Weidlich. "Tracing carbon dioxide emissions in the European electricity markets." In *2020 17th International Conference on the European Energy Market (EEM)*, pp. 1-6. IEEE, 2020.

energy usage or actions and the emissions assigned to the reporting organization. However, some new research by Gagnon et al.³³ may indicate that when using an hourly emission factor there is a slight positive correlation between induced emissions from an organization's load interventions (e.g., adding load to the grid) and the allocated GHG emissions, potentially implying that requiring use of hourly emission factors produces inventory data that better enables decision-making for consumers and customers. However, there are mixed views on whether this correlation exists or is helpful for decision-making. Some research is generally unsupportive or inconclusive of the concept of using average emission factors to inform decision-making (e.g., shifts in demand, usage patterns, or the adoption of new technologies), suggesting that alternate methodologies, such as short-run or long-run marginal emission factors, should be used to inform these actions).³⁴ Further research is needed to examine the implication of increased spatiotemporal granularity of the location-based method for decision-making, particularly research evaluating these questions in regions outside of the United States.

GHG accounting and reporting principles

The GHG accounting and reporting principles of completeness and consistency are well supported through the proposed location-based method approach. The additional principle of comparability is also well supported, however, compared with Option A, increasing granularity may unintentionally introduce greater data variability. This is due to differences in data availability for hourly emission factors (based on grid regions that may account for imports/exports differently) and hourly activity data from reporting organizations. Such variability could initially affect comparability.

The proposed approach may improve alignment with the principle of relevance. Research, as described in the scientific integrity section above, indicates that use of hourly, regionally-specific emission factors inclusive of imports/exports can more accurately estimate the allocation of system emissions than annual average emission factors. However, there is mixed evidence regarding whether the proposed use of hourly grid average emission factors would provide more relevant information to facilitate internal decision-making concerning load shifting, demand response, and energy storage applications for existing facilities. There is similarly mixed evidence regarding whether the use of more granular emission factors provides relevant information for evaluating emission outcomes from adding new load to the grid (e.g., siting new facilities or significant increases purchased and consumed energy). When considering information relevant for meeting external decision-making needs, the same limitations of this proposed approach appear to apply.

³³ Gagnon, Pieter, and Wesley Cole. "Planning for the evolution of the electric grid with a long-run marginal emission rate." *Iscience* 25, no. 3 (2022).

³⁴ Holland, Stephen P., Matthew J. Kotchen, Erin T. Mansur, and Andrew J. Yates. "Why marginal CO2 emissions are not decreasing for US electricity: estimates and implications for climate policy." *Proceedings of the National Academy of Sciences* 119, no. 8 (2022): e2116632119.;

Elenes, Alejandro GN, Eric Williams, Eric Hittinger, and Naga Srujana Goteti. "How well do emission factors approximate emission changes from electricity system models?" *Environmental Science & Technology* 56, no. 20 (2022): 14701-14712;

He, Hua, Aleksandr Rudkevich, Xindi Li, Richard Tabors, Alexander Derenchuk, Paul Centolella, Ninad Kumthekar, Chen Ling, and Ira Shavel. "Using marginal emission rates to optimize investment in carbon dioxide displacement technologies." *The Electricity Journal* 34, no. 9 (2021): 107028;

Siler-Evans, Kyle, Ines Lima Azevedo, and M. Granger Morgan. "Marginal emissions factors for the US electricity system." *Environmental science & technology* 46, no. 9 (2012): 4742-4748;

Hawkes, Adam D. "Long-run marginal CO2 emissions factors in national electricity systems." *Applied Energy* 125 (2014): 197-205;

Gagnon, Pieter, and Wesley Cole. "Planning for the evolution of the electric grid with a long-run marginal emission rate." *Iscience* 25, no. 3 (2022).

The principle of accuracy is more closely met under the proposed approach than the current location-based method. This approach more precisely defines the ‘geographic boundary’ and ‘time of use’ for grid-average emission factors, aligning more closely with new research outcomes that test the implications of refining these boundaries on the accuracy of how the grid’s average emissions are allocated to individual reporters. However, the extent to which more accurately allocated inventory emissions data can be used to inform accurate decision-making requires further exploration.

Requiring the use of more granular emission factors and consumption data may complicate location-based emissions calculations and limit the public availability of emission factors. This may affect the auditability of this accounting approach and, consequently, its alignment with the principle of transparency.

Support decision-making that drives ambitious global climate action

The current Guidance indicates the location-based method using annual average emission factors may incentivize organizations to:

- Report GHG emissions using a simple and comparable allocation method.
- Reduce overall grid electricity consumption and improve energy efficiency as a means to reduce reported activity data.
- Make facility-siting decisions based on the average grid emission intensity of different regions.
- Make facility-siting decisions based on natural features of a location.
- Make time-of-use decisions based on the average grid emission intensity at different hours of the day.
- Rely on incremental changes in grid emission intensity to reduce reported emissions. Some organizations may be incentivized to attempt to accelerate this change through indirect actions such as grid decarbonization advocacy and lobbying.

Some of these actions or decisions, including reporting GHG emissions using a simple and comparable allocation method, decisions that reduce overall electricity purchases and consumption in aggregate, and advocacy and lobbying efforts, may support ambitious global climate actions.

As detailed in the scientific integrity section, research is inconclusive about whether the required use of hourly average and ‘deliverable’ emission factors may provide accurate information to inform time of use decisions, how incremental changes in grid emission intensity reduce emissions, or make facility- or generation-siting decisions.

Support programs based on GHG Protocol and uses of GHG data

Compared to the current location-based method, this approach may provide users with more useful emission data as it is more accurate, relevant, and comparable for the reasons described above.

For reasons of feasibility, it is unclear how this option might impact interoperability with policies and programs that have implemented the location-based method as new legal disclosure requirements including in IFRS S2 and ESRS E1.

Feasibility to implement

This proposed approach would introduce greater barriers to feasibility than the current location-based method for some organizations and/or some regions of the world. Evidence of widespread global implementation of this option, relative to the current location-based method, is limited. The necessary

datasets to report location-based emissions under this method are available in some markets, however they remain unavailable or challenging to obtain in many regions globally. Likewise, hourly electricity consumption data for a facility would be challenging to obtain for many organizations globally. However, utilities and energy providers are increasingly making hourly consumption data available to customers, and increased demand for hourly emissions accounting would likely drive further availability of this information.

Option C: Revise Location-Based Method Emission Factor Hierarchy to Include Power Flow Modeling

Details of the proposed approach:

- Revise the location-based method emission factor hierarchy³⁵ to include emission factors calculated using a power flow modeling approach as the highest (most precise) emission factor. This revision could also include changes to how advanced grid study estimations are reported.³⁶

Option C was not assessed in detail by the Secretariat. Further discussion with the TWG is necessary to determine whether this approach should be considered alongside Options A and B as a standalone proposal or addressed as a component of Options A and B and discussed within the context of each.

Questions for Technical Working Group Discussion

- What additional research/evidence should be incorporated into this analysis?
- Are there additional uses of the location-based method, either as stated in the Scope 2 Guidance or in common practice, that should be considered?
- Are the current uses as stated in the Scope 2 Guidance appropriate? Can the location-based method using average emission factors inform the risks and opportunities associated with emissions from purchased and consumed electricity as described in Chapter 2 of the Scope 2 Guidance?³⁷
- Is a one-hour period the most appropriate temporal granularity for location-based emission factors under the approach described in Option B? Is there data or research that indicates an alternative time period better aligns with the Decision-Making Criteria (daily, monthly, annually, sub-hourly, etc.)?
- What data or evidence exists that can comprehensively and objectively assess the global feasibility of location-based emission calculations for Options A, B, and potentially C?
- What datasets, tools, or resources are available to help reporting organizations consistently and accurately assess 'deliverable' electricity grid boundaries worldwide?
- How should Option C be considered in the context of the location-based methodology specifically and scope 2 accounting and reporting generally?

³⁵ Scope 2 Guidance, Table 6.2, p. 47

³⁶ Scope 2 Guidance, section 7.2, p. 61

³⁷ Scope 2 Guidance, section 2.2, p. 15

5. Technical Improvements: Market-Based Method

Background

As detailed in Chapter 4 of the Scope 2 Guidance (and Chapter 4 of the Corporate Standard), calculating scope 2 emissions requires an allocation method to assign direct emissions from power generation to reporting organization's indirect emissions associated with their energy purchases and consumption.³⁸ The market-based method is provided as a means to allocate GHG emissions generated by electricity production based on the choices a consumer makes regarding its electricity supplier or product.³⁹

In this method, emissions are calculated by assigning specific emission rates to the electricity that a reporting organization purchases and consumes, based on the type of energy and the supplier selected. Organizations use contractual instruments such as energy attribute certificates (EACs) (e.g., RECs in the U.S., GOs in Europe) or supplier-specific emission rates, each representing the emission profile of the electricity produced. The EAC acts as an indicator of the emission rate for the electricity purchased and consumed, often representing a low or zero-emissions source (e.g., zero kg CO₂ per MWh for renewable energy). This emission rate from the certificate is then applied to the organization's purchased and consumed energy, allowing them to report lower scope 2 emissions that reflect the lower emission energy source they have chosen. By selecting emission factors linked to specific contracts and choosing the most precise factor available for each location, companies can reflect their purchasing choices in their scope 2 emissions, distinguishing between renewable and non-renewable sources. This method thus aligns the organization's emissions with their purchasing actions, providing a customized emission profile tied to their energy procurement strategy.⁴⁰

Table 6.3 in the Scope 2 Guidance represents a hierarchy of these emission factors. The most precise emission factors are EACs issued in units that match consumption units (e.g. MWh), followed by contracts for electricity where EACs do not exist or are not required for a usage claim, supplier/utility emission rates, residual mixes that factors out voluntary purchases, and lastly grid-average emission factors where residual mix data are unavailable.⁴¹ Note that this hierarchy does *not* represent a preferred hierarchy for procurement methods, but instead provides guidance on which emission factors to use when available.⁴²

The Scope 2 Guidance states that the market-based method is currently designed to reflect:

“the GHG emissions associated with the choices a consumer makes regarding its electricity supplier or product. These choices—such as choosing a retail electricity supplier, a specific generator, a differentiated electricity product, or purchasing unbundled energy attribute certificates—are conveyed through agreements between the purchaser and the provider. Under the market-based method of scope 2 accounting, an energy consumer uses the GHG emission factor associated with the qualifying contractual instruments it owns. In contrast to the location-based method, this allocation pathway represents contractual information and claims flow, which may be different from underlying energy flows in the grid. The

³⁸ Scope 2 Guidance, section 5.3, p. 34

³⁹ Scope 2 Guidance, Table 4.1, p. 26

⁴⁰ Scope 2 Guidance, section 6.11, p. 54

⁴¹ Scope 2 Guidance, section 6.5, p. 45-48

⁴² Scope 2 Guidance, section 6.5, p. 45-46

certificate does not necessarily represent the emissions caused by the purchaser's consumption of electricity. One company choosing to switch suppliers does not directly or in the short-term impact the entire operation of the grid and its emissions. Over time, the collective consumer demand for particular energy types and their resulting attributes (e.g., zero GHG emissions from generation) can send a market signal to support building more of those types of generation facilities, just as purchasing any product sends the market signals to produce more of that product.”⁴³

The Scope 2 Guidance reiterates from the Corporate Standard that:

“...reductions in indirect emissions (changes in scope 2 or 3 emissions over time) may not always capture the actual emissions reduction accurately. This is because there is not always a direct cause-effect relationship between the single activity of the reporting company (purchasing and consuming energy) and the resulting GHG emissions on the grid.”⁴⁴

The Corporate Standard and Scope 2 Guidance further states that:

“generally, as long as the accounting of indirect emissions over time recognizes activities that in aggregate change global emissions, any such concerns over accuracy should not inhibit companies from reporting their indirect emissions.”⁴⁵

While the Guidance suggests that activities in aggregate should change global emissions,⁴⁶ the Scope 2 Guidance does not require any additionality or other impact criteria in the quality criteria for contractual instruments claimed under the market-based method⁴⁷ and further states that:

“offset additionality criteria are not fundamental to, or largely compatible with, the underlying rules for market-based scope 2 accounting and allocation. Scope 2 reporting is a report of usage and as such is independent of issues associated with additionality”⁴⁸

While not included as a mandatory requirement for market-based scope 2 accounting, the Scope 2 Guidance addresses ways companies can go beyond the Scope 2 Quality Criteria to:

“shift their impact from ‘aggregate’ to more directly spurring an increase in new, low-carbon energy generation facilities in a short period of time.”⁴⁹

Suggested actions include to:

- *“contract directly with new low-carbon energy projects*
- *work with electricity suppliers for new projects or*
- *establish ‘eligibility criteria’ for corporate energy procurement, relating to specific energy generation features or policy interactions that align with new low-carbon energy projects.”⁵⁰*

⁴³ Scope 2 Guidance, section 4.1.2, p. 26-27

⁴⁴ Scope 2 Guidance, section 4.3, p. 28; Corporate Standard, p. 59

⁴⁵ Scope 2 Guidance, section 4.3, p. 28; Corporate Standard, p. 59

⁴⁶ Scope 2 Guidance, section 4.3, p. 28

⁴⁷ Scope 2 Guidance, section 11.3, p. 90

⁴⁸ Scope 2 Guidance, section 11.3, p. 90

⁴⁹ Scope 2 Guidance, section 11.4, p. 91

⁵⁰ Scope 2 Guidance, section 11.4, p. 91

Throughout the Scope 2 Guidance, the various purposes of the market-based method are recognized as 1) useful for demonstrating, and 2) providing decision-making relevant information in the following areas:

1. Estimating emissions based on contractual relationships to electricity supply

- Demonstrating the individual choices of electricity product or supplier, or the lack of a differentiated choice, which requires the use of a residual mix⁵¹
- Allocating emission attributes based on a company's contractual relationships, or what a company is paying for⁵²

2. Influencing electricity suppliers and generation resource supply mix across the grid

- Increasing demand for low-carbon energy⁵³
- Motivating consumers to partner with suppliers offering low-carbon products, and to seek out opportunities to leverage a company's own financial resources to help develop new projects⁵⁴

3. Risk and opportunity assessment related to contractual relationships

- Reflecting reputational risks/opportunities related to a company's energy procurement⁵⁵
- Conveying legally enforceable rights and claims from contractual instruments (reducing exposure to legal risks)⁵⁶
- Reflecting risks related to cost premiums of low-carbon energy and related GHG emissions⁵⁷
- Reflecting risks related to cost of environmental compliance for the energy resources owned or purchased by a customers' utility⁵⁸

4. Enabling decision-making for consumers and companies

- Enabling facility-siting decisions based on carbon intensities of supply offerings or the residual mix used in a location⁵⁹
- Highlighting opportunities for reduced energy consumption⁶⁰
- Enabling a choice of specific resources⁶¹
- Reflecting the individual consumer or supplier choices (or lack thereof) that over time and in aggregate drive supply change⁶²
- Providing transparency for stakeholders⁶³

⁵¹ Scope 2 Guidance, section 4.3, p. 31

⁵² Scope 2 Guidance, section 2.4, p. 19

⁵³ Scope 2 Guidance, section 11.1, p. 89

⁵⁴ Scope 2 Guidance, section 2.3, p. 19

⁵⁵ Scope 2 Guidance, section 2.2, p. 17

⁵⁶ Scope 2 Guidance, section 2.2, p. 17

⁵⁷ Scope 2 Guidance, section 2.2, p. 15

⁵⁸ Scope 2 Guidance, section 2.2, p. 16

⁵⁹ Scope 2 Guidance, section 4.3, p. 28

⁶⁰ Scope 2 Guidance, section 4.3, p. 30

⁶¹ Scope 2 Guidance, section 2.4, p. 19

⁶² Scope 2 Guidance, section 4.3, p. 31

⁶³ Scope 2 Guidance, section 7.4, p. 62

Feedback and research provided to the Secretariat highlighted that the current technical requirements of the market-based method may not be or are now less suited to demonstrate or provide valuable information for all these purposes. Various options have been [proposed by stakeholders](#) to update the technical requirements of the market-based method to more effectively capture the link between reported emissions and actual system-wide emission outcomes, and to revise the stated purpose and intended uses associated with the market-based method. The following section evaluates these options using the Decision-Making Criteria.

This is a rapidly evolving area of research that explores complex systems and can rely on methodologies not widely familiar to all stakeholders. While there may be varying levels of consensus across the literature, the GHG Protocol Secretariat remains committed to collaborating closely with stakeholders to thoroughly assess and integrate the latest scientific insights. Furthermore, the Secretariat recognizes that a majority of cited research concerning the market-based method focuses on the North American and European markets, and therefore further research and exploration may be required to make informed conclusions.

Market-Based Method Technical Improvements Under Consideration

The current Scope 2 Guidance Chapter 7, “Accounting and Reporting Requirements” details the required information for reporting the scope 2 market-based method, which includes the Scope 2 Quality Criteria. Stakeholder feedback proposed either maintaining the status quo with minor updates or the following technical improvements to the market-based method. Updates generally relate to creating more specific and more rigorous Scope 2 Quality Criteria, along with further clarification and guidance on how the market-based method can produce the most appropriate, accurate, precise, and highest quality accounting and reporting outcomes.

A. Maintain the current market-based method accounting and reporting requirements

- Maintain current broad flexibility of the scope 2 market-based method emission factor hierarchy and contractual instrument Quality Criteria:
 - *“Companies **should** use the most appropriate, accurate, precise, and highest quality emission factors available for each method.”⁶⁴*
 - *“Companies **shall** ensure that any contractual instruments used in the market-based method total meet the Scope 2 Quality Criteria specified in Table 7.1. If instruments do not meet the Criteria, then other data (listed in Table 6.3) **shall** be used as an alternative in the market-based method total. In this way, all companies required to report according to the market-based method will have some type of data option.”⁶⁵*
- Criteria 4. Vintage: Maintain language “...**[shall]** be issued and redeemed as close as possible to the period of consumption to which the instrument is applied,”⁶⁶ which generally results in annual matching.

⁶⁴ Scope 2 Guidance, section 6.5, p. 45

⁶⁵ Scope 2 Guidance, section 7.1, p. 60

⁶⁶ Scope 2 Guidance, Table 7.1 Scope 2 Quality Criteria, p. 60

- Criteria 5. Market boundaries: Maintain language “...[**shall**] be sourced from the same market in which the reporting entity’s electricity-consuming operations are located and to which the instrument is applied”⁶⁷

B. Time and location matching

- Change Scope 2 Quality Criteria to require more temporally and spatially granular matching of emission factors to electricity consumption, such as:
 - Criteria 4. Vintage: Change language to require hourly matching, e.g.:
 - ‘...**shall** be issued and redeemed for the same hour of consumption to which the instrument is applied’
 - Criteria 5. Market boundaries: Change language to require matching from ‘deliverable’ market boundaries (note: see discussion of ‘deliverability’ in the location-based method technical improvements section), e.g.:
 - ‘... **shall** be sourced from physically deliverable market boundaries in which the electricity consuming operations are located and to which the instrument is applied.’

C. Three pillars (time matching, deliverability, newness)

- Change Scope 2 Quality Criteria to require time and location matching plus introduce a requirement for resource newness (e.g., facility age, operational or repowering date, etc.)
 - Criteria 4 & 5, same as in Option B
 - New Quality Criteria: Resource newness or facility age, e.g.:
 - ‘... **shall** be sourced from resources with a commercial operation date or recommissioning date within [*a specified number of*] years from the reporting period to which the instrument is applied.’
 - See Appendix C for further discussion on ‘specified number of years.’

D. Introduce additionality or causality test in the Scope 2 Quality Criteria

- Introduce new requirements to the Scope 2 Quality Criteria related to ‘additionality’ and/or ‘causality.’
- A precise definition of one or both terms in the context of scope 2 would need to be developed and further defined in the TWG process. See detailed discussion below and in Appendix C on preliminary treatments and definitions.
- Specific language change possibilities to be discussed with TWG.

E. Replace existing market-based method with a formula ‘Scope 2 emissions = induced – avoided emissions’

- Adjust emissions calculation approach to quantify emissions ‘induced’ and emissions ‘avoided’, and net the two values using the formula: scope 2 emissions = induced emissions – avoided emissions

⁶⁷ Scope 2 Guidance, Table 7.1 Scope 2 Quality Criteria, p. 60

- Induced emissions calculation: electricity purchased and consumed * locational marginal emission rate
- Avoided emissions calculation: renewable energy purchase * marginal emission rate on grid where the purchase renewable energy was generated
- Under this option avoided emissions need not occur in the same region or time as where the reporting organization's induced emissions occur.
- Some details of this option, such as whether the induced and avoided emissions calculations use annual or more granular emission factors, follows a hierarchy, apply to all purchased and consumed load and contracted renewable energy or just what differs from a hypothetical baseline differ within proposals related to this option and would need to be defined.
- Specific language change possibilities to be discussed with TWG.

The Scope 2 TWG and the GHG Protocol Secretariat will continue to review these and any new options to update or maintain the market-based method relative to the stated objectives and principles in the Scope 2 Guidance and the GHG Protocol Decision-Making Criteria. To this end, an initial assessment is provided in the following table and summarized below. A comprehensive analysis is presented in Appendix C. These draft considerations are provided as a *starting point* for further discussion by the Scope 2 TWG.

*For formatting reasons, the full option titles for table are presented here:

- **Option A:** Maintain the current market-based method accounting and reporting requirements
- **Option B:** Time and location matching
- **Option C:** Three pillars (time and location matching plus resource newness)
- **Option D:** Introduce additionality or causality test in the Scope 2 Quality Criteria
- **Option E:** Replace existing market-based method with a formula ‘Scope 2 emissions = induced – avoided emissions’

Table 3. Preliminary evaluation of changes to the market-based accounting and reporting method

		*Option A	*Option B	*Option C	*Option D	*Option E
Scientific integrity		Mixed	Mixed / Yes	Mixed / Yes	Mixed	Mixed
Corporate Standard GHG accounting and reporting principles	Relevance	Mixed	Mixed / Yes	Yes	Mixed	N/A
	Completeness	Yes	Yes	Mixed	Mixed	N/A
	Consistency	Mixed	Yes	Yes	Mixed	N/A
	Transparency	Yes	Yes	Yes	Mixed	N/A
	Accuracy	Mixed	Mixed / Yes	Yes	Mixed	N/A
	Comparability⁶⁸	Mixed	Mixed / Yes	Mixed / Yes	Mixed	N/A
Supports decision-making that drives ambitious global climate action		Mixed	Mixed / Yes	Yes	Mixed	Mixed
Supports programs based on GHG Protocol and uses of GHG data		Mixed	Mixed	Mixed	Mixed	Mixed / No
Feasibility to implement		Mixed / Yes	Mixed	Mixed / No	Mixed	Mixed

Further Market-Based Method Considerations

Additional options or combinations of options may be possible for the market-based method, and the Scope 2 TWG is encouraged to raise further options or combinations and refinements to build upon this starting point. Further consideration may be necessary to determine if recommending, rather than requiring, aspects of different options might impact alignment with one or more Decision-Making Criteria. For example, if organizations vary in their use of options or parts of some options, this could impact consistency, comparability, and performance tracking of scope 2 emissions over time.

⁶⁸ See additional principles in GHG Protocol [Decision-Making Criteria and Hierarchy](#)

Option A: Maintain the Current Market-Based Method Accounting and Reporting Requirements

Details of the proposed approach:

- Maintain current broad flexibility of the scope 2 market-based method emission factor hierarchy and contractual instrument Quality Criteria (see full text above)

The following is a summarization of the detailed assessment of this approach using the full Decision-Making Criteria presented in Appendix C.

Scientific integrity

The current market-based method provides an estimation of the reporting organization's indirect emissions associated with their purchased and consumed electricity. This estimation is determined by allocating a pro rata share of the total emissions from a power generation grid occurring within a defined time period according to the amount of electricity purchased and consumed by the organization using emission factors conveyed via contractual instruments. If the reporting organization does not have contractual information that meets the Scope 2 Quality Criteria, they must use the "residual mix" emission factor representing the untracked or unclaimed energy and emissions or, where a residual mix is not available, they may use other grid average emission factors. Under the current market-based method, the emissions reported in an organization's scope 2 market-based inventory will increase or decrease as result of either corresponding increases or decreases in their activities (i.e., electricity purchases and consumption), changes in the emission intensity of the contractual supply procured by the reporting organization, or changes in the residual mix or grid-average emission rate. A volume of recent research has identified that closer consideration of both the time and location where energy is purchased and consumed in relation to energy generation on the grid may improve the accuracy of the market-based method's allocation of system emissions to all end users based on their contractual relationships.⁶⁹

The current market-based method intends to recognize activities that in aggregate change global emissions. Some research has attempted to contextualize the impact of the voluntary renewable energy market on clean energy deployment through interviews with market participants, indicating that those interviewed generally agree on the value of the existing voluntary market.⁷⁰ However, when assessing this objective against the scientific integrity criteria, significant research has demonstrated that some current applications of the existing market-based method and Scope 2 Quality Criteria provide limited or no ability to influence electricity suppliers and generation resource supply mix across the grid.⁷¹ Based

⁶⁹ Xu, Qingyu, Wilson Ricks, Aneesha Manocha, Neha Patankar, and Jesse D. Jenkins. "System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies." *Joule* 8, no. 2 (February 21, 2024): 374–400. <https://doi.org/10.1016/j.joule.2023.12.007>;

Scholta H & Blaschke MJ (2024), "Shedding Light on Green Claims: The Impact of a Closer Temporal Alignment of Supply and Demand in Voluntary Green Electricity Markets" MIT CEEPR Working Paper 2024-08, June 2024.;

de Chalendar et al., "Tracking Emissions," 25497-25502;

Ji et al., "Greenhouse Gas Emission Factors," 751-758;

Qu et al., "CO2 emissions embodied in interprovincial electricity transmissions in China," 10893-10902;

⁷⁰ O'Shaughnessy, Eric. "A More Comprehensive View of the Impacts of Voluntary Demand for Renewable Energy." (September 11, 2024). <https://ssrn.com/abstract=4953515> or <http://dx.doi.org/10.2139/ssrn.4953515>

⁷¹ Hamburger, Ákos. "Is guarantee of origin really an effective energy policy tool in Europe? A critical approach", *Society and Economy Soc Ec* 41, 4 (2019): 487-507, <https://doi.org/10.1556/204.2019.41.4.6>;

on this research, if decisions are made using the current market-based method, using broad market boundaries and annual matching of emission factors to purchased and consumed electricity, they may inaccurately reflect the actual emissions outcomes of an organization's actions and potentially misrepresent the effectiveness of efforts to reduce emissions in aggregate. There are mixed views on whether improving the spatiotemporal granularity of contractual instruments could provide greater influence in generation resource supply mix across the grid and result in improved decision-making, or if other requirements (e.g. newness, additionality, etc.) are needed to achieve this result. See the discussion under Options B-D for further analysis on this.

Corporate Standard GHG accounting and reporting principles

The principles of accuracy and relevance are not fully met as research indicates allocation of emissions using annual emission factors and broad geographic boundaries may obfuscate the accuracy of the emissions inventory, especially when accounting approaches that use more granular time intervals or more localized conditions would show different results.⁷² Additionally, to evaluate whether the market-based method is sufficiently accurate requires an assessment of how actions incentivized by the approach change emissions in aggregate.⁷³ Research (as discussed in scientific integrity section) shows that voluntary market activities incentivized by the current market-based method may not lead to system-wide reductions in emissions, nor new non-emitting generation resources. This introduces significant uncertainty for users and limits the relevance of this option as a tool to inform decision-making by internal or external users seeking to reduce emissions or assess performance.

This approach aligns partially with the principle of consistency by providing a framework that enables organizations to track GHG emissions over time using specific, contractually sourced emission factors tied to energy procurement choices. However, as the current market-based method does not require uniform market boundaries, EAC or emission factor vintages, residual mix data, and other parameters across reporting periods, organizations may approach the methodology with varying levels of rigor, which can complicate consistent year-over-year tracking. Generally, market-based comparisons across companies are possible, however inconsistent use of key implementation details undermines the ability

Galzi, Pierre-Yves. "Do Green Electricity Consumers Contribute to the Increase in Electricity Generation Capacity from Renewable Energy Sources? Evidence from France." *Energy Policy* 179 (2023): 113627.;

Langer, Lissy and Brander, Matthew and Lloyd, Shannon M. and Keles, Dogan and Matthews, H. Damon and Bjørn, Anders. "Does the purchase of voluntary renewable energy certificates lead to emission reductions? A review of studies quantifying the impact." (November 17, 2023). <http://dx.doi.org/10.2139/ssrn.4636218>;

Ricks, Wilson, Qingyu Xu, and Jesse D. Jenkins. "Minimizing Emissions from Grid-Based Hydrogen Production in the United States." *Environmental Research Letters* 18, no. 1 (January 2023): 014025. <https://doi.org/10.1088/1748-9326/acacb5>;

Zeyen, Elisabeth, Iegor Riepin, and Tom Brown. "Temporal Regulation of Renewable Supply for Electrolytic Hydrogen." Zenodo, September 7, 2023. <https://doi.org/10.5281/zenodo.8324521>;

Xu, et al. "System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies," 374–400.

Olson, Arne, Patel, Kushal, Mettetal, Liz, Gangelhoff, Gregory, Zohrabian, Angineh, Somerset, Hugh, Li, Ruoshui, and Spooner, Joshua. "Consequential Impacts of Voluntary Clean Energy Procurement." (July 2024). https://www.ethree.com/wp-content/uploads/2024/07/E3_VoluntaryCorporateProcurement_HourlyEmissions_June-2024.pdf

⁷² Xu, et al. "System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies," 374–400.;

Scholta et al., "Shedding Light on Green Claims.;"

de Chalendar et al., "Tracking Emissions," 25497-25502;

Ji et al., "Greenhouse Gas Emission Factors," 751-758;

Qu et al., "CO2 emissions embodied in interprovincial electricity transmissions in China," 10893-10902;

⁷³ The Scope 2 Guidance states that "generally, as long as the accounting of indirect emissions over time recognizes activities that in aggregate change global emissions, any such concerns over accuracy should not inhibit companies from reporting their indirect emissions." (Scope 2 Guidance, section 4.3, p. 28). Therefore, the assessment of the principle of accuracy requires consideration of the method's ability to meet this intention.

to accurately compare emissions across reporting organizations and may lead to potential misinterpretations of performance.

Support decision making that drives ambitious global climate action

The current market-based method may incentivize organizations to seek low-carbon electricity supply options, reduce overall grid electricity consumption, improve energy efficiency, and make facility-siting decisions based on availability of clean energy supply in a region. As discussed in the scientific integrity section, some actions to seek low-carbon electricity supply incentivized by the current market-based method may not result in system-wide grid decarbonization, and therefore may not support decisions that drive global climate action.

Support programs based on GHG Protocol and uses of GHG data

The market-based method and its current Scope 2 Quality Criteria have been adopted for use by regulatory and climate disclosure rules such as the European Sustainability Reporting Standards, the Science Based Targets Initiative, RE100, and GRI, among others. The effectiveness of the current market-based method in generating data for general users largely depends on the intended use of the data. The use of annual data or broad geographic boundaries may limit the data's usefulness for assessing a reporter's grid-related risks and opportunities or for informing decision-making.

Feasibility to implement

The current market-based method using annual activity data with annual matching of contractually owned emission factors has been widely implemented around the world, and by organizations at varying levels of maturity. However, in markets where data access is limited and differentiated clean energy supply options are unavailable, a market-based method cannot be reported.

The current emission factor hierarchy allows reporters to use a grid-average emission factor where they do not have access to a more precise emission factor. The next most precise emission factor, a residual mix, is not available in many regions globally, and without it, accurately apportioned electricity emission data under the market-based method is not realistic for all regions. Supporting the development of these datasets, and datasets that are more frequently updated, utilize consistent measurement methods, and are publicly available (free to access) would further facilitate feasibility of the market-based method.

Option B: Time and Location Matching

Details of the proposed approach:

- Change Scope 2 Quality Criteria to require more temporally and spatially granular matching of emissions factors to electricity consumption, e.g.:
 - Change language to require hourly matching
 - Change language to require matching from 'deliverable' market boundaries

See full text in *Market-Based Method Technical Improvements Under Consideration*.

The following is a summarization of the detailed assessment of this approach using the full Decision-Making Criteria presented in Appendix C.

Scientific integrity

This proposed approach provides an estimation of the reporting organization’s indirect emissions associated with their purchased and consumed electricity similar to the existing market-based method, but instead requires the use of a more defined geographic area and time matching for both activity data and emission factors. For reference, within research this approach has been referred to as “24/7” or “24/7 matching.”

Studies that looked at the time and location of generation and consumption found that hourly matching generation from deliverable resources takes seasonal and daily fluctuations in renewable energy supply into consideration and better approximates the portfolio of carbon-free resources serving an organization.⁷⁴ As a result of this research, it appears that the proposed time- and location-matched approach may improve the scientific integrity of the market-based method's allocation of system emissions method relative to the status quo. Distinct from Option A, Option B may also better align a reporter’s market-based purchasing activities with real-world risks and opportunities, such as energy resource availability, prices, climate change events, and economic factors.

Research shows that the combination of temporal and geographic granularity requirements are crucial elements for a market-based method to influence electricity suppliers and the generation resource supply mix across the grid. Studies analyzing the impact of carbon-free procurement by commercial and industrial (C&I) participants in a voluntary market context as well as in the context of hydrogen generation incentives found that hourly matching strategies performed far better than annual matching strategies and other approaches sometimes referred to as 'carbon matching' or 'emissions matching'.⁷⁵ One study found that removing either temporal or geographic granularity resulted in significantly higher consequential emissions compared to a strategy that required both.⁷⁶ However, all referenced studies included an additional constraint that procured renewable energy come from 'new' sources, indicating the extent to which a time and location matching approach, without other requirements, could influence electricity suppliers and generation resource supply mix across the grid needs further consideration. Additionally, one research paper which modeled the consequential emissions impact of time and location matching without any additional restrictions on resource eligibility found that time and location matching alone had no impact on the generation supply mix.⁷⁷

As discussed above, increasing the granularity of emission factors and activity data may better align the emission inventory of the reporting organization with the emissions of the grid they purchase and consume electricity from and may therefore result in an emissions accounting framework that is better suited to informing decision-making. However, the extent to which a time and location matching requirement alone can influence the generation resource mix, and the impact of this on decision making, requires further evaluation.

⁷⁴ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.

⁷⁵ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400;

Olson et al., “Consequential Impacts of Voluntary Clean Energy Procurement,” July 2024;

Ricks et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States”;

Haley, Ben and Jeremy Hargreaves. “45V Hydrogen Production Tax Credits – Three-Pillars Accounting Impact Analysis.” (June 2023). <https://www.evolved.energy/post/45v-three-pillars-impact-analysis>

⁷⁶ Ricks et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States.”

⁷⁷ Ricks et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States.”

Corporate Standard GHG accounting and reporting principles

The GHG accounting and reporting principles of completeness, consistency and transparency are well supported under the proposed time- and location-matched market-based method. A time- and location-matched approach can provide a potentially more accurate and relevant approach to allocate emissions than the status quo market-based method. However, this may be limited by whether a time and location matching requirement alone, without constraints such as additionality or project newness, can support the development of new non-emitting generation on the grid and therefore enable users to make decisions necessary to reduce system-wide emissions.

This approach may enhance comparability across organizations by standardizing data choices more than the current market-based method. However, varying levels of data precision applied by different organizations may still limit the ability to compare market-based emissions, as is the case today.

Support decision making that drives ambitious global climate action

The proposed market-based method may incentivize organizations to seek low-carbon electricity supply options, reduce overall grid electricity consumption and improve energy efficiency, shift electricity consumption to hours when there are more non-emitting energy resources on the grid, and make facility-siting decisions based on availability of clean energy supply in a region. The proposed time and location matching approach provides a framework that encourages organizations to align their energy procurement with renewable availability and geographical grid proximity. This approach can potentially drive more relevant decision-making than the current market-based method approach in the context of climate goals by encouraging investments in renewables that meet time- and location-specific demand, rather than relying on annualized and geographically broad EAC purchases, which may have limited impact on actual grid decarbonization. However, as noted in the sections above, research suggests that while more precise temporal and geographic matching can improve the accuracy of emissions allocation, ensuring alignment with global climate goals may also require additional criteria to drive system-level emission reductions.

Support programs based on GHG Protocol and uses of GHG data

Given that the time and location matching approach is generally a more precise version of today's market-based method, the approach likely would not implicitly create issues with interoperability across policies and programs that have instituted use of the market-based method. However, without additional criteria such as "newness" or additionality requirements, the data may still have limitations in fully reflecting a reporter's grid-related risks, opportunities, or decision-making needs.

For reasons of feasibility, it is unclear how this option might impact interoperability with policies and programs that have implemented the current market-based method as new legal disclosure requirements including those in IFRS S2 and ESRS E1. Considering this sensitivity, further consideration of how this proposal aligns with this criterion may be necessary.

Feasibility to implement

Some organizations have begun calculating market-based emissions and transacting using time and location matching approaches.⁷⁸ These organizations have thus far utilized two approaches to do so, the first relies on turnkey time- and location-matched products from power suppliers, and the second

⁷⁸ See power purchase agreements by [Google](#), [Microsoft](#), [Iron Mountain](#), the [US Federal Government](#).

requires managing a portfolio of electricity supply agreements to reach high-levels of time and location matching from non-emitting resources.⁷⁹

To enable a time- and location-matched approach, various data are needed, including hourly electricity consumption data, timestamped EACs, and an hourly residual mix factor. Without these, accurately apportioned electricity emission data under the granular time- and location-matched approach is not realistic for all organizations across all geographic regions of the world. However, various initiatives are underway to improve access to granular data.

Aside from an increased volume of data when moving from annual to hourly matching under a time- and location-matched approach, integrating “deliverability” into market boundary requirements presents additional challenges with feasibility. Research shows that no single market boundary definition may work well in all contexts globally.⁸⁰

Given these challenges, a time- and location-matching requirement may not be possible for organizations across a range of sizes, sophistication, and across various geographies. Some tools and resources are already being developed to support the adoption of time and location matching, including timestamped EACs and hourly residual mix emission factors, but further development is required.

Option C: Three Pillars (Time and Location Matching Plus Resource Newness)

Details of the proposed approach:

- Change Scope 2 Quality Criteria to require time and location matching plus introduce a requirement for resource newness (e.g., facility age)

See full text in *Market-Based Method Technical Improvements Under Consideration*.

The following is a summarization of the detailed assessment of this approach using the full Decision-Making Criteria presented in Appendix C.

Scientific integrity

The proposed approach provides an estimation of the reporting organization’s indirect emissions associated with their purchased and consumed electricity similar to the existing market-based method, but like Option B, it also requires the use of a more defined geographic area and time matching for both activity data and emission factors. In addition, any EACs, contracted renewable energy, green tariffs, etc. used for this approach must be sourced from ‘new’ projects. A precise definition of ‘new’ remains necessary and requires closer consideration with the TWG. For simplicity, this approach will be referred to as “three pillars.”

As described in detail in Options A and B, recent research has demonstrated that closer consideration of time and location in scope 2 emissions accounting may result in a more accurate allocation of system emissions to all end users based on their contractual relationships. An additional ‘newness’ requirement

⁷⁹ EPRI. “24/7 Carbon-Free Energy: Matching Carbon-Free Energy Procurement to Hourly Electric Load,” 2022. <https://www.epri.com/research/products/000000003002025290>

⁸⁰ Miller, Gregory, Gailin Pease, Wenbo Shi, Long Lam, Kathleen Spees, Jadon Grove, and Ivy Yang. “Where Matters: Integrating Deliverability into Voluntary Clean Energy Market Boundaries.” Singularity Energy and Brattle Group, August 2023. <https://singularity.energy/boundaries-report>.

may further improve the estimation of emissions based on contractual relationships to electricity supply sources. This approach may also better align a reporter's market-based purchasing activities with real-world risks and opportunities, such as energy resource availability, prices, climate change events, and economic factors.

As described earlier, studies that analyzed carbon-free procurement by C&I participants in a voluntary market context as well as in the context of hydrogen generation incentives found that hourly matching strategies performed better than annual matching strategies and other strategies sometimes referred to as 'carbon matching' or 'emissions matching' strategies.⁸¹ In addition, the third pillar of this approach (resource newness) was modeled at some level by most researchers. Compared to Option B, which doesn't include a newness requirement, this option aligns more closely to the modelled strategies found to be most effective in reducing emissions at the system-level. Researchers collectively identified several technological and economic factors under which the findings of their work may differ that should be considered in making an assessment against this criterion (outlined in Appendix C).

Corporate Standard GHG accounting and reporting principles

The GHG accounting and reporting principles of relevance, consistency, transparency and accuracy are well supported under the proposed three pillars approach. Compared to the other options, this approach aligns most favorably with the principles overall. More information is needed to understand whether a market-based inventory allowing only claims to emission rates from carbon-free electricity that comes from new resources would fulfil the principle of completeness.

In regard to comparability, a three pillars approach, which requires the use of more granular activity data and emission factors and introduces a requirement for resource newness would standardize data choices more than under the current market-based method, so may improve comparability across organizations. However, different levels of data precision applied by different organizations may still limit the ability to compare market-based emissions across organizations, as is the case today.

Support decision making that drives ambitious global climate action

The proposed market-based method may incentivize organizations to seek low-carbon electricity supply options, reduce overall grid electricity consumption and improve energy efficiency, shift electricity consumption to hours when there are more non-emitting energy resources on the grid, and make facility-siting decisions based on availability of clean energy supply in a region. The proposed three pillars approach requires hourly matching of energy use with EACs sourced from the same grid, and from newer projects, providing a framework that encourages organizations to align their energy procurement with real-time renewable availability and geographical grid proximity. This approach can drive more relevant decision-making than the current market-based method approach in the context of climate goals by encouraging investments in renewables that meet location- and time-specific demand, and by supporting development of new projects.

As noted in the sections on scientific integrity, accuracy, and relevance, research suggests that the combination of temporal matching, geographic matching, and newness has a significant system-wide

⁸¹ Xu, et al. "System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies," 374–400; Olson et al., "Consequential Impacts of Voluntary Clean Energy Procurement," July 2024; Ricks et al., "Minimizing Emissions from Grid-Based Hydrogen Production in the United States"; Haley, Ben and Jeremy Hargreaves. "45V Hydrogen Production Tax Credits – Three-Pillars Accounting Impact Analysis."; Zeyen, Elisabeth, Iegor Riepin, and Tom Brown. "Temporal Regulation of Renewable Supply for Electrolytic Hydrogen."

impact on grid decarbonization, above all other proposals analyzed here. This may mean that the proposed approach is best suited to informing decisions that drive global climate action.

Support programs based on GHG Protocol and uses of GHG data

A three pillars approach to the market-based method can in theory be used to meet purposes related to climate-related disclosure, target-setting, and performance tracking. It is unclear whether the approach would create issues with interoperability across policies and programs that have instituted a market-based method based solely on the allocation of all attributes. As evidenced in the scientific integrity section, the three pillars approach further improves the estimation of emissions based on contractual relationships to electricity supply sources and substantially reduces system-wide emissions when compared to annual matching, time and location matching, and emissions matching approaches. Thus, it may be better suited for climate-related disclosure, target setting and performance tracking purposes than the status quo. However, the feasibility of the three pillars option may be constrained by interoperability challenges with existing programs and disclosure frameworks such as IFRS S2 and ESRS E1. Further evaluation is needed to determine the feasibility of widespread adoption and ensure alignment with current standards and policies.

Feasibility to implement

As discussed in Option B, organizations have already begun calculating market-based emissions and transacting using time and location matching approaches,⁸² however information on any organizations further incorporating ‘newness’ as the required third pillar is lacking, and therefore this approach may show mixed to unfavorable alignment with the feasibility criteria for organizations across geographies.

Challenges for the three pillars approach also include the need to establish consistent supplier-specific or residual mix emission factors to account for electricity not sourced from three-pillar-compliant resources, as well as the additional complexity in distinguishing compliant attributes from non-compliant ones across diverse electricity markets.

The three pillars approach has been closely examined in the context of issuing subsidies for grid-connected hydrogen production (electrolysis) and has been instituted into law in the European Union.⁸³ However, the European Union rule includes an interim period (until January 2030) during which matching of contractual instruments to electricity consumption need only be done on a monthly basis. Full time and location matching will go into effect in January 2030.

Furthermore, research has shown that implementing a three pillars approach may be significantly more costly than other approaches, such as annual matching with additionality, and therefore may limit feasibility for a majority of organizations globally.

⁸² See power purchase agreements by [Google](#), [Microsoft](#), [Iron Mountain](#), the [US Federal Government](#).

⁸³ 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 fuels of non-biological origin, Document 02023R1184-20240610 (2023). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02023R1184-20240610>.

Option D: Introduce Additionality or Causality Test in the Scope 2 Quality Criteria

Details of the proposed approach:

- Introduce new requirement to Scope 2 Quality Criteria related to ‘additionality’ or ‘causality’.

See full text in *Market-Based Method Technical Improvements Under Consideration*.

The following is a summarization of the detailed assessment of this approach using the full Decision-Making Criteria presented in Appendix C.

Scientific integrity

The proposed approach revises the Quality Criteria to require that any contractual instruments accounted for under the market-based method shall meet an “additionality” or “causality” test. A precise definition of these terms requires closer consideration with the working group, this could include requirements related to financial, regulatory, environmental, and technological additionality or other potential options.

This proposed option requires greater clarity regarding requirements for matching the time and location of energy generation and consumption. If it permits either annual matching of emission factors with activity data or broad market boundaries—or both—it is unlikely to align with the principle of scientific integrity due to the inherent inaccuracies of such approaches, as outlined in Option A. If this proposed option requires more granular matching of emission factors with activity data *and* deliverable market boundaries, it increasingly resembles Option C (three pillars) with the notable difference in the potential definitions of “additionality” or “causality” relative to only a “newness” requirement.

In assessing available research to date, there appears to be limited to no true test of the ability of an additionality or causality requirement to influence generation resources and system-level emissions on the grid, due to the complexity of modeling this dynamic. Research comparing several studies on hydrogen incentives found that the varying definitions of additionality and assumptions on long-run investment effects used by these models determines whether additionality requirements alone are enough to ensure minimal consequential emission impacts, or whether additional hourly requirements are necessary, identifying a potential need for further research in this area.⁸⁴

Because proving additionality or causality requires use of counterfactuals, much of the research on this consideration uses a renewable energy project’s ‘newness’ as a proxy or heuristic for additionality. There is mixed research on how a ‘newness’ requirement alone (without both hourly matching and deliverability requirements) can impact consequential emission impacts.⁸⁵ However, ‘newness’ is notably distinct from more commonly understood definitions of causality or additionality related to project financing, regulatory surplus, etc.

Introducing an additionality or causality requirement without increasing the granularity of emission factors and activity data does not necessarily support accurate decision-making for companies based on

⁸⁴Cybulsky, Anna, Michael Giovanniello, Tim Schittekatte, and Dharik Mallapragada. *Producing Hydrogen from Electricity: How Modeling Additionality Drives the Emissions Impact of Time Matching Requirements*. 2023. <https://doi.org/10.21203/rs.3.rs-2834020/v1>.

⁸⁵ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400; Ricks et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States.”; Zeyen, Elisabeth, Igor Riepin, and Tom Brown. “Temporal Regulation of Renewable Supply for Electrolytic Hydrogen.”

their scope 2 inventory. However, if this proposed approach requires more granular matching of emission factors with activity data and deliverable market boundaries it may result in an emissions accounting framework that is better suited to informing decision-making, similar to the assessment of Option C. The impact of various potential definitions of “causality” and/or “additionality” needs further consideration.

Corporate Standard GHG accounting and reporting principles

Alignment of this proposed method with the GHG accounting and reporting principles is generally mixed. The proposed approach may provide some relevant information to users about an organization’s performance and procurement from ‘additional’ resources and could potentially lead to greater accuracy through system-wide reductions in emissions and additional non-emitting generation resources. However, if this proposed option permits annual matching of emission factors with activity data and broad geographic boundaries—which studies show does not lead to system-wide reductions in emissions despite organizations’ claims to zero scope 2 emissions⁸⁶—it is unlikely to align with the principles of accuracy, relevance, and consistency.

Assessment of the proposed approach against the principles of transparency, completeness, and comparability is mixed. Transparency depends on the auditability of additionality or causality criteria. Completeness requires clarity on reporting for non-additional generation. Comparability hinges on standardized criteria and consistent application of emission factors and activity data across markets.

Support decision making that drives ambitious global climate action

The proposed market-based method may incentivize organizations to seek low-carbon electricity supply options, reduce overall grid electricity consumption and improve energy efficiency, and make facility-siting decisions based on availability of clean energy supply in a region. The proposed approach shows potential for supporting decision-making that encourages climate action by promoting investments in renewable energy projects that are more likely to be “additional,” meaning they might not have occurred without targeted support. However, as noted in the scientific integrity, accuracy, and relevance sections, significant uncertainties remain regarding whether the additionality requirement alone can consistently lead to meaningful system-level emissions reductions, particularly in the absence of specific temporal or geographic alignment.

This lack of time-specific and location-specific criteria introduces uncertainty about how well emissions from these additional resources align with actual grid operations and emissions patterns. Without requirements for temporal and deliverability matching, this approach may not fully capture the operational dynamics of electricity grids, potentially resulting in emissions reporting that does not accurately represent the real-world impact.

Support programs based on GHG Protocol and uses of GHG data

The proposed approach can in theory generate useful data for climate risk disclosure and performance as a company’s claimed emissions and emission reductions may reflect the emissions from generation they directly caused, however, this option is dependent on how additionality or causality is defined and tested. As discussed in the scientific integrity section, some combinations of other technical improvements with additionality (i.e. three pillars) may better estimate emissions and lead to systemic grid decarbonization than others (i.e. annual matching). Thus, this approach’s ability to support climate

⁸⁶ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400; Ricks et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States.”

disclosure and target-setting is dependent on how additionality is defined. Programs and policies with existing implementation of the market-based method may be unaligned with a new market-based method that requires additionality or causality, possibly leading to a lack of interoperability with programs.

Feasibility to implement

The proposed market-based method with an additionality or causality requirement shares several commonalities with the current market-based method approach discussed in Option A, and therefore shares many of the same principles as it relates to feasibility of the method. A unique feasibility challenge compared to Option A arises from the need to verify that purchased electricity meets additionality or causality criteria, as well as to determine residual mix or default emission factors for electricity that does not meet this standard, both of which add complexity to implementation.

However, the introduction of an additionality or causality requirement will likely serve to limit availability of contractual instruments for organizations and could increase costs associated with procurement of instruments from non-emitting resources. The impact on other procurement methods in the market-based emission factor hierarchy (such as utility programs or residual mixes) is unknown and could create complications for organizations.

Option E: Replace Existing Market-Based Method with a Formula: 'Scope 2 Emissions = Induced – Avoided Emissions'

Details of the proposed approach:

- Adjust emissions calculation approach to quantify emissions 'induced' and emissions 'avoided' and net the two values using the formula: 'scope 2 emissions = induced emissions – avoided emissions.'

See full text in *Market-Based Method Technical Improvements Under Consideration*.

The following is a summarization of the detailed assessment of this approach using the full Decision-Making Criteria presented in Appendix C.

Scientific integrity

The proposed approach presents a framework to estimate the reporting organization's emissions associated with their purchased and consumed electricity (i.e., 'induced electricity emissions') and with contracted renewable energy or purchased EACs (i.e., 'avoided electricity emissions'). This estimation uses an adaptation of project accounting calculation methods, and generally follows the formula of: scope 2 emissions = induced emissions – avoided emissions. For reference, within research this approach has been referred to as "emissions matching" or "carbon matching."

Assessing the scientific integrity of this proposed option as an inventory accounting method is challenging due to the application of project accounting principles and methodologies (consequential) in its calculation. Consistent with the Corporate Standard and Scope 3 Standard, the Scope 2 Guidance reiterates it is an emission rate approach that uses generation-only emission factors representing emission rates that allocate the total quantity of physical emissions from the electric grid that occur during a reporting period to end-users. Inventory accounting across the scopes does not support

inclusion of an “avoided emissions” approach due to clear distinctions between corporate accounting and project-level accounting. For these reasons an evaluation of this proposed option's ability to, as an inventory, estimate emissions based on contractual relationships to electricity supply or inform risk and opportunity assessment methodology is outside the scope of this analysis.

Several recent studies that attempted to analyze the impacts of the proposed approach on real world grid decarbonization have generally found mixed results. One study looking at the impacts and costs of a carbon matching strategy using marginal emission rates (MERs) to guide renewable energy sourcing found that carbon matching was effective at displacing 100% of induced emissions at a fraction of the cost of annual and hourly matching strategies.⁸⁷ However, critics have pointed to the study's use of short-run MERs as an indication this only captures how the grid would respond to changes at a snapshot in time.⁸⁸ Other studies that utilize capacity expansion modeling to measure the impacts of a carbon matching strategy, have demonstrated the proposed approach may not result in significant changes in generation supply on the grid.⁸⁹

The proposed approach may support decision-making for consumers and companies by allowing them to utilize MERs to guide renewable electricity procurement decisions. MERs may represent a more precise tool for estimating the emission impacts of decisions to add or subtract electricity load from the grid than average emission factors,⁹⁰ and therefore may also be a more useful tool for siting renewable energy projects in locations that will have the greater emission impacts. However, there are mixed views on whether MERs are useful in estimating impacts from large, permanent, or policy-driven projects, for which the consideration of structural impacts to the grid in addition to operational impacts are necessary. Some research suggests long-run marginal emission factors, which do consider induced structural changes to the grid, are potentially more decision-useful and accurate.⁹¹ In addition, evaluating the science related to decision-making for the proposed approach requires an assessment of whether decisions incentivized by the approach result in real world impacts. As discussed earlier, evidence is mixed as to the degree that the proposed approach can influence changes in overall generation supply on the grid.

Corporate Standard GHG accounting and reporting principles

As discussed in the scientific integrity section, the proposed approach represents a fundamentally different accounting method that is grounded in consequential accounting (used to estimate emission impacts of actions) as opposed to attributional accounting (used to allocate all emissions from a shared supply to end users based on activity data), and therefore may not be possible to assess using GHG accounting and reporting principles from the Corporate Standard.

The proposed approach also does not strictly follow guidelines set forth in the [GHG Protocol for Project Accounting](#) or [Guidelines for Quantifying GHG Reductions from Grid Connected Electricity Projects](#) (e.g., construction of baseline and project scenarios), and therefore analyzing the proposed approach against the principles identified in the Project Accounting standard would require further clarifications.

⁸⁷ He et al., "Using Marginal Emission Rates to Optimize Investment in Carbon Dioxide Displacement Technologies."

⁸⁸ Ricks, Wilson, Pieter Gagnon, and Jesse D. Jenkins. "Short-run marginal emission factors neglect impactful phenomena and are unsuitable for assessing the power sector emissions impacts of hydrogen electrolysis." *Energy Policy* 189 (2024): 114119.

⁸⁹ Xu, et al. "System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies," 374–400.

⁹⁰ Elenes et al., "How Well Do Emission Factors Approximate Emission Changes from Electricity System Models?"

⁹¹ Gagnon, Pieter, J.E.T. Bistline, M.H. Alexander, and W.J. Cole, Short-run marginal emission rates omit important impacts of electric-sector interventions, *Proc. Natl. Acad. Sci. U.S.A.* 119 (49) e2211624119, <https://doi.org/10.1073/pnas.2211624119> (2022).

Support decision making that drives ambitious global climate action

The proposed market-based approach may incentivize organizations to seek low-carbon electricity supply options in locations with the highest marginal emissions intensity, reduce overall grid electricity consumption and improve energy efficiency, and make facility-siting decisions based on marginal emission intensities in a region. This approach departs from standard attributional accounting, where emissions are based on purchased and consumed electricity rather than hypothetical emissions avoided, so complicates efforts to align with broader GHG Protocol Corporate Standard reporting for reliable inventory tracking.

Further, as discussed in scientific integrity, reliance on short-run MEFs to estimate induced emissions may fail to account for how long-term structural changes to the grid will affect grid decarbonization. This limitation could make MEF-based emissions data less reliable for stakeholders' planning and tracking progress toward climate goals. While this method could support sector-specific decision-making when applied in specific cases, its alignment with system-wide decarbonization goals remains unclear without more evidence on actual reductions and potential for misinterpretation.

Support programs based on GHG Protocol and uses of GHG data

Since this approach is incompatible with the current attributional inventory approach as defined by the GHG Protocol Corporate Standard, the method would not be interoperable with existing policies and programs that have used GHG Protocol standards.

Despite the lack of compatibility with the existing inventory approach and the programs and policies that use it, reporting of consequential emission impacts may generate useful information about a company's climate-related actions, impacts and/or performance.

Feasibility to implement

The proposed market-based method is technically feasible to implement and has been supported by numerous corporates based primarily in the U.S. and EU.⁹² The feasibility of the proposed approach relies on the existence of marginal emission factors, which are available in some regions of the world, but may not be available in all geographies. Whether the proposed approach utilizes annual, or more granular temporal and geographic emission factors is another consideration that may impact feasibility.

While the proposed approach may be technically feasible, there is insufficient information of the proposed approach having been implemented at scale, and therefore it is difficult to assess real-world feasibility. Further analysis of the feasibility of this approach using real-world examples is necessary.

⁹² Emissions First Partnership, <https://www.emissionsfirst.com/>.

Questions for Technical Working Group Discussion

- What additional research/evidence should be incorporated into this analysis?
- Are there additional purposes of the market-based method, either as stated in the Scope 2 Guidance or in common practice, that should be considered?
- Are the current purposes as stated in the Scope 2 Guidance appropriate? Should they be changed or clarified?
- Can the current market-based method inform the risks and opportunities associated with emissions from purchased and consumed electricity as described in Chapter 2 of the Scope 2 Guidance?⁹³
- Is a one-hour period the most appropriate temporal granularity for market-based emission factors under the approach described in Option B and C? Is there data or research that indicates an alternative time period better aligns with the Decision-Making Criteria (daily, monthly, annually, sub-hourly, etc.)?
- What data or evidence exists that can comprehensively and objectively assess the global feasibility of market-based emission calculations for Options A-E?
- What datasets, tools, or resources are available to help reporting organizations consistently and accurately assess 'deliverable' electricity grid boundaries worldwide for Options B and C?
- How should the residual mix be treated within Options A-E? Does it continue to apply to all options? Are there other updates to the emission factor data hierarchy that are necessary? (e.g. residual mix, grid-average, fossil- or thermal-only emission factors, order of operations, etc.)
- Are there clarifications or changes that need to be made for how to account for carbon-free electricity and renewable power supplied under utility programs or regulatory compliance schemes? How should this be treated within the various options proposed?
- Is there additional research evaluating regions of the world, energy markets, grid systems, etc. showing the current market-based methodology performs better (or worse) than its assessment in North American and European markets?
- The current Scope 2 Quality Criteria used for the market-based method are described as being *"policy-neutral and represent the minimum features necessary for instruments to function together as a complete market-based allocation system for consumers."*⁹⁴ Do more stringent requirements go beyond these minimum criteria and what are the implications?
- What clarifications are needed to clarify how this method should be used by climate disclosure/reporting programs, target-setting programs, and individual reporters?

⁹³ Scope 2 Guidance, section 2.2, p. 15

⁹⁴ Scope 2 Guidance, section 1.5.2, p. 8

Appendix A - Detailed Decision-Making Criteria Analysis for Required Reporting Options

A. Maintain Dual Reporting Requirement, with Potential Updates; Optional Project Accounting:

- Organizations shall report both the location- and market-based inventory methods, potentially incorporating updates to one or both methods as described in the Technical Improvements sections.
- Organizations may report emission impacts from projects and interventions (i.e. the project-based method, or project-based assessments), separate from the inventory.

Option A: Maintain Dual Reporting Requirement, with Potential Updates; Optional Project Accounting	
Decision-Making Criteria	Evaluation
<p><u>Scientific integrity</u> Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research), and align with the latest climate science.</p>	<p>N/A</p> <p>The concept of scientific integrity can be more specifically applied to the Technical Improvements section of this document. A growing body of research has identified potential issues with both the existing location- and market-based methods while also providing potential options to increase scientific integrity across each method. Preliminary analysis suggests that improvements to the location- and market-based methods may be required to ensure the scientific integrity of each method. The level of scientific integrity each method can achieve will depend on the specifics of how they are implemented. See the Technical Improvements section for more details on these improvements.</p>
<p><u>GHG accounting and reporting principles</u></p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p><u>1. Relevance</u></p> <p>Corporate Standard: Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p> <p>Project Accounting Standard: Use data, methods, criteria, and assumptions that are appropriate for the intended use of reported information.</p> <p>Mixed / Yes</p> <p>Requiring dual reporting of both the location-based and market-based methods in a Scope 2 inventory, while making project-based assessments optional, presents a moderate alignment with the GHG Protocol Corporate Standard and GHG Protocol for Project Accounting principles of relevance.</p> <p>The dual reporting requirement supports development of a GHG inventory that reflects a comprehensive view of the organization’s emissions, enabling an opportunity to reflect both an allocation of regional average emissions based on electricity use (location-based) and a more specific allocation of energy usage and procurement decisions (market-based). This combination can provide a reflection of the organization’s GHG emissions and useful information for internal and external decision-making, enabling the organization’s GHG inventory to serve as a relevant tool for understanding and managing emissions.</p> <p>However, the optional nature of project-based assessments, particularly without clear guidance and standardization, may limit the relevance of the information provided. While these assessments could offer valuable insights into an organization's specific initiatives, their optional status and lack of standardization might lead to inconsistencies and omissions in the reported data. This could reduce the overall effectiveness of how organizations use project accounting evaluations to assess actions or investments to evaluate their emission abatement or increase potential. Even as an optional methodology, a clear separation of any project accounting assessments from the broader inventory remains necessary to allows stakeholders to assess the information.</p> <p>In summary, while dual reporting can strengthen the relevance of the GHG inventory by offering a broader view of emissions, the optional and less standardized nature of project-based assessments could detract from the overall relevance by potentially omitting critical information needed for comprehensive decision-making by users.</p>

Option A: Maintain Dual Reporting Requirement, with Potential Updates; Optional Project Accounting

<p>GHG accounting and reporting principles (cont.)</p>	<p>2. Completeness</p> <p>Corporate Standard: Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p> <p>Project Accounting Standard: Consider all relevant information that may affect the accounting and quantification of GHG reductions and complete all requirements.</p>	<p>Mixed / Yes</p> <p>The location-based and market-based methods require accounting for and allocation of all relevant emission sources within the chosen inventory boundary and thus aligns with the Corporate Standard principle of completeness.</p> <p>This reporting option would account for all GHG activities (e.g., purchased and consumed energy) within the inventory boundary. However, the approach may face challenges accounting for all GHG emission activities within the inventory boundary if inconsistencies arise in the application of the market-based method—due to its complexity—or the location-based method—due to variations in activity or grid data, potentially leading to incomplete reporting of the organization’s inventory of emissions. See technical improvements for specific parameters within the location-based and market-based methods.</p> <p>The optional nature of project-based assessments, particularly without clear guidance and standardization, may limit the completeness of the information provided. While these assessments could offer valuable insights into an organization’s specific initiatives, their optional status and lack of standardization might lead to inconsistencies and gaps in the reported data. This could reduce the overall effectiveness of GHG emission reporting in fully reflecting the organization’s emissions and supporting informed decision-making.</p>
	<p>3. Consistency</p> <p>Corporate Standard: Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p> <p>Project Accounting Standard: Use data, methods, criteria, and assumptions that allow meaningful and valid comparisons.</p>	<p>Mixed</p> <p>Requiring dual reporting of both the location-based and market-based methods in a Scope 2 inventory, while making project-based assessments optional, presents a mixed alignment with the GHG Protocol Corporate Standard and GHG Protocol for Project Accounting principles of consistency.</p> <p>For dual reporting to maintain consistency, the market-based method must apply energy procurement choices uniformly across reporting periods, while the location-based method requires the consistent use of grid average emission factors based on regional data.</p> <p>The optional nature of project-based assessments, particularly without clear guidance and standardization, may limit the ability to provide meaningful and valid comparisons over time. A lack of standardization might lead to inconsistencies and gaps in the reported data.</p>

Option A: Maintain Dual Reporting Requirement, with Potential Updates; Optional Project Accounting

<p>GHG accounting and reporting principles (cont.)</p>	<p>4. Transparency</p> <p>Corporate Standard: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p> <p>Project Accounting Standard: Provide clear and sufficient information for reviewers to assess the credibility and reliability of GHG reduction claims.</p>	<p>Mixed / Yes</p> <p>Requiring dual reporting of both the location-based and market-based methods in a Scope 2 inventory, while making project-based assessments optional, presents a moderate alignment with the GHG Protocol Corporate Standard and GHG Protocol for Project Accounting principles of transparency.</p> <p>The degree to which a reporting method or combination of methods meets the transparency principle is largely a factor of the technical specifics of that reporting method(s) and is difficult to assess in the abstract. Given that both reporting methods included in this approach have the capacity to provide transparent and auditable GHG information, it can be concluded that this criterion has been met by the approach.</p> <p>The optional nature of project-based assessments, particularly without clear guidance and standardization, may limit the ability of reporting organizations to provide auditable and detailed disclosures of the data, methods, criteria, and assumptions used in quantifying GHG reductions from specific initiatives. A lack of standardization might lead to inconsistencies and gaps in the reported data.</p>
	<p>5. Accuracy</p> <p>Corporate Standard: Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p> <p>Project Accounting Standard: Reduce uncertainties as much as is practical.</p>	<p>N/A</p> <p>The accuracy each method can achieve will depend on the specifics of how they are implemented, with some technical improvements initially demonstrating stronger alignment with the accuracy principle than others. Further evaluation of research associated with each dual reporting method is necessary to ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions and that uncertainties are reduced as far as practicable. See the technical improvements section for discussion on both the existing inventory methods' accuracy and details on any improvements that may impact their accuracy.</p> <p>Including both the location-based and market-based methods, along with recommending project-based assessments may increase the likelihood that inventories calculated with this approach communicate GHG data that better aligns with the principle of accuracy.</p> <p>The optional nature of project-based assessments, particularly without clear guidance and standardization, may limit the ability to provide accurate disclosures of the data, methods, criteria, and assumptions used in quantifying GHG reductions from specific initiatives. Furthermore, a clear separation of any project impacts from the broader inventory remains necessary to enable users to make decisions with reasonable confidence as to the integrity of the reported inventory or project-assessment information.</p>

Option A: Maintain Dual Reporting Requirement, with Potential Updates; Optional Project Accounting

	<p>6. Comparability (subject to discussion on TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed / Yes</p> <p>Requiring dual reporting can support comparability by providing a comprehensive view of an organization’s emissions through two distinct methods of allocating the grid’s emissions: the location-based method, which offers a broad estimate of an organization’s emissions as an allocation of regional emissions, and the market-based method, which allocates emissions based on the organization’s specific energy usage and procurement decisions. This dual approach helps address relevant issues by providing both a general perspective on grid emissions and a detailed view of how the organization’s energy choices affect its allocated emissions, supporting a transparent assessment of the reported information.</p> <p>However, comparability depends on the consistent application of key implementation details, such as standardized activity data, emission factor sources, market boundaries, data quality, and vintage criteria. Inconsistent use of these factors could undermine the ability to accurately compare emissions across reporting organizations and may lead to potential misinterpretations of environmental performance.</p> <p>While this option requires dual reporting of Scope 2 market- and location-based methods, it leaves project accounting assessments optional and without necessarily providing clear guidance or standardization. This may limit the ability to provide comparable disclosures of the project-assessment data, methods, criteria, and assumptions used in quantifying GHG reductions from specific initiatives across reporting organizations.</p>
	<p><u>Support decision making that drives ambitious global climate action</u></p> <ul style="list-style-type: none"> • Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. • GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. • Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 	<p>Mixed / Yes</p> <p>Requiring dual reporting of Scope 2 emissions has the potential to offer a more comprehensive and informative framework for supporting global climate action and goals compared to requiring only one method. By including both the location-based and market-based methods, this approach can broaden the range of information that organizations may consider in alignment with a transition to a net-zero emission electricity grid. The location-based method can motivate efforts to reduce overall electricity consumption and improve energy efficiency, while the market-based method has the potential to support the procurement and use of clean energy resources, siting decisions, load management, and other mitigation actions contributing to grid decarbonization. The specific actions incentivized by the location and market-based methods will still depend on how each method is implemented, with some options potentially more strongly supporting the transition to a net-zero electricity grid, as further explored in the technical improvements section.</p> <p>In contrast with other options that require only one reporting method, this approach may reduce the risk of systematically under- or overcounting emissions in the inventory by providing two perspectives on emissions. The inclusion of both methods helps ensure no single reporting method plays an outsized role in informing and supporting ambitious actions to reduce GHG emissions in line with global climate goals.</p> <p>The absence of clear guidance and standardization on data, methods, criteria, and assumptions for project-accounting assessments limits the potential of this option to fully inform climate actions and goals. This gap impacts the overall emissions report by limiting the range of actions an organization might evaluate in the context of global climate action.</p>

Option A: Maintain Dual Reporting Requirement, with Potential Updates; Optional Project Accounting

<p><u>Support programs based on GHG Protocol and uses of GHG data</u></p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality. Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>Mixed / Yes</p> <p>This option has the potential to support uses of GHG data and programs based on the GHG Protocol by generating emissions data that is both comprehensive and versatile. By offering multiple perspectives on an organization’s inventory emissions, this approach can provide useful data for general users of GHG inventory reports and reduce the risk of overreliance on a single method.</p> <p>Additionally, it can generate emissions data that is currently relevant for existing mandatory reporting frameworks including IFRS Climate-Related Disclosures (IFRS S2), European Sustainability Reporting Standards: Climate Change (ESRS E1), ISO 14064-1:2018, The Enhancement and Standardization of Climate-Related Disclosures for Investors Rule (U.S. SEC Rule), and California Climate Corporate Data Accountability Act (CA SB 253), as well as voluntary programs including SBTi, RE100, GRI, and CDP, among others.</p> <p>The optional nature of project-based assessments, particularly without clear guidance and standardization, may limit the ability of this approach to support uses of GHG data. As this methodology is currently under-utilized or not required by many programs, the absence of clear guidance and standardization, may continue to limit its usage.</p>
<p><u>Feasibility to implement</u></p> <ul style="list-style-type: none"> Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable. GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.). For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation. 	<p>Yes</p> <p>There is a strong track record of implementation of the existing dual reporting framework globally and across a wide range of organizations, particularly in regions where both the location-based and market-based methods are well understood and supported by existing tools and resources. However, technical improvements to these methods may support or hinder feasibility globally. Further, some regions of the world lack high quality data (for both location- and market-based reporting) and/or the ability to make, track, and support supply choices (for the market-based method). While implementation challenges may vary globally, particularly in regions with less access to high-quality data, the widespread availability of guidance and resources from the GHG Protocol could support broader adoption.</p> <p>While the project-based method generally has a track record of implementation in carbon markets to quantify project-level GHG reductions and removals, its feasibility and use as part of organizations’ overall emission reporting, decision-making, and target-setting efforts appears to be limited. A continuation of the optional status for project-based assessments would be feasible as it requires little to no change from the status quo.</p>

B. Report Only the Market-Based Method, with Potential Updates; Optional Project Accounting

- Organizations shall report the market-based inventory method potentially incorporating updates as described in the Technical Improvements section; organizations should not report the location-based method.
- Organizations may report emission impacts from projects and interventions (i.e. the project-based method, or project-based assessments), separate from the inventory.

Option B: Report Only the Market-Based Method, with Potential Updates; Optional Project Accounting	
Decision-Making Criteria	Evaluation
<p>Scientific integrity</p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>N/A</p> <p>The concept of scientific integrity can be more specifically applied to the Technical Improvements section of this document. A growing body of research has identified potential issues with both the existing location- and market-based methods while also providing potential options to increase scientific integrity across each method. Preliminary analysis suggests that improvements to the location- and market-based methods may be required to ensure the scientific integrity of each method. The level of scientific integrity each method can achieve will depend on the specifics of how they are implemented, with some options initially demonstrating higher integrity than others. See the Technical Improvements section for more details on these improvements.</p>
<p>GHG accounting and reporting principles</p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p>1. Relevance</p> <p>Corporate Standard: Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p> <p>Project Accounting Standard: Use data, methods, criteria, and assumptions that are appropriate for the intended use of reported information.</p> <p>Mixed / No</p> <p>Requiring only the Scope 2 market-based method, while eliminating the location-based method and not providing clear guidance and standardization for project-accounting may limit the ability of this option to align with the GHG Protocol principle of relevance.</p> <p>The market-based method can reflect GHG emissions allocated to the organization and provide relevant decision-making information based on energy procurement and consumption decisions, such as procurement and supply choices, managing the timing of their consumption of electricity based on when clean energy is generated on the grid, reducing overall energy consumption, and siting facilities and operations in grids with more clean energy available for procurement.</p> <p>However, by excluding the location-based method, this approach could restrict the comprehensiveness of the GHG inventory, as it no longer also offers a general view of emissions based on the average carbon intensity of the regional grid. This might reduce the ability of the inventory to provide all GHG emission information relevant for the organization, particularly in regions where market-based procurement options are limited.</p> <p>Moreover, without including or clearly defining a project-accounting assessments methodology, this option may further limit the reporting of specific impacts from energy choices and initiatives, making it more challenging for internal and external users to assess the full scope of the organization’s emissions and the effectiveness of its sustainability strategies.</p>

Option B: Report Only the Market-Based Method, with Potential Updates; Optional Project Accounting

<p>GHG accounting and reporting principles (cont.)</p>	<p>2. Completeness</p> <p>Corporate Standard: Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p> <p>Project Accounting Standard: Consider all relevant information that may affect the accounting and quantification of GHG reductions and complete all requirements.</p>	<p>Mixed / Yes</p> <p>The market-based method requires accounting for and allocation of all relevant emission sources within the chosen inventory boundary and thus aligns with the Corporate Standard principle of completeness.</p> <p>This reporting option would account for all GHG activities (e.g., purchase energy) within the inventory boundary. However, the approach may face challenges accounting for all GHG emission activities within the inventory boundary if inconsistencies arise in the application of the market-based method due to its complexity, potentially leading to incomplete reporting of the organization’s inventory of emissions. See technical improvements for specific parameters within the location-based and market-based methods.</p> <p>The optional nature of project-based assessments, particularly without clear guidance and standardization, may limit the completeness of the information provided. While these assessments could offer valuable insights into an organization’s specific initiatives, their optional status and lack of standardization might lead to inconsistencies and gaps in the reported data. This could reduce the overall effectiveness of GHG emission reporting in fully reflecting the organization’s emissions and supporting informed decision-making.</p>
	<p>3. Consistency</p> <p>Corporate Standard: Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p> <p>Project Accounting Standard: Use data, methods, criteria, and assumptions that allow meaningful and valid comparisons.</p>	<p>Mixed</p> <p>Requiring only the market-based method can provide a reporting methodology that produces GHG inventory information consistently over time. For this method to maintain consistent GHG emissions data over time the reporting organization must apply energy procurement choices such as market boundaries, EAC vintage, and other metrics uniformly across reporting periods. In practice, this can be more difficult for the market-based method than for the location-based method due to its complexity, data availability, and other factors.</p> <p>The optional nature of project-based assessments, particularly without clear guidance and standardization, may limit the ability to provide consistency over time. A lack of standardization might lead to inconsistencies and gaps in the reported data.</p>

Option B: Report Only the Market-Based Method, with Potential Updates; Optional Project Accounting

<p>GHG accounting and reporting principles (cont.)</p>	<p>4. Transparency</p> <p>Corporate Standard: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p> <p>Project Accounting Standard: Provide clear and sufficient information for reviewers to assess the credibility and reliability of GHG reduction claims.</p>	<p>Mixed / Yes</p> <p>Requiring only the market-based method has the potential to align with the GHG Protocol principle of transparency if the reporting organization provides comprehensive data and emission factors during an audit.</p> <p>The degree to which a reporting method or combination of methods meets the transparency principle is largely a factor of the technical specifics of that reporting method(s) and is difficult to assess in the abstract. Since the market-based method has the capacity to provide transparent and auditable GHG information, it can be concluded that this criterion has been met by the approach.</p> <p>However, it is worth noting that in practice the assumptions and market instruments involved in market-based emissions calculations may not be clearly understood by all users. This lack of clarity can hinder a clear understanding of the issues in the context of the reporting company, making it difficult for users to meaningfully assess performance. Additionally, verification and audit challenges may arise due to changes in market conditions and assumptions over time, complicating the establishment of a clear audit trail. The use of supplier-specific emission factors that are not publicly disclosed can further obscure the transparency of the inventory, increasing uncertainty and making it harder for third parties to replicate the results, thereby reducing the transparency of the report.</p> <p>The optional nature of project-based assessments, particularly without clear guidance and standardization, may limit the ability to provide transparency to assess the credibility and reliability of GHG reduction claims over time. A lack of standardization might lead to inconsistencies and gaps in the reported data.</p>
	<p>5. Accuracy</p> <p>Corporate Standard: Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p> <p>Project Accounting Standard: Reduce uncertainties as much as is practical.</p>	<p>N/A</p> <p>The accuracy each method can achieve will depend on the specifics of how they are implemented, with some technical improvements initially demonstrating stronger alignment with the accuracy principle than others. Further evaluation of research associated with each dual reporting method is necessary to ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions and that uncertainties are reduced as far as practicable. See the technical improvements section for discussion on both the existing method’s accuracy and details on any improvements that may impact its accuracy.</p> <p>Only including the market-based method without the location-based method or optional/recommended project-based assessments diminishes the likelihood that users receive a more accurate representation of the reporting organization’s GHG emissions, increasing the risk that a single method could systematically misrepresent emissions impacts.</p>

Option B: Report Only the Market-Based Method, with Potential Updates; Optional Project Accounting

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p>6. Comparability (subject to discussion on TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed</p> <p>Only requiring the market-based method may limit comparability as users have fewer options to assess and compare company inventories, potentially leading to inconsistent or misleading evaluations.</p> <p>In theory, market-based to market-based comparisons across companies are possible, but variations in data choices, such as market geographic and temporal boundaries and residual mix calculations, can impact the results. Additionally, data limitations or regulatory policies in some regions may restrict a reporting organization’s ability to use the market-based method everywhere, further complicating comparisons. Without consistent use of market boundaries and vintage quality criteria, reports might not clearly convey how a company’s emissions relate to the energy grid’s emissions where it operates, making it difficult for users to accurately assess environmental performance and potentially leading to misleading comparisons between companies.</p> <p>The absence of the location-based method may impair the ability to evaluate a company’s emissions in relation to the specific energy grid emissions of the regions where it operates, hindering accurate and consistent comparisons across organizations.</p> <p>Furthermore, the absence of standardized guidance for project-based assessments reduces the opportunity to compare similar projects across organizations, further limiting the ability to evaluate and compare the specific impacts of emissions reduction initiatives.</p>
<p><u>Support decision making that drives ambitious global climate action</u></p> <ul style="list-style-type: none"> • Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. • GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. • Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 	<p>Mixed</p> <p>In principle, the market-based method can provide reporting organizations with a means to inform, account for, and report progress towards ambitious climate action and goals related to their procurement and usage of electricity. This is achieved through incentivizing specific energy procurement and supply choices, managing the timing of their consumption of electricity based on when clean energy is generated on the grid, reducing overall energy consumption, and siting facilities and operations in grids with more clean energy available for procurement. Eliminating the location-based method as a required reporting method may omit information such as insights to an organization’s overall exposure to electricity consumption or remove incentives for some actions, such as policy advocacy around grid decarbonization.</p> <p>As discussed in the GHG Protocol Principles criteria, the alignment with accuracy and completeness among other principles for each of the proposed market-based method will depend on the specifics of how they are implemented, with some implementation options initially demonstrating stronger alignment than others. Further evaluation of the scientific integrity and alignment with accounting principles for each market-based method proposal is necessary to ensure that GHG emissions are systematically neither over nor under allocated and that uncertainties are reduced as far as practicable. See the technical improvements section for evaluation of the existing market-based method and additional proposals.</p> <p>Relying exclusively on inventory accounting may omit relevant information necessary to fully support grid-related decarbonization actions and climate goals. Using information quantified and separately reported using the GHG Protocol Project Accounting Standard can provide a means to further support and inform effective mitigation actions when used in conjunction with inventory reporting.</p>	

Option B: Report Only the Market-Based Method, with Potential Updates; Optional Project Accounting

<p><u>Support programs based on GHG Protocol and uses of GHG data</u></p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality. Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>No</p> <p>This approach has the potential to only partially support the use of GHG data and programs based on the GHG Protocol. Exclusion of the location-based method would be inconsistent with numerous existing mandatory (IFRS S2, ESRS E1, ISO 14064-1:2018, proposed U.S. SEC Rule, and CA SB 253.) and voluntary climate disclosure and target-setting programs, such as the SBTi, RE100, GRI, CDP. In only providing a single perspective on an organization’s emissions, this approach lacks useful data for general users of GHG reports and increases the risk of overreliance on a single method that might misrepresent impacts.</p> <p>The lack of clear guidance and standardization for project-based assessments may further limit the ability to support uses of GHG data and programs based on GHG Protocol. As this methodology is currently under-utilized or not required by many programs, the absence of clear guidance and standardization may continue to limit its usage.</p>
<p><u>Feasibility to implement</u></p> <ul style="list-style-type: none"> Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable. GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.). For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation. 	<p>Yes</p> <p>The market-based method is a current scope 2 accounting and reporting methodology that is widely used globally in regions where markets provide “differentiated energy products” such as the availability of contractual instruments including direct contracts, certificates, or supplier-specific information. However, aggregate reporting data from CDP indicates that many organizations still only report location-based emissions, despite often operating in regions where dual reporting would be required. In some cases, the lack of sufficient information to meet the quality criteria (supply-specific emissions rates, EAC tracking systems, residual mix data) or lack of electricity supply choices in certain regions results in companies reporting market-based emissions totals that include some portion of regional grid-average emission factors. Although grid-average emission factors are included in the market-based emission factor hierarchy, further discussion is necessary to assess whether their use for market-based calculations truly aligns with the spirit of the feasibility criteria.</p> <p>While implementation challenges may vary globally, particularly in regions with less access to high-quality data, the widespread availability of guidance and resources from the GHG Protocol is a means to further support broader adoption.</p> <p>Under existing GHG Protocol Standards, any project-based assessments are optional. Continued status as an optional methodology is presumably a similarly feasible option.</p>

C. Report Only the Location-Based Method, with Potential Updates; Recommend or Require Project Accounting

- Organizations shall report the location-based inventory method potentially incorporating updates as described in Technical Improvements section; organizations should not report the market-based method.
- Organizations [shall or should] (to be discussed with TWG) report emission impacts from projects and interventions (i.e., the project-based method, or project-based assessments), separate from the inventory.

Option C: Report Only the Location-Based Method, with Potential Updates; Recommend or Require Project Accounting	
Decision-Making Criteria	Evaluation
<p>Scientific integrity</p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>N/A</p> <p>The concept of scientific integrity can be more specifically applied to the Technical Improvements section of this document. A growing body of research has identified potential issues with the existing location-based method while also providing potential options to increase scientific integrity of the method. Preliminary analysis suggests that improvements to the location-based methods may be required to ensure the scientific integrity of each method. The level of scientific integrity achievable will depend on the specifics of how the method is implemented, with some options initially demonstrating higher integrity than others. See the Technical Improvements section for more details on these improvements.</p>
<p>GHG accounting and reporting principles</p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p>1. Relevance</p> <p>Corporate Standard: Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p> <p>Project Accounting Standard: Use data, methods, criteria, and assumptions that are appropriate for the intended use of reported information.</p> <p>Mixed / No</p> <p>Requiring only the location-based method in a scope 2 inventory along with recommended or required separate project-based assessments and eliminating the market-based methods may limit the ability of this option to align with the GHG Protocol principle of relevance.</p> <p>The location-based method is one of two existing ways to allocate grid emissions to energy purchased and used by the reporting organization. It provides a simplified estimation of the reporting organization’s indirect emissions by allocating a pro rata share of total system emissions according to electricity consumed within a defined geographic area and time period using a grid average emission factor and the organization’s total energy usage.</p> <p>Exclusive use of the location-based method may have limitations in its relevance to users as a means to serve their decision-making needs. By its mathematical design, the allocation of emissions using a grid average emission rate is not able to reflect any direct or precise causal responsibility between an organization’s energy usage or actions and the emissions assigned to the reporting organization. The grid average may provide an estimate of an organization’s emissions as an allocation of regional emissions but is potentially unable to capture the specific emissions changes that occur when new electricity demand or reductions occur, from shifts in when usage occurs, or new technologies are introduced. This means any of the method’s stated purposes or use cases should acknowledge it may not necessarily represent accurate or relevant emission information directly related to an organization’s purchase and consumption of electricity.</p> <p>Recommending or requiring a robust and standardized usage of GHG Protocol’s project-accounting assessments can provide an option for organizations to selectively assess actions or investments to evaluate their emission abatement or increase potential. This can be relevant in evaluating what actions could result in the greatest emissions impact per investment. Externally, project-based emissions assessments can be used to communicate the impacts of specific actions undertaken by a reporting organization to reduce or avoid emissions separately from the overall GHG emissions allocated to the reporting organization. Project accounting assessments must be reported separately from the inventory report’s emissions estimates of the reporting organization’s energy usage. As project-accounting assessments are currently not included in most target-setting or mandatory disclosure programs it is unclear how currently relevant this information is for the decision-making needs of users—both internal and external to the reporting organization. Elevating the project-based method to required or recommended could support its further adoption by these programs.</p>

Option C: Report Only the Location-Based Method, with Potential Updates; Recommend or Require Project Accounting

<p>GHG accounting and reporting principles (cont.)</p>	<p>2. Completeness</p> <p>Corporate Standard: Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p> <p>Project Accounting Standard: Consider all relevant information that may affect the accounting and quantification of GHG reductions and complete all requirements.</p>	<p>Yes</p> <p>The location-based method requires accounting for and allocation of all relevant emission sources within the chosen inventory boundary and thus aligns with the Corporate Standard principle of completeness.</p> <p>This approach helps to account for all GHG activities (e.g., purchase energy) within the inventory boundary. However, the approach may face challenges accounting for all GHG emission activities within the inventory boundary if inconsistencies arise in the application of the location-based method due to variations in activity or grid data, potentially leading to incomplete reporting of the organization’s inventory of emissions. See technical improvements for specific parameters within the location-based and methods.</p> <p>By elevating the project-based method to a recommended or required reporting category, this approach may support project-based assessments to incorporate all relevant information that affects a project’s potential GHG reductions at a system level, separate from the overall GHG emissions of the reporting organization. While this can be done completely for specific projects, it may provide an incomplete representation of all actions, investments, etc. associated with the reporting organization.</p>
	<p>3. Consistency</p> <p>Corporate Standard: Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p> <p>Project Accounting Standard: Use data, methods, criteria, and assumptions that allow meaningful and valid comparisons.</p>	<p>Mixed / Yes</p> <p>The location-based method can provide a consistent approach to estimating over time the pro rata shares of total system emissions based on electricity purchased and consumed within a defined geographic area and time period using a grid average emission factor, though current methodologies may benefit from updates to ensure more consistent market boundaries, emission factor vintage, and other parameters.</p> <p>Project-accounting can provide consistent assessments so long as it utilizes standardized data, methods, criteria, and assumptions to ensure consistent and comparable reporting of emissions reductions outside the inventory, reflecting the broader impact of specific initiatives.</p>

Option C: Report Only the Location-Based Method, with Potential Updates; Recommend or Require Project Accounting

<p>GHG accounting and reporting principles (cont.)</p>	<p>4. Transparency</p> <p>Corporate Standard: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p> <p>Project Accounting Standard: Provide clear and sufficient information for reviewers to assess the credibility and reliability of GHG reduction claims.</p>	<p>Yes</p> <p>The location-based method can provide a transparent and auditable means to estimating over time the pro rata shares of total system emissions based on electricity purchased and consumed within a defined geographic area and time period using a grid average emission factor, though current methodologies may benefit from updates to ensure more consistent market boundaries, emission factor vintage, and other parameters.</p> <p>The degree to which a reporting method or combination of methods meets the transparency principle largely depends on the technical specifics of the reporting method(s) and is difficult to assess in the abstract. Given that the location-based method has the capacity to provide transparent and auditable GHG information, this option appears to be in alignment with this GHG Protocol principle and criterion. Furthermore, the simplicity of location-based emissions calculations and the public availability of emission factors, compared to other accounting methods, enhance the transparency and auditability of this approach.</p> <p>By elevating the project-based method to a recommended or required reporting category, this approach may result in GHG data that in aggregate better meets the transparency principle as the application of the project-based method may be better understood and applied by GHG reporters.</p>
	<p>5. Accuracy</p> <p>Corporate Standard: Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p> <p>Project Accounting Standard: Reduce uncertainties as much as is practical.</p>	<p>N/A</p> <p>The accuracy each method can achieve will depend on the specifics of how they are implemented, with some technical improvements initially demonstrating stronger alignment with the accuracy principle than others. Further evaluation of research associated with the location-based method is necessary to ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions and that uncertainties are reduced as far as practicable. See the technical improvements section for discussion on both the existing method's accuracy and details on any improvements that may impact its accuracy.</p> <p>Only including the location-based method without the market-based method may impact the accuracy of the inventory and users' ability to make decisions with reasonable confidence and may increase the risk that a single method could systematically misrepresent emissions impacts.</p> <p>Recommended or required project-based assessments may be able to achieve sufficient accuracy to enable users to make decisions with reasonable confidence as to the integrity of the reported information. To ensure such quantifications do not systematically misrepresent emissions impacts, further consideration may be necessary to ensure reporting organization do not exclusively focus on GHG emission abatement projects, while omitting accounting for and reporting on projects or actions that increase emissions.</p>

Option C: Report Only the Location-Based Method, with Potential Updates; Recommend or Require Project Accounting

	<p>6. Comparability (subject to discussion on TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed</p> <p>Only requiring the location-based method may limit comparability as users have fewer options to assess and compare company inventories, potentially leading to inconsistent or misleading evaluations.</p> <p>Generally, location-based to location-based comparisons across companies are possible, however variations in data choices, such as grid emission factors, geographic and temporal boundaries can impact the results. Furthermore, by its mathematical design the location-based method serves a potentially narrow purpose and should not be used to compare emissions changes between organizations that occur when new electricity demand or reductions occur, from shifts in when usage occurs, or new technologies are introduced.</p> <p>With standardized guidance for project-based assessments there could be opportunity to compare similar projects across organizations, however this may enable evaluation of specific projects without necessarily allowing for comparability across reporting organizations. Additionally, if project-based assessments are recommended (and not required) some organizations may opt to comprehensively use project assessments, others may conduct more limited assessments and others might forgo any evaluations entirely, further hindering any such comparisons.</p>
<p>Support decision making that drives ambitious global climate action</p> <ul style="list-style-type: none"> Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 	<p>Mixed</p> <p>The current location-based method (using annual average emission factors) provides a straightforward way to allocate an organization's share of total system emissions. This estimation is determined by allocating a pro rata share of total system emissions according to electricity purchased and consumed within a defined geographic area and time period using an annual grid average emission factor and the organization's total energy usage. Under the current location-based method, the emissions reported in an organization's scope 2 location-based inventory will increase or decrease as result of either corresponding increases or decreases in their activities (i.e., electricity purchases and consumption), or changes in the grid average emission factor used by the reporting organization. While this approach can help ensure the completeness, consistency, comparability, and transparency of an organization's GHG inventory, it has limitations. It does not necessarily provide nor is it intended to inform a detailed or direct assessment of the relationship between an organization's activities (i.e., energy usage) and the grid emissions produced in supplying power. The actual emissions an organization causes can vary based on its specific practices and efforts to reduce emissions, and these may often not align well with the allocated emissions based on a simplified method like an annual average emission factor. For these reasons the current location-based method's ability to inform effective mitigation actions and create incentives for both individual and systemwide GHG reductions in line with global climate goals is limited. Further evaluation and refinement of the location-based method is discussed in the technical improvements section.</p> <p>Recommended or required project-based assessments could provide additional information to assess climate actions and goals. However, the absence of an easily implementable, standardized approach with consistent boundaries for determining which projects are evaluated and which are not may limit overall efficacy. Additionally, to ensure such quantifications do not systematically misrepresent emissions impacts, further consideration may be necessary to ensure reporting organizations do not exclusively focus on GHG emission abatement projects, while omitting accounting for and reporting on projects or actions that increase emissions.</p> <p>For many public target or goal programs as well as internal metrics used by reporting organizations, exclusively or primarily relying on project-based assessments to support climate action and goals may also require a transition period given the current state of practice, availability of standardized methodologies, and inclusion by target-setting programs and mandatory disclosure policies.</p>	

Option C: Report Only the Location-Based Method, with Potential Updates; Recommend or Require Project Accounting

<p><u>Support programs based on GHG Protocol and uses of GHG data</u></p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality. Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>No</p> <p>This approach supports some usages of GHG data and programs based on GHG Protocol while eliminating a methodology widely used by organizations and programs globally.</p> <p>The location-based method provides users of GHG data with relevant climate risk information, and has been incorporated in mandatory (IFRS S2, ESRS E1, ISO 14064-1:2018, U.S. SEC Rule, and CA SB 253) and voluntary (CDP, GRI) programs globally. However, in eliminating the market-based method this approach only provides a single perspective on an organization’s inventory, which may lack useful data for general users of GHG reports and increases the risk of overreliance on a single method. Exclusion of the market-based method would also be inconsistent with numerous existing mandatory disclosure frameworks (EFRAG CSRD, proposed U.S. SEC Rule and CA SB 253, etc.), and would eliminate the most widely used scope 2 accounting method for tracking progress toward climate goals and targets.</p> <p>While the reporting of project-based emissions assessments can provide additional relevant information for stakeholders, whether this method remains an <i>optional</i> category or is elevated to required or recommended has implications for its use by external programs. Elevating the project-based method to required or recommended could support its adoption by these programs, pending the feasibility of implementation for organizations.</p>
<p><u>Feasibility to implement</u></p> <ul style="list-style-type: none"> Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable. GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.). For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation. 	<p>Mixed / Yes</p> <p>The location-based method is a current scope 2 accounting and reporting requirement and is currently used globally by a wide range of organizations. Continuing this existing requirement fit for its intended purposes is presumably a feasible option, however, technical improvements made to the location-based method may impact its feasibility for particular regions or organization types.</p> <p>While the project-based method has a long track record of implementation in carbon markets to quantify project-level GHG reductions and removals, its feasibility as part of organizations' overall emission reporting is unknown. As such, the decision of whether to elevate it to a required or recommended reporting method has significant implications for the feasibility of this approach.</p>

D. Maintain Dual Reporting Requirement, with Potential Updates; Recommend or Require Project Accounting

- Organizations shall report both the location- and market-based inventory methods, potentially incorporating updates to one or both methods as described in the Technical Improvements sections.
- Organizations [shall or should] (to be discussed with the TWG) report emission impacts from projects and interventions (i.e. the project-based method, or project-based assessments), separate from the inventory.

Option D: Maintain Dual Reporting Requirement, with Potential Updates; Recommend or Require Project Accounting	
Decision-Making Criteria	Evaluation
<p>Scientific integrity</p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>The concept of scientific integrity can be more specifically applied to the Technical Improvements section of this document. A growing body of research has identified potential issues with both the existing location- and market-based methods while also providing potential options to increase scientific integrity across each method. Preliminary analysis suggests that improvements to the market- and location-based methods may be required to ensure the scientific integrity of each method. The level of scientific integrity each method can achieve will depend on the specifics of how they are implemented, with some options initially demonstrating higher integrity than others. See the Technical Improvements section for more details on these improvements.</p>
<p>GHG accounting and reporting principles</p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p>1. Relevance</p> <p>Corporate Standard: Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p> <p>Project Accounting Standard: Use data, methods, criteria, and assumptions that are appropriate for the intended use of reported information.</p> <p>Yes</p> <p>Required dual reporting of both the location-based and market-based methods in a scope 2 inventory, along with required or recommended separate project-based assessments, enables a range of options for an organization to disclose their overall emissions and the impacts of their initiatives. Depending on specific implementation details, this approach may offer the most comprehensive means to report clear and relevant information, helping inform internal and external users make decisions.</p> <p>The location-based method and the market-based method provide two ways to allocate grid emissions to the reporting organization. The location-based method provides an allocation of regional emissions based on electricity use. The market-based method, depending on its implementation, can allocate emissions based on the organization’s specific energy usage and procurement decisions, such as purchasing renewable energy, reflecting their active role in influencing grid emissions. Both methods, when effectively applied, can provide a comprehensive understanding of the organization’s responsibility for the emissions associated with purchased energy.</p> <p>Recommending or requiring a robust and standardized usage of GHG Protocol’s project-accounting assessments can provide an option for organizations to selectively assess actions or investments to evaluate their emission abatement or increase potential. This can be relevant in evaluating what actions could result in the greatest emissions impact per investment. Externally, project-based emissions assessments can be used to communicate the impacts of specific actions undertaken by a reporting organization to reduce or avoid emissions separately from the overall GHG emissions allocated to the reporting organization. Project accounting assessments must be reported separately from the inventory report’s emissions estimates of the reporting organization’s energy usage. As project-accounting assessments are currently not included in most target-setting or mandatory disclosure programs it is unclear how currently relevant this information is for the decision-making needs of users—both internal and external to the reporting organization. Elevating the project-based method to required or recommended could support its further adoption by these programs.</p> <p>Together, these three methods provide both internal and external users with the necessary insights to understand the full scope of the organization's emissions and the effectiveness of its sustainability strategies, thereby reflecting the substance and economic reality of the company’s business practices.</p>

Option D: Maintain Dual Reporting Requirement, with Potential Updates; Recommend or Require Project Accounting

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p>2. Completeness</p> <p>Corporate Standard: Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p> <p>Project Accounting Standard: Consider all relevant information that may affect the accounting and quantification of GHG reductions and complete all requirements.</p>	<p>Yes</p> <p>The location-based and market-based methods require accounting for and allocation of all relevant emission sources within the chosen inventory boundary and thus aligns with the Corporate Standard principle of completeness.</p> <p>Required dual reporting, combined with recommended or required project-based assessments, can provide a complete view relative to the other options of an organization's electricity-related emissions by ensuring that all GHG sources and activities within the inventory boundary are accounted for (once via the location-based method and once via the market-based method) and that all relevant information affecting the quantification of GHG reductions is considered.</p> <p>This reporting option would account for all GHG activities (e.g., purchase energy) within the inventory boundary. However, the approach may face challenges accounting for all GHG emission activities within the inventory boundary if inconsistencies arise in the application of the market-based method—due to its complexity—or the location-based method—due to variations in activity or grid data, potentially leading to incomplete reporting of the organization's inventory of emissions. See technical improvements for specific parameters within the location-based and market-based methods.</p> <p>By elevating the project-based method to a recommended or required reporting category, this approach may support project-based assessments can incorporate all relevant information that affect a project's potential GHG reductions at a system level separate from the overall GHG emissions of the reporting organization. While this can be done completely for specific projects, it may provide an incomplete representation of all actions, investments, etc. associated with the reporting organization.</p>
	<p>3. Consistency</p> <p>Corporate Standard: Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p> <p>Project Accounting Standard: Use data, methods, criteria, and assumptions that allow meaningful and valid comparisons.</p>	<p>Yes</p> <p>Required dual reporting, combined with recommended or required project-accounting assessments, can provide reporting methodologies that produce relevant and complete GHG information consistently over time. Dual reporting focuses on all operations within an organization's inventory boundary, while project accounting addresses primary and secondary effects through separate disclosures. For dual reporting to maintain consistency, the market-based method must apply energy procurement and consumption choices uniformly across reporting periods, while the location-based method requires the consistent use of grid average emission factors based on regional data. Project-accounting assessments, on the other hand, must utilize standardized data, methods, criteria, and assumptions to ensure consistent and comparable reporting of emissions reductions outside the inventory, reflecting the broader impact of specific initiatives.</p> <p>This approach also aligns with the established reporting practices of the last decade under the GHG Protocol Scope 2 Guidance, supporting continuity in reporting even if methodologies evolve with new scientific insights and the advancing role of the GHG Protocol.</p>

Option D: Maintain Dual Reporting Requirement, with Potential Updates; Recommend or Require Project Accounting

<p>GHG accounting and reporting principles (cont.)</p>	<p>4. Transparency</p> <p>Corporate Standard: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p> <p>Project Accounting Standard: Provide clear and sufficient information for reviewers to assess the credibility and reliability of GHG reduction claims.</p>	<p>Yes</p> <p>Required dual reporting, combined with recommended or required project-accounting assessments, can provide a suite of reporting methodologies that transparently disclose comprehensive GHG information. By elevating the project-based method to a recommended or required reporting category, this approach may result in GHG data that in aggregate better meets the transparency principle as the application of the project-based method may be better understood and applied by GHG reporters.</p> <p>The degree to which a reporting method or combination of methods meets the transparency principle is largely a factor of the technical specifics of that reporting method(s) and is difficult to assess in the abstract. Given that all three reporting methods included in this approach have the capacity to provide transparent and auditable GHG information, this option appears to be in alignment with the GHG Protocol transparency principle and criterion.</p>
	<p>5. Accuracy</p> <p>Corporate Standard: Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p> <p>Project Accounting Standard: Reduce uncertainties as much as is practical.</p>	<p>N/A</p> <p>The accuracy each method can achieve will depend on the specifics of how they are implemented, with some technical improvements initially demonstrating stronger alignment with the accuracy principle than others. Further evaluation of research associated with each dual reporting method is necessary to ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions and that uncertainties are reduced as far as practicable. See the technical improvements section for discussion on both the existing method’s accuracy and details on any improvements that may impact its accuracy.</p> <p>Including both the location-based and market-based methods, along with recommending or requiring project-based assessments, helps ensure that users receive a more accurate representation of the reporting organization’s GHG emissions, reducing the risk of any one method systematically misrepresenting emissions impacts.</p>

Option D: Maintain Dual Reporting Requirement, with Potential Updates; Recommend or Require Project Accounting

	<p>6. Comparability (subject to discussion on TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed / Yes</p> <p>Requiring dual reporting can enhance comparability by providing a comprehensive view of an organization’s emissions through two distinct methods of allocating the grid’s emissions: the location-based method, which offers a broad estimate based on regional grid carbon intensity, and the market-based method, which allocates emissions based on the organization’s specific energy usage and procurement decisions. This dual approach helps address relevant issues by providing both a general perspective on grid emissions and a detailed view of how the organization’s energy choices affect its allocated emissions, supporting a transparent assessment of the reported information.</p> <p>However, comparability depends on the consistent application of key implementation details, such as standardized activity data, emission factor sources, market boundaries, data quality, and vintage criteria. Inconsistent use of these factors could undermine the ability to accurately compare emissions across reporting organizations and may lead to potential misinterpretations of environmental performance.</p> <p>With regard to the project-based method, it is crucial to maintain a clear separation of project impacts from the broader inventory to enable users to make informed comparisons and decisions with reasonable confidence in the integrity of the reported inventory and project-assessment information.</p>
	<p>Support decision making that drives ambitious global climate action</p> <ul style="list-style-type: none"> Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 	<p>Yes</p> <p>The option of requiring dual reporting of Scope 2 emissions, combined with required or recommended project-based assessments, offers a more comprehensive framework for supporting global climate action and goals. By requiring both the location-based and market-based methods, this approach may incentivize reporting organizations to take a broader range of actions that align with the transition to a net-zero electricity grid. The location-based method encourages organizations to reduce overall electricity consumption and improve energy efficiency, while the market-based method can additionally enable the procurement and use of clean energy resources, facility siting decisions, and load management which can in turn contribute to the decarbonization of the grid.</p> <p>This dual reporting structure, when complemented by project-based assessments, helps ensure that no single method’s quantifications are overly weighted, thus providing a more actionable representation of an organization’s GHG emissions. It also aims to mitigate the potential weaknesses of relying on a single method by offering multiple perspectives on emissions, which can reduce uncertainties and better support climate goals. The accuracy of each method will depend on its specific implementation, with some technical improvements likely demonstrating stronger alignment with the Decision-Making Criteria. Further evaluation and refinement of these methods is discussed in the technical improvements section.</p> <p>By encouraging a comprehensive approach to emissions reporting, this combined option has a higher probability of supporting global climate action more effectively than options that use only a subset of these methods. It increases the likelihood that all relevant mitigation actions are considered, providing stakeholders with the necessary information to assess progress toward climate goals and make informed decisions that contribute to the transition to a net-zero future.</p>

Option D: Maintain Dual Reporting Requirement, with Potential Updates; Recommend or Require Project Accounting

<p><u>Support programs based on GHG Protocol and uses of GHG data</u></p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality. Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>Yes</p> <p>This option has the potential to support uses of GHG data and programs based on the GHG Protocol by generating emissions data that is both comprehensive and versatile. By offering multiple perspectives on an organization’s emissions, this approach can provide useful data for general users of GHG reports and reduce the risk of overreliance on a single method that might undercount impacts. Additionally, it can generate emissions data that is more likely to be interoperable with existing mandatory (IFRS S2, ESRS E1, ISO 14064-1:2018, U.S. SEC Rule, and CA SB 253) and voluntary climate disclosure and target-setting programs, such as the CDP, SBTi, RE100, and GRI. Project-based method reporting would add to this suite of relevant data, and by elevating it to a required or recommended reporting category with a more rigorous and standardized methodology this approach would likely increase the availability of this data compared with other approaches that exclude it or maintain it as only an optional reporting category with little guidance. However, the reporting of project-based assessments is currently under-utilized or not required by many programs, so it only provides the potential for such support. The effectiveness of this approach also depends on how these programs choose to apply and integrate the suite of methods provided by the GHG Protocol.</p>
<p><u>Feasibility to implement</u></p> <ul style="list-style-type: none"> Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable. GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.). For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation. 	<p>Mixed / Yes</p> <p>The option of requiring dual reporting of Scope 2 emissions appears to be feasible for a wide range of organizations and regions. Dual reporting methods have a track record of being implemented by many reporting organizations, particularly in regions where both the location-based and market-based methods are well understood and supported by existing tools and resources.</p> <p>While the project-based method has a long track record of implementation in carbon markets to quantify project-level GHG reductions and removals, its feasibility as part of organizations' overall emission reporting, decision-making, and target-setting efforts is unknown. As such, the decision of whether to elevate it to a required or recommended reporting method has significant implications for the feasibility of this approach</p> <p>While implementation challenges may vary globally, particularly in regions with less access to high-quality data, the widespread availability of guidance and resources from the GHG Protocol could support broader adoption. The inclusion of project-based assessments, though currently under-utilized, has the potential to be integrated more widely as additional tools and resources are developed, making this approach increasingly feasible over time.</p>

Appendix B – Detailed Decision-Making Criteria Analysis for Location-Based Method Technical Improvements

A. Maintain the Current Location-Based Method Accounting and Reporting Requirements:

- Maintain current broad flexibility of the scope 2 location-based method emission factor hierarchy.
 - Companies should use the most appropriate, accurate, precise, and highest quality emission factors available for each method
 - Organizations should first try to use regional or subnational emission factors: *“Average emission factors representing all electricity production occurring in a defined grid distribution region that approximates a geographically precise energy distribution and use area. Emission factors should reflect net physical energy imports/exports across the grid boundary.”*⁹⁵
 - When such information is unavailable, organizations may use national production emission factors: *“Average emission factors representing all electricity production information from geographic boundaries that are not necessarily related to dispatch region, such as state or national borders. No adjustment for physical energy imports or exports, not representative of energy consumption area.”*⁹⁶
- Maintain broad temporal requirements
 - An annual grid-average emission factor is proposed as an indicative example for an appropriate regional or subnational emission factor
 - Organizations are encouraged to take into account *“temporal representativeness due to time delays between the year in which energy generation and resulting emissions occurred, and the year in which the data is published”*⁹⁷ when analyzing location-based scope 2 results.

Option A: Maintain the Current Location-Based Method Accounting and Reporting Requirements	
Decision-Making Criteria	Evaluation
<p><u>Scientific integrity</u></p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>Mixed</p> <p>To evaluate if the current location-based method using annual average emission factors ensures scientific integrity and validity, adheres to the best applicable science and evidence, and aligns with the latest climate science, its performance is assessed within the context of its stated purpose and use cases as outlined above. In this context, it shows mixed alignment with the scientific integrity criteria. Note: updates to the stated purpose and use cases will be considered during the revision process.</p> <p>1. Estimating and reflecting emissions based on grid data</p> <p>The current location-based method provides a simplified estimation of reporting organizations’ indirect emissions associated with their purchased and consumed electricity. This estimation is determined by allocating a pro rata share of total system emissions within a defined geographic area and time period according to the amount of electricity purchased and consumed by the organization using a grid average emission factor. Under the current location-based method, the emissions reported in an organization’s scope 2 location-based inventory will increase or decrease as result of either corresponding increases or decreases in their activities (i.e., purchased and consumed electricity), or changes in the grid-average emission factor used by the reporting organization.</p> <p>Recent research has highlighted that improving the accuracy of the location-based method's allocation of average system emissions may require closer consideration of both the time and location of energy generation and consumption.</p> <p>Regarding temporal granularity, research shows that the current method of allocating emissions, using an annual average grid emission factor may lead to over or underestimation of how the grid's average emissions are allocated to individual reporting organizations by up to 35%, when compared to a location-based method inventory using hourly average emission factors.⁹⁸ These differences are greater in regions</p>

⁹⁵ Scope 2 Guidance, Table 6.2, p. 47

⁹⁶ Scope 2 Guidance, Table 6.2, p. 47

⁹⁷ Scope 2 Guidance, section 6.10.1, p. 54

⁹⁸ Miller, Gregory J., Kevin Novan, and Alan Jenn. "Hourly accounting of carbon emissions from electricity consumption." *Environmental Research Letters* 17, no. 4 (2022): 044073.

Option A: Maintain the Current Location-Based Method Accounting and Reporting Requirements

Scientific integrity (cont.)

with high variability in hourly emission intensities and may be exacerbated as additional intermittent clean energy resources are deployed (e.g., wind and solar).

Regarding spatial granularity, research has pointed to the importance of requiring ‘deliverability’ (i.e., the notion that a specific power resource can physically deliver power to a reporting organization) in defining grid regions for use in emission inventories. Research shows that the use of grid-average emission factors that reflect only emissions from electricity generation within a region may lead to over or underestimation of allocated emissions when compared to using an emission factor that considers energy imports/exports across grid boundaries.⁹⁹ The extent of the difference is dependent on the average emission intensities and degree of imports and exports between the relevant grid networks.

As a result, while it is useful for understanding an allocation of system-wide emissions based on total consumption, the use of annual data or large geographic boundaries may introduce inaccuracies, especially when finer time frames or more localized conditions would show different results.

2. Assessing risks and opportunities related to grid emissions

Per the considerations discussed above related to “Estimating and reflecting emissions based on grid data”, there is a limited and conflicting scientific basis for use of the current location-based method with annual average emission factors and large regional boundaries as a means to assess a reporter’s risks and opportunities related to grid emissions associated with their purchased and consumed electricity.

3. Enabling decision-making for consumers and companies

By its mathematical design, the current location-based method using annual grid-average emission factors is poorly suited or unable to reflect any direct or precise causal responsibility between an organization’s energy purchasing and usage and the emissions assigned via the location-based method to the reporting organization. Annual average emission factors provide a generalized view of electricity emissions but are not able to account for changes at the grid level that result from shifts in demand, usage patterns, or the introduction of new technologies.¹⁰⁰ This does not compromise the legitimacy of the method as a means to allocate emissions using a grid-average emission rate, however it indicates the current method using annual average emission factors does not fully align with the scientific integrity criteria when it comes to enabling decision-making for consumers and companies. If decisions are made based on the current location-based method using annual average emission factors, they may not accurately reflect the actual emission-related consequences of organizational actions, potentially misrepresenting the effectiveness of efforts to reduce emissions. There are mixed views in research on whether improving the spatiotemporal granularity of average emission factors could result in improved decision-making utility. See Option B for further analysis of the impact of improved granularity in the location-based method.

4. Improving comparability

As a basis for comparison using a simple and easily understood methodology for average emission allocations, the current location-based method using an annual average emission factor has mathematical integrity. However, within this methodology, research has shown overly broad temporal and geographic grid-average emission factors can result in inaccurate allocation and thus potentially compromise comparability across a reporting organization’s operations across multiple markets over time.

⁹⁹ Ji, Ling, Sai Liang, Shen Qu, Yanxia Zhang, Ming Xu, Xiaoping Jia, Yingtao Jia et al. "Greenhouse gas emission factors of purchased electricity from interconnected grids." *Applied Energy* 184 (2016): 751-758;

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¹⁰⁰ Hawkes, Adam D. "Long-run marginal CO2 emissions factors in national electricity systems." *Applied Energy* 125 (2014): 197-205;

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Elenes, Alejandro GN, Eric Williams, Eric Hittinger, and Naga Srujana Goteti. "How well do emission factors approximate emission changes from electricity system models?." *Environmental Science & Technology* 56, no. 20 (2022): 14701-14712.

Option A: Maintain the Current Location-Based Method Accounting and Reporting Requirements

<p><u>GHG accounting and reporting principles</u></p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p><u>1. Relevance</u></p> <p>Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p>	<p>Mixed</p> <p>A GHG inventory based on the current location-based method using annual average emission factors has mixed alignment with the relevance principle and how it reflects the GHG emissions of the company and serves the decision-making needs of users. Although it can provide a simplified estimation of an organization’s emissions associated with purchased and consumed electricity based on grid data, the use of annual average emission factors is largely incompatible with risk and opportunity assessments related to grid emissions and inappropriate for informing decision-making by internal users seeking to reduce emissions or assess performance (see scientific integrity section).</p> <p>Given the shared nature of transmission and distribution on an electricity grid, using an annual grid average emission factor can be an appropriate method to account for an organization’s emissions attributable to their electricity purchases and consumption. However, by its mathematical design, the allocation of emissions using an annual grid average emission rate is poorly suited or unable to reflect direct or precise causal relationships between an organization’s electricity purchases and usage and the emissions assigned to it. As a result, it has limitations in its relevance to users as a decision-making tool.</p> <p>The current location-based method using annual average emission factors may provide relevant information for external decision-making needs as a simple and easily understood methodology to make comparisons of average allocation of grid emissions across markets and time. For instance, under IFRS S2 requiring use of the location-based method aligns with the qualitative characteristic ‘comparability’, described by the IFRS Foundation as enhancing the usefulness of sustainability-related financial information. The limitations outlined under the scientific integrity criterion should be factored into the scope and accuracy of any such comparisons.</p>
	<p><u>2. Completeness</u></p> <p>Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p>	<p>Yes</p> <p>The current location-based method can provide a means to ensure that all electricity-related indirect GHG emission sources associated with activities within the reporting organization’s inventory boundary are accounted for (e.g., all activities, denominated in megawatt hours (MWhs), are accounted for in a complete scope 2 location-based method inventory).</p>
	<p><u>3. Consistency</u></p> <p>Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p>	<p>Yes</p> <p>The current location-based method can provide a consistent approach to estimating over time the pro rata shares of total system emissions based on electricity consumed within a defined geographic area and time period using a grid-average emission factor.</p> <p>To achieve this outcome, it is necessary for the reporting organization to use consistent market boundaries, emission factor vintages, and other parameters consistently.</p>

Option A: Maintain the Current Location-Based Method Accounting and Reporting Requirements

	<p>4. Transparency</p> <p>Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p>	<p>Yes</p> <p>The current location-based method can provide a transparent and auditable means to estimating over time the pro rata shares of total system emissions based on electricity purchased and consumed within a defined geographic area and time period using a grid-average emission factor.</p> <p>The simple nature of emissions calculations under the current location-based method and the public availability of annual average emission factors, in comparison with other accounting methods, aids the transparency and auditability of this accounting approach.</p> <p>It is possible the current methodology may benefit from updates to ensure more consistent market boundaries, emission factor vintage, and other parameters.</p>
<p>GHG accounting and reporting principles (cont.)</p>	<p>5. Accuracy</p> <p>Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p>	<p>Mixed</p> <p>The current location-based method can provide an accurate means to allocate the pro rata shares of total system emissions based on purchased and consumed electricity within a defined geographic area and time period using a grid-average emission factor. As stated in the Guidance, the scope 2 location-based method “reflects the average emissions intensity of grids on which energy consumption occurs (using mostly grid-average emission factor data)”¹⁰¹ and “is based on statistical emissions information and electricity output aggregated and averaged within a defined geographic boundary and during a defined time period.”¹⁰² It further states that “[c]ompanies should use the most appropriate, accurate, precise, and highest quality emission factors available for each method.”¹⁰³ The current location-based method generally achieves these outcomes at a level of accuracy consistent with the range described above. However, as outlined in the scientific integrity criterion, research indicates that in some regions this method may misallocate emissions due to its lack of temporal and spatial granularity and not requiring the accounting of electricity imports across regions. Depending on the degree, these factors may limit the method’s ability to provide sufficiently accurate data.</p> <p>Although it provides a broad estimate of regional emissions based on grid averages, by its mathematical design the method is not able to provide the accuracy needed to ensure that a reporting organization’s emissions quantifications are neither systematically over- nor underestimated relative to GHG emissions to the atmosphere. The use of annual average grid emission factors introduces significant uncertainties, especially when it comes to achieving sufficient accuracy to enable users to make decisions related to facility siting, increases or decreases in electricity consumption, timing of demand shifts, and deployment of new technologies with reasonable confidence as to the integrity of the reported emission information. See scientific integrity section for more information.</p>

¹⁰¹ Scope 2 Guidance, section 1.5, p. 8

¹⁰² Scope 2 Guidance, section 4.1.1, p. 25

¹⁰³ Scope 2 Guidance, section 6.5, p. 45

Option A: Maintain the Current Location-Based Method Accounting and Reporting Requirements

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p>6. Comparability (not a current principle; subject to discussion in the ISB and TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed</p> <p>Generally, location-based to location-based comparisons across companies are possible, however variations in data choices, such as precision of activity data, grid emission factors, as well as geographic and temporal boundaries can impact the results. For instance, comparability of reporting organizations consuming electricity from the same grid relies on them using the same grid average emission factors.</p> <p>However, within this methodology, research has shown overly broad temporal and geographic grid-average emission factors can result in inaccurate allocation and thus potentially compromise comparability across a reporting organization’s operations across multiple markets over time.</p>
<p><u>Support decision making that drives ambitious global climate action</u></p> <ul style="list-style-type: none"> Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 		<p>Mixed / No</p> <p>The current Guidance indicates the location-based method using annual average emission factors may incentivize organizations to:</p> <ul style="list-style-type: none"> Report GHG emissions using a simple and comparable allocation method. Reduce overall grid electricity consumption and improve energy efficiency as a means to reduce reported activity data. Make facility-siting decisions based on the annual average grid emission intensity of different regions. Make facility-siting decisions based on natural features of a location. Make time-of-use decisions based on the average grid emission intensity at different hours of the day. Rely on incremental changes in grid emission intensity to reduce reported emissions. Some organizations may be incentivized to attempt to accelerate this change through indirect actions such as grid decarbonization advocacy and lobbying. <p>Some of these actions, including reporting GHG emissions using a simple and comparable allocation method, advocacy and lobbying efforts, and decisions that reduce overall electricity purchases and consumption in aggregate, may contribute to ambitious climate actions.</p> <p>However, as detailed in the scientific integrity section, the current location-based method using annual average emission factors based on large geographic regions may not provide accurate information to inform decisions that add, remove, or shift electricity load, nor develop clean energy generation resources due to the limitations inherent in the use of annual average emission factors.</p>

Option A: Maintain the Current Location-Based Method Accounting and Reporting Requirements

<p><u>Support programs based on GHG Protocol and uses of GHG data</u></p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>Mixed</p> <p>The use of the location-based method across various mandatory sustainability reporting directives and programs demonstrates its broad applicability and alignment with global climate disclosure standards. The current location-based method is used by several key programs, including:</p> <ul style="list-style-type: none"> A reporting requirement within European Sustainability Reporting Standards: Climate Change (ESRS E1) mandated by the European Union Corporate Sustainability Reporting Directive (CSRD) A reporting requirement within IFRS S2 Climate-related Disclosures issued by the International Sustainability Standards Board (ISSB) A reporting requirement within ISO 14064-1:2018 An option for reporting scope 2 emissions within the Enhancement and Standardization of Climate-Related Disclosures for Investors Rule adopted by the United States Securities and Exchange Commission (U.S. SEC Rule) A method for scope 2 emissions disclosure under the Global Reporting Initiative (GRI) and CDP, among others <p>The effectiveness of the current location-based method in generating data for general users is mixed, as it is highly dependent on the intended use of such data. As described in the sections above, whilst the location-based method may provide an allocation of system-wide emissions based on total consumption, the use of annual data or large geographic boundaries may introduce limitations for the use of the data to assess a reporter’s risks and opportunities related to grid emissions or to inform decision-making.</p>
<p><u>Feasibility to implement</u></p> <ul style="list-style-type: none"> Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable. GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.). For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation. 	<p>Yes</p> <p>The current location-based method has a strong track record of implementation. Organizations at varying levels of maturity can access the activity data and emission factors required to implement this method. The widespread availability of annual grid-average emission factors has facilitated the adoption of location-based reporting globally.</p>

B. Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity:

- Building on the current location-based method requirements, organizations **shall** account and report their location-based method inventory using more temporally and geographically granular accounting and reporting requirements for the location-based method.
 - Organizations **shall** account for and report the location-based method inventory using hourly grid average emission factors and activity data.
 - Organizations **shall** account for and report the location-based method inventory using emission factors that reflect ‘deliverable’ geographic boundaries.
 - In this option ‘deliverable’ geographic boundaries are considered in two ways:
 - Deliverable boundaries **shall** use granular geographic boundaries (to be discussed and defined by TWG).
 - Deliverable boundaries **shall** use grid-average emission factors that include energy imports/exports across grid boundaries.

Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity	
Decision-Making Criteria	Evaluation
<p><u>Scientific integrity</u></p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>Mixed / Yes</p> <p>To evaluate if this proposed location-based method using more granular accounting requirements ensures sufficient scientific integrity and validity by adhering to the best applicable science and evidence, its performance is assessed within the context of its stated purpose and use cases as outlined above. In this context, it shows mixed to favorable alignment with the scientific integrity criteria. Note, this stated purpose and use case will be considered during the revision process.</p> <p style="margin-left: 20px;">1. Estimating and reflecting emissions based on grid data</p> <p>Similar to Option A (i.e., the current location-based method) outlined above, Option B would seek to provide a simplified, albeit more granular, estimation of the reporting organization’s indirect emissions associated with their purchased and consumed electricity. This estimation is determined by allocating a pro rata share of total system emissions within a defined geographic area and time period (i.e., hourly) according to the amount of electricity purchased and consumed. The differences of this proposed approach from the current location-based method are requiring the use of hourly grid average emission factors matched with hourly activity data and requiring the use of ‘deliverable’ geographic boundaries inclusive of imported/exported energy.</p> <p>As outlined in Option A, the use of annual grid-average emission factors based on large geographic boundaries combined with annual activity data for purchased and consumed electricity is likely unable to consistently provide accurate and relevant information for the intended uses of the location-based method as described in the Scope 2 Guidance. Research highlights that improving the accuracy of the location-based method's allocation of average system emissions likely requires closer consideration of both the time and location of energy generation and consumption.</p> <p>Regarding temporal granularity, a recent study demonstrated that the current method of allocating emissions, using <i>annual</i> average grid emission factors, may lead to over or underestimation of how the grid's average emissions are allocated to individual reporting organizations by up to 35% when compared with a location-based method using hourly average emission factors¹⁰⁴. These differences are greater in regions with high variability in hourly emission intensity and may be exacerbated as additional intermittent clean energy resources are</p>

¹⁰⁴ Miller, Gregory J., Kevin Novan, and Alan Jenn. "Hourly accounting of carbon emissions from electricity consumption." *Environmental Research Letters* 17, no. 4 (2022): 044073.

Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity

Scientific integrity (cont.)

deployed (e.g., wind and solar). Another study by de Chalendar et al.¹⁰⁵ considering emissions in the U.S. electricity system demonstrated that trends in fluctuating grid carbon intensity cannot be accurately reflected without temporally granular exchange data. For example, for the Idaho Power Company, the carbon content of imports is much higher than that of local generation (71 kg/MWh), and the reliance on imports depends sensitively on time. In the spring, this region generates almost enough energy to meet its demand, but in other months it relies heavily on imports from the neighboring PacifiCorp East (716 kg/MWh) and North Western Energy (765 kg/MWh).¹⁰⁶ Such trends cannot be accurately captured with annual average emission factors.

Regarding spatial granularity, research has pointed to the importance of requiring emission factors used under the location-based method to reflect ‘deliverability’ (the notion that a specific power resource can physically deliver power to a reporting organization). For this Option, ‘deliverability’ is considered in two ways: requiring use of granular geographic boundaries and requiring consideration of energy imports/exports across grid boundaries.

Use of a large geographic boundary (such as national boundaries or eGRID subregions in the U.S.) for calculating a grid average emission factor may not always accurately reflect the carbon intensity of the specific grid an organization directly consumes electricity from. For instance, a study by de Chalendar et al.¹⁰⁷ found that the overall U.S. electric grid carbon intensity would accurately match the carbon embodied in electricity consumed only in three balancing authorities in the continental U.S. Similar phenomena are evident in national and regional emission rate data published by a variety of governments (e.g., Australia,¹⁰⁸ U.S. eGRID,¹⁰⁹ European Environment Agency (EEA)¹¹⁰) which further suggests that granular emission rates are necessary to more accurately allocate emissions based on the specific location where an organization purchases and consumes electricity.

Research shows that the use of grid-average emission factors that reflect only emissions from electricity generation within a region may lead to over or underestimation of allocated emissions when compared to using an emission factor that considers energy imports/exports across grid boundaries.¹¹¹ The extent of the difference is dependent on the average emission intensities and degree of imports and exports between the relevant grid networks. For example, Schäfer et al.¹¹² demonstrated that including imports/exports when calculating the emission intensity of European electricity markets has a significant impact on allocated emissions, particularly for well-connected small countries. Another study comparing generation-only emission factors against emission factors inclusive of imports/exports for fifty-three European and Asian countries found that the emission factors inclusive of imports/exports could be 823% greater or 58% less than generation-only emission factors¹¹³.

As outlined in Option A, the location-based method provides a simplified method for estimating and reflecting emissions based on grid data. Improving the granularity of how average system emissions are allocated is not necessarily required for the location-based method to meet its purpose of providing a simple means to allocate emissions using a grid average emission rate. However, the studies outlined above indicate that increasing the granularity of the average emission factor and activity data used under the location-based method tends to improve the accuracy of how emissions are estimated. Hence the rationale for this proposed option is that an improvement in how emissions

¹⁰⁵ de Chalendar, Jacques A., John Taggart, and Sally M. Benson. "Tracking emissions in the US electricity system." *Proceedings of the National Academy of Sciences* 116, no. 51 (2019): 25497-25502

¹⁰⁶ de Chalendar, Taggart, and Benson, "Tracking Emissions," 25497-25502

¹⁰⁷ de Chalendar, Taggart, and Benson, "Tracking Emissions," 25497-25502

¹⁰⁸ Department of Climate Change, Energy, the Environment and Water. *National Greenhouse Account Factors 2024*. Australian Government, 2024. <https://www.dceew.gov.au/sites/default/files/documents/national-greenhouse-account-factors-2024.pdf>.

¹⁰⁹ U.S. Environmental Protection Agency. "Summary Data." Last modified October 22, 2024. Accessed October 22, 2024. <https://www.epa.gov/egrid/summary-data>

¹¹⁰ European Environment Agency (EEA) Greenhouse gas emission intensity of electricity generation in Europe Accessed October 24, 2024. <https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emission-intensity-of-1>

¹¹¹ Ji, Ling, Sai Liang, Shen Qu, Yanxia Zhang, Ming Xu, Xiaoping Jia, Yingtao Jia et al. "Greenhouse gas emission factors of purchased electricity from interconnected grids." *Applied Energy* 184 (2016): 751-758;

Qu, Shen, Sai Liang, and Ming Xu. "CO2 emissions embodied in interprovincial electricity transmissions in China." *Environmental science & technology* 51, no. 18 (2017): 10893-10902;

Schäfer, Mirko, Bo Tranberg, Dave Jones, and Anke Weidlich. "Tracing carbon dioxide emissions in the European electricity markets." In *2020 17th International Conference on the European Energy Market (EEM)*, pp. 1-6. IEEE, 2020.

¹¹² Schäfer, Mirko, Bo Tranberg, Dave Jones, and Anke Weidlich. "Tracing carbon dioxide emissions in the European electricity markets." In *2020 17th International Conference on the European Energy Market (EEM)*, pp. 1-6. IEEE, 2020.

¹¹³ Ji, Ling, Sai Liang, Shen Qu, Yanxia Zhang, Ming Xu, Xiaoping Jia, Yingtao Jia et al. "Greenhouse gas emission factors of purchased electricity from interconnected grids." *Applied Energy* 184 (2016): 751-758

Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity

Scientific integrity (cont.)

are estimated and reflected based on grid data may better enable the location-based method to meet its other stated purposes and use cases as outlined in the Scope 2 Guidance. The rest of this section considers these points further.

2. Assessing risks and opportunities related to grid emissions

Per the considerations discussed above related to “Estimating and reflecting emissions based on grid data”, there is a limited and conflicting scientific basis for use of the current location-based method with annual average emission factors and large regional boundaries as a means to accurately and comprehensively assess a reporter’s risks and opportunities related to grid emissions associated with their purchased and consumed electricity. Further research is necessary to fully assess how increasing the granularity of the location-based method could enable a more accurate and decision-relevant assessment of the risks and opportunities related to grid emissions associated with generation sources physically ‘deliverable’ to the reporting organization and operational at the hourly interval of consumption.

3. Enabling decision-making for consumers and companies

This option proposes *requiring* hourly emission factors and *requiring* the use of ‘deliverable’ geographic boundaries to improve the alignment of the location-based method with the scientific integrity criteria. One research paper¹¹⁴ found, for the U.S. grid in 2024, a slight negative correlation between induced emissions from an organization’s load interventions (e.g., adding load to the grid) and allocated GHG emissions using an hourly average emission factor. When modeling a future grid with greater variable renewable generation, however, the correlation gained a slight positive correlation, suggesting that temporally resolved average emissions rates may become more correlated with impact over time. This positive correlation may imply that requiring use of hourly emission factors under the location-based method could produce inventory data that better aligns with the scientific integrity criteria when it comes to enabling decision-making for consumers and customers. However, there are mixed views on whether this correlation exists or is helpful for decision-making. For example, work by Steinsultz et al.¹¹⁵ indicates that increasing the spatiotemporal granularity of average emission factors beyond the balancing-authority level (BA sub-regions) may potentially misrepresent the effectiveness of efforts to reduce emissions. Other research is generally unresponsive or inconclusive of the concept of using average emission factors to inform decision-making (e.g., shifts in demand, usage patterns, or the adoption of new technologies), suggesting that alternate methodologies, such as short-run or long-run marginal emission factors, should be used to inform these actions.¹¹⁶ Further research is needed to examine the implication of increased spatiotemporal granularity of the location-based method for decision-making, particularly research evaluating these questions in regions outside of the United States.

4. Improving comparability

Research has shown that increasing the spatial and temporal granularity of the location-based method better reflects variations in grid emissions over time and across locations, which can allow for a more accurate allocation of emissions. Consistent application of this approach may enhance comparability across a reporting organization’s operations in multiple markets and over time, and reduce potential inaccuracies associated with broader average emission factors. However, compared to Option 1, increasing granularity may unintentionally introduce greater variability due to differences in data availability for both hourly emission factors, based on appropriate grid regions that account for imports and exports, and hourly activity data from reporting organizations. This could affect comparability. For more on comparability and feasibility, see the discussion below.

¹¹⁴ Gagnon, Pieter, and Wesley Cole. "Planning for the evolution of the electric grid with a long-run marginal emission rate." *Isience* 25, no. 3 (2022).

¹¹⁵ Steinsultz, Nat, Pierre Christian, Joel Cofield, Gavin McCormick, and Sarah Sofia. "Validating locational marginal emissions models with wind generation." *Environmental Research: Energy* 1, no. 3 (2024): 035008.

¹¹⁶ Hawkes, Adam D. "Long-run marginal CO2 emissions factors in national electricity systems." *Applied Energy* 125 (2014): 197-205;

He, Hua, Aleksandr Rudkevich, Xindi Li, Richard Tabors, Alexander Derenchuk, Paul Centolella, Ninad Kumthekar, Chen Ling, and Ira Shavel. "Using marginal emission rates to optimize investment in carbon dioxide displacement technologies." *The Electricity Journal* 34, no. 9 (2021): 107028;

Holland, Stephen P., Matthew J. Kotchen, Erin T. Mansur, and Andrew J. Yates. "Why marginal CO2 emissions are not decreasing for US electricity: estimates and implications for climate policy." *Proceedings of the National Academy of Sciences* 119, no. 8 (2022): e2116632119.;

Gagnon, Pieter, and Wesley Cole. "Planning for the evolution of the electric grid with a long-run marginal emission rate." *Isience* 25, no. 3 (2022);

Elenes, Alejandro GN, Eric Williams, Eric Hittinger, and Naga Srujana Goteti. "How well do emission factors approximate emission changes from electricity system models?." *Environmental Science & Technology* 56, no. 20 (2022): 14701-14712;

Siler-Evans, Kyle, Ines Lima Azevedo, and M. Granger Morgan. "Marginal emissions factors for the US electricity system." *Environmental science & technology* 46, no. 9 (2012): 4742-4748.

Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity

<p><u>GHG accounting and reporting principles</u></p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p><u>1. Relevance</u></p> <p>Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p>	<p>Mixed / Yes</p> <p>A GHG inventory based on the proposed option of <i>requiring</i> the use of hourly emission factors and <i>requiring</i> the use of ‘deliverable’ geographic boundaries may improve alignment with the principle of relevance.</p> <p>Similar to the current location-based method, this proposed approach provides a broad estimate of grid emissions by using a regional average grid emission rate, offering a general view of the reporting organization’s GHG emissions based on their purchased and consumed electricity. Given the shared nature of transmission and distribution on an electricity grid, emissions calculated using a grid average emission factor can be an appropriate method of reflecting a company’s emissions attributable to purchased and consumed electricity. Research as described in the scientific integrity criterion indicates that moving from annual average to hourly average, regionally specific emission factors inclusive of imports and exports will more accurately allocate the emissions of the specific power resources used to generate electricity at the time of consumption.</p> <p>The proposed location-based method approach can support some internal decision-making such as incentivizing reductions in total electricity consumption, installing on-site generation, and improvements to energy efficiency. There is mixed evidence regarding whether the proposed use of hourly grid-average emission factors, as opposed to annual average emission factors, would better facilitate internal decision-making concerning load-shifting, demand response, and energy storage applications for existing facilities. There is similarly mixed evidence regarding whether the use of more granular emission factors provides relevant information for evaluating emission outcomes from adding new load to the grid (e.g., siting new facilities or significant increases in purchased and consumed energy).</p> <p>When considering information relevant for meeting external decision-making needs, the same limitations of this proposed approach appear to apply.</p>
	<p><u>2. Completeness</u></p> <p>Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p>	<p>Yes</p> <p>The proposed location-based method approach can provide a means to ensure that all electricity-related indirect GHG emission sources associated with activities within the reporting organization’s inventory boundary are accounted for (e.g., all activities, denominated in megawatt hours (MWhs), are accounted for in a complete scope 2 location-based method inventory).</p>

Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p><u>3. Consistency</u></p> <p>Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p>	<p>Yes</p> <p>The proposed location-based method approach can provide a consistent approach to estimating over time the pro rata shares of total system emissions based on electricity consumed within a defined geographic area and time period using a grid average emission factor. To achieve this outcome, it is necessary for the reporting organization to use consistent market boundaries, emission factor vintages, and other parameters consistently.</p>
	<p><u>4. Transparency</u></p> <p>Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p>	<p>Mixed / Yes</p> <p>The proposed location-based method approach can provide a transparent and auditable means to estimating over time the pro rata shares of total system emissions based on electricity purchased and consumed within a defined geographic area and time period using a grid-average emission factor.</p> <p>Requiring the use of more granular emission factors and consumption data may impact the simplicity of location-based emissions calculations and public availability of emission factors, which may affect the transparency and auditability of this accounting approach.</p>

Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p><u>5. Accuracy</u></p> <p>Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p>	<p>Mixed / Yes</p> <p>The proposed location-based method approach provides a means to allocate the pro rata shares of total system emissions based on purchased and consumed electricity within a ‘deliverable’ geographic area at the hourly interval of consumption using a grid-average emission factor.</p> <p>As stated in the Guidance, the scope 2 location-based method “<i>reflects the average emissions intensity of grids on which energy consumption occurs (using mostly grid-average emission factor data)</i>”¹¹⁷ and “<i>is based on statistical emissions information and electricity output aggregated and averaged within a defined geographic boundary and during a defined time period.</i>”¹¹⁸ It further states that “[c]ompanies should use the most appropriate, accurate, precise, and highest quality emission factors available for each method”¹¹⁹ where:</p> <ul style="list-style-type: none"> • The most precise factor listed in the location-based emission factor hierarchy is defined as using “[a]verage emission factors representing all electricity production occurring in a defined grid distribution region that approximates a geographically precise energy distribution and use area. Emission factors should reflect net physical energy imports/exports across the grid boundary.”¹²⁰ • The “<i>most appropriate spatial boundaries for emission factors serving the location-based method are those that approximate regions of energy distribution and use, such as balancing areas. All generation and emissions data within this boundary should be aggregated and any net physical energy imports/ exports and their related emissions should be taken into account.</i>”¹²¹ Options are also provided to use larger boundaries when necessary. • No additional specific detail is provided on the temporal resolution in determining the most appropriate, accurate, precise, and highest quality emission factors (e.g., should organizations use hourly emission factors over annual if available). <p>The proposed location-based method generally achieves these outcomes at a level of accuracy suggested above. By further defining the ‘geographic boundary’ and ‘time period’ required to be used for grid-average emission factors, this approach aligns more closely with new research outcomes testing the implications of refining these boundaries on the accuracy of how the grid’s average emissions are allocated to individual reporters. However, the extent to which more accurately allocated inventory emission data can be used to inform accurate decision-making requires further exploration. See discussion in the scientific integrity section, as well as in the ‘Supports decision making that drives ambitious global climate action’ section.</p>
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¹¹⁷ Scope 2 Guidance, section 1.5, p. 8
¹¹⁸ Scope 2 Guidance, section 4.1.1, p. 25
¹¹⁹ Scope 2 Guidance, section 6.5, p. 45
¹²⁰ Scope 2 Guidance, Table 6.2, p. 47
¹²¹ Scope 2 Guidance, section 6.10.1, p. 54

Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p>6. Comparability (not a current principle; subject to discussion in ISB and TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed /Yes</p> <p>Location-based to location-based comparisons across reporting organizations using the proposed approach would be possible. Research has shown the use of more granular temporal and geographic grid-average emission factors can result in greater accuracy of emission allocations, so the proposed option of <i>requiring</i> hourly emission factors and <i>requiring</i> the use of ‘deliverable’ geographic boundaries may provide more relevant information to assist comparability across a reporting organization’s operations and across multiple markets over time. However, compared to Option A, increasing granularity may unintentionally introduce greater variability. This is due to differences in data availability for hourly emission factors (based on grid regions that may account for imports and exports differently) and hourly activity data from reporting organization. Such variability could affect comparability.</p>
<p><u>Support decision making that drives ambitious global climate action</u></p> <ul style="list-style-type: none"> Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 		<p>Mixed</p> <p>The current Guidance indicates the location-based method may incentivize organizations to:</p> <ul style="list-style-type: none"> Report GHG emissions using a simple and comparable allocation method. Reduce overall grid electricity consumption and improve energy efficiency as a means to reduce reported activity data. Make facility-siting decisions based on the average grid emission intensity of different regions. Make facility-siting decisions based on natural features of a location. Make time-of-use decisions based on the average grid emission intensity at different hours of the day. Rely on incremental changes in grid emission intensity to reduce reported emissions. Some organizations may be incentivized to attempt to accelerate this change through indirect actions such as grid decarbonization advocacy and lobbying. <p>Some of these actions or decisions, including reporting GHG emissions using a simple and comparable allocation method, decisions that reduce overall electricity purchases and consumption in aggregate, and advocacy and lobbying efforts, may support ambitious global climate actions.</p> <p>As detailed in the scientific integrity section, research is inconclusive about whether the required use of hourly average and ‘deliverable’ emission factors may provide accurate information to inform time-of-use decisions, whether incremental changes in average grid emission intensity reduces emissions, or and whether this data would inform facility- or generation-siting decisions.</p>

Option B: Refine Reporting Requirements for the Location-Based Method to Require Temporal and Geographic Granularity

<p><u>Support programs based on GHG Protocol and uses of GHG data</u></p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target-setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality. Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>Mixed / Yes</p> <p>Compared to the current location-based method, this approach may provide various users with more useful emission data as it is more accurate, relevant, and comparable for the reasons described above.</p> <p>For reasons of feasibility, it is unclear how this option might impact interoperability with policies and programs that have implemented the current location-based method (relying on annual-average emission factors) as new legal disclosure requirements including those in IFRS S2 and ESRS E1. Considering this sensitivity, further consideration of how this proposal aligns with this criterion may be necessary.</p>
<p><u>Feasibility to implement</u></p> <ul style="list-style-type: none"> Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable. GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.). For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation. 	<p>Mixed / No</p> <p>The option of requiring hourly average emission factors and ‘deliverable’ geographic boundaries for the location-based method would have barriers to feasibility for some organizations and/or some regions of the world. The global level of participation in this location-based accounting approach relative to the current location-based method is limited. The necessary datasets to report location-based emissions under this approach are available in some markets, however they remain unavailable or challenging to obtain in many regions globally.</p> <p>Likewise, hourly electricity consumption data for a facility would be challenging to obtain for many organizations globally, however utilities and energy providers are increasingly making hourly consumption data available to customers, and increased demand for hourly emissions accounting would likely drive further availability of this information.</p> <p>One proposal to increase the feasibility of this approach includes allowing for load profiles to be used as proxies for estimating hourly electricity consumption where hourly data is not available. This would not address the feasibility of obtaining hourly emission factor data. Further examination of this option is needed.</p>

Appendix C – Detailed Decision-Making Criteria Analysis for Market-Based Method Technical Improvements

A. Option A: Maintain the Current Market-Based Method Accounting and Reporting Requirements

- Maintain current broad flexibility of the scope 2 market-based method emission factor hierarchy and contractual instrument Quality Criteria:
 - “Companies **should** use the most appropriate, accurate, precise, and highest quality emission factors available for each method.”¹²²
 - “Companies **shall** ensure that any contractual instruments used in the market-based method total meet the Scope 2 Quality Criteria specified in Table 7.1. If instruments do not meet the Criteria, then other data (listed in Table 6.3) **shall** be used as an alternative in the market-based method total. In this way, all companies required to report according to the market-based method will have some type of data option.”¹²³
- Criteria 4. Vintage: Maintain language “...[**shall**] be issued and redeemed as close as possible to the period of consumption to which the instrument is applied,”¹²⁴ which generally results in annual matching.
- Criteria 5. Market boundaries: Maintain language “...[**shall**] be sourced from the same market in which the reporting entity’s electricity-consuming operations are located and to which the instrument is applied”¹²⁵.

Option A: Maintain Current Market-Based Method Requirements	
Decision-Making Criteria	Evaluation
<p>Scientific integrity</p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>Mixed</p> <p>To evaluate whether the current scope 2 market-based inventory method, which allows for annual matching of electricity purchases to electricity consumption from broad market boundaries, ensures scientific integrity and validity, adheres to the best applicable science and evidence, and aligns with the latest climate science, its performance is assessed within the context of its stated purpose and use cases as outlined in section 4 above. In this context, it shows mixed alignment with the scientific integrity criteria. Note, this stated purpose and use cases will be considered during the revision process.</p> <p>1. Estimating emissions based on contractual relationships to electricity supply</p> <p>The current market-based method provides an estimation of the reporting organization’s indirect emissions associated with their purchased and consumed electricity. This estimation is determined by allocating a pro rata share of the total emissions from a power generation grid occurring within a defined time period according to the amount of electricity purchased and consumed by the organization using emission factors conveyed via EACs, direct contracts (for both low-carbon, renewable, or fossil fuel generation), supplier-specific emission rates, or other default emission factors. If the reporting organization does not have contractual information that meets the Scope 2 Quality Criteria, they must use the “residual mix” emission factor representing the untracked or unclaimed energy and emissions. Absent any of these options, organizations should use the grid-average emission rate. Under the current market-based method, the emissions reported in an organization’s scope 2 market-based inventory will increase or decrease as result of either corresponding increases or decreases in their activities (i.e., purchased and consumed electricity), changes in the emission intensity of the contractual supply procured by the reporting organization, or changes in the residual mix emission rate.</p> <p>A volume of recent research has increasingly highlighted that improving the accuracy of the market-based method's allocation of system emissions to all end users based on their contractual relationships may require closer consideration of both the time and location of energy generation and consumption.</p>

¹²² Scope 2 Guidance, section 6.5, p. 45

¹²³ Scope 2 Guidance, section 7.1, p. 60

¹²⁴ Scope 2 Guidance, Table 7.1 Scope 2 Quality Criteria, p. 60

¹²⁵ Scope 2 Guidance, Table 7.1 Scope 2 Quality Criteria, p. 60

Option A: Maintain Current Market-Based Method Requirements

Scientific integrity (cont.)

Research shows the current practice of matching contractual emission factors on an annual basis and using broad market boundaries may lead to a mismatch between an organization’s claim to using carbon-free electricity and the emissions from the relevant power grid at the time of consumption due to actual generation resource availability on the relevant grid and variability of their output over time. One study shows that without matching carbon-free energy (CFE) with electricity load on the same grid and on an hourly basis, a company reporting use of 100% CFE may reach only 75% CFE in California and 62% in the Pennsylvania–New Jersey–Maryland Power Pool (PJM).¹²⁶ Another analysis of the European GO market between 2016-2021 compared quarterly, monthly, daily, and hourly matching strategies and found that annual matching obscures renewable energy supply shortages in winter months. The study authors advocate for a shift to a quarterly (in the near term) and hourly (in the long term) matching requirement to rectify this.¹²⁷ These errors may not be universally applicable or may be negligible depending on the reporting company’s procurement strategy or the composition of generating resources supplying the grid.

Regarding spatial granularity, research has pointed to the importance of requiring emission factors used to reflect ‘deliverability’ (the notion that a specific power resource can physically deliver power to a reporting organization). Studies that looked at the geographic granularity of emission factors found that large, national boundaries are often insufficiently granular to account for variation in energy generating resources,¹²⁸ and that emission factors that don’t consider imports and exports can introduce significant errors in emission estimations. Research shows that the use of emission factors that reflect only emissions from electricity generation within a region may lead to over or underestimation of allocated emissions when compared to using an emission factor that considers energy imports/exports across grid boundaries. One study comparing generation-only emission factors against emission factors inclusive of imports/exports for 53 European and Asian countries found that the emission factors inclusive of imports/exports could be 823% greater or 58% less than generation-only emission factors.¹²⁹ Another study looking at sub-national electricity grids in China found differences of -58% to +44% between generation-only emission factors and emission factors adjusted to incorporate networked electricity trade between grids.¹³⁰ While these differences can be large, the extent of the difference is dependent on the average emission intensities and degree of imports and exports between the relevant grid networks.

As a result, while it may be useful for understanding an organization’s support for renewable energy using contractual instruments, matching contractual instruments over annual timeframes and across large geographic market boundaries may obfuscate the accuracy of the emission inventory, especially when more granular time intervals or more localized conditions would show different, more accurate results.

2. Influencing electricity suppliers and generation resource supply mix across the grid

A significant body of research has demonstrated that some current applications of the existing market-based method and Scope 2 Quality Criteria provide a limited or no ability to influence electricity suppliers and generation resource supply mix across the grid.

One area of research has examined whether consumer demand for EACs through green electricity products has led to increased renewable energy on the grid. A study looking at various impacts on renewable energy generating capacity in 30 European countries between 2009 and 2016 found that consumer commitment (defined as the share of tracked EACs) had no impact on renewable energy capacity.¹³¹ Another study, focusing on the residential green electricity market in France from 2014 to 2021 found that 90% of EACs (GOs) cancelled in France originated from hydro facilities, and 80% from facilities commissioned before 1990, suggesting that these programs have not supported the development of new renewable energy projects.¹³²

¹²⁶ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.

¹²⁷ Scholta et al., “Shedding Light on Green Claims.”

¹²⁸ de Chalendar et al., “Tracking Emissions,” 25497-25502.;

U.S. Environmental Protection Agency. “Summary Data.” Last modified October 22, 2024. Accessed October 22, 2024. <https://www.epa.gov/egrid/summary-data>

¹²⁹ Ji et al., “Greenhouse Gas Emission Factors,” 751-758.

¹³⁰ Qu et al., “CO2 emissions embodied in interprovincial electricity transmissions in China,” 10893-10902.

¹³¹ Hamburger, Ákos, “Is guarantee of origin really an effective energy policy tool in Europe? A critical approach,” 487-507.

¹³² Galzi, Pierre-Yves, “Do Green Electricity Consumers Contribute to the Increase in Electricity Generation Capacity from Renewable Energy Sources? Evidence from France,”: 113627.

Option A: Maintain Current Market-Based Method Requirements

Scientific integrity (cont.)

Another area of study has looked at several strategies for voluntary renewable energy procurement, to assess the extent to which these strategies result in system-wide reductions in emissions. One review compared eight modeling studies that evaluated annual matching, hourly matching, and ‘emission matching’ renewable energy procurement strategies and found that across the research studies, annual matching strategies did not lead to significant new renewable energy generation and emission reductions.¹³³ Several studies that looked at the impact of renewable energy procurement strategies in the context of U.S.¹³⁴ and European¹³⁵ hydrogen production incentives (for non-flexible constant production) found that strategies employing annual matching did not result in emission reductions. Another study looking at voluntary renewable energy purchasing in the western U.S. found that market actors matching renewable energy purchases on an annual basis had a minimal impact on long-run system-level CO₂ emissions.¹³⁶ The same study found that at high C&I participation rates (50% and 100%) matching only 88% of electricity consumption with carbon-free energy on an hourly basis in California reduced emissions more than a strategy that matched 100% of electricity with carbon-free energy on an annual basis, while at low C&I participation rates (10% and 25%) annual matching strategies had near zero impact on emission reductions.¹³⁷ Finally, one self-published report using capacity expansion modeling to evaluate the impacts of annual and hourly matching under different demand scenarios found that at low market participation rates (10% and 25% C&I participation) both annual matching and hourly matching resulted in no lasting additional clean energy generation, at the highest market participation rate (50% C&I participation) both annual and hourly matching did result in additional clean energy generation, though the additional capacity was higher in the hourly matching case.¹³⁸

Other work has attempted to contextualize the impact of the voluntary renewable energy market on clean energy deployment through interviews with market participants, demonstrating that a majority of these stakeholders agree there is value in the existing voluntary market.¹³⁹

3. Risk and opportunity assessment related to contractual relationships

Per the considerations discussed above related to “Estimating emissions based on contractual relationships to electricity supply” there is a limited *scientific basis* for use of the current market-based method, with annual matching of procured electricity from broad market boundaries, as a means to assess a reporter’s risks and opportunities related to emissions associated with their purchased and consumed electricity.

4. Enabling decision-making for consumers and companies

Based on the above research, the current market-based method, using annual matching of procured electricity from broad market boundaries, appears poorly suited to enable decision-making for consumers and companies based on an accurate allocation of grid emissions to the reporting organization. Furthermore, specific to the market-based method, new research on system-level impacts of renewable energy procurement decisions has implications for evaluating the decision-making capacity of the existing market-based method. Several studies that used capacity expansion modeling to evaluate how grids respond to various procurement strategies found that options based on annual matching across broad market boundaries do not result in system-wide changes to the grid.¹⁴⁰

¹³³ Langer et al., “Does the purchase of voluntary renewable energy certificates lead to emission reductions? A review of studies quantifying the impact.”

¹³⁴ Ricks, et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States,” 014025.

¹³⁵ Zeyen, et al., “Temporal Regulation of Renewable Supply for Electrolytic Hydrogen.”

¹³⁶ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.

¹³⁷ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.

¹³⁸ Olson, et al., “Consequential Impacts of Voluntary Clean Energy Procurement.”

¹³⁹ O’Shaughnessy, Eric. “A More Comprehensive View of the Impacts of Voluntary Demand for Renewable Energy.”

¹⁴⁰ Ricks, et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States,” 014025.;

Langer et al., “Does the purchase of voluntary renewable energy certificates lead to emission reductions? A review of studies quantifying the impact.”;

Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.;

Olson, et al., “Consequential Impacts of Voluntary Clean Energy Procurement.”

Option A: Maintain Current Market-Based Method Requirements

<p><u>GHG accounting and reporting principles</u></p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p><u>1. Relevance</u></p> <p>Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p>	<p>Mixed</p> <p>A GHG inventory based on the current market-based method using annual matching of emission factors matched with the organization’s purchased and consumed electricity has mixed alignment with the relevance principle and how it reflects the GHG emissions of the company and serves the decision-making needs of users. As discussed in the scientific integrity section, research has shown that the current method of allocating emissions using annual emission factors may not accurately reflect the GHG emissions associated with electricity purchased and consumed by the reporting organization due to daily and seasonal fluctuations in generation resources, as well as important differences in emissions intensity across geographies and even within electricity grids due to transmission constraints.</p> <p>The current market-based method using annual matching may provide some relevant information for external decision-making needs as a simple and easily understood methodology to provide information about the emissions attributable to an organization’s procurement choices. For example, the current method can communicate average emission intensities of various electricity providers in regions where consumers can choose providers or may support the development of renewable energy projects through mechanisms like power purchase agreements or virtual power purchase agreements. However, research has questioned whether all types of renewable energy purchases, using the existing market-based method, consistently support the development of new non-emitting projects on the grid.¹⁴¹ Therefore, the current method may not provide users with a relevant tool to reduce emissions.</p> <p>Further, the current market-based method has limitations in effectively supporting decision-making by internal users focused on reducing their inventory emissions or assessing performance. Research suggests that some actions incentivized by the current application of the Scope 2 Quality Criteria may not consistently lead to changes in the grid’s resource supply mix or result in system-wide emission reductions (see scientific integrity section).</p>
	<p><u>2. Completeness</u></p> <p>Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p>	<p>Yes</p> <p>The current market-based method can provide a means to ensure that all indirect GHG emission sources associated with activities within the reporting organization’s inventory boundary are accounted for (e.g., all activities, denominated in megawatt hours (MWhs), are accounted for in a complete scope 2 market-based method inventory).</p>
	<p><u>3. Consistency</u></p> <p>Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p>	<p>Mixed</p> <p>The current market-based method aligns partially with the principle of consistency by providing a framework that enables organizations to track GHG emissions over time using specific, contractually sourced emission factors tied to procurement choices. For the method to support consistent performance tracking, organizations would need to apply uniform market boundaries, EAC or emission factor vintages, residual mix data, and other parameters across reporting periods, as well as transparently document any changes. However, as the market-based method does not require these factors to be applied consistently, organizations may approach the methodology with varying levels of rigor, which can complicate consistent year-over-year tracking. Consequently, while the method allows for consistent inventory reporting, its alignment with the consistency principle is mixed.</p>

¹⁴¹ Langer et al., “Does the purchase of voluntary renewable energy certificates lead to emission reductions? A review of studies quantifying the impact.”

Option A: Maintain Current Market-Based Method Requirements

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p><u>4. Transparency</u></p> <p>Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p>	<p>Yes</p> <p>The current market-based method can provide a transparent and auditable means of estimating, over time, the pro rata shares of total system emissions based on electricity purchased and consumed within a defined geographic area and time period, using contractually owned emission factor data. To produce a clear audit trail, use of emission rates conveyed by ownership of contractual instrument requires proof of ownership to the certificates or supplier-specific rate data.</p> <p>It is possible the current methodology may benefit from updates to ensure more consistent application of market boundaries, emission factor vintages, residual mix data, and other parameters.</p>
	<p><u>5. Accuracy</u></p> <p>Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p>	<p>Mixed</p> <p>The current market-based method can provide an approach to allocate the pro rata shares of total system emissions based on purchased and consumed electricity within a broadly defined geographic area and similarly broad time period using contractually owned emission factor data.</p> <p>As it relates to the accuracy of calculating scope 2 emissions, the Corporate Standard and Scope 2 Guidance states that, <i>“reductions in indirect emissions (changes in scope 2 or 3 emissions over time) may not always capture the actual emissions reduction accurately. This is because there is not always a direct cause effect relationship between the single activity of the reporting company (purchasing and consuming energy) and the resulting GHG emissions on the grid. Generally, as long as the accounting of indirect emissions over time recognizes activities that in aggregate change global emissions, any such concerns over accuracy should not inhibit companies from reporting their indirect emissions.”</i>¹⁴²</p> <p>Therefore, to evaluate whether an accounting approach is sufficiently accurate requires an assessment of how actions incentivized by the approach change emissions in aggregate.</p> <p>As discussed in the scientific integrity section, the voluntary market activities incentivized by the current market-based method may not lead to system-wide reductions in emissions, nor new non-emitting generation resources. Further, allocation of emissions using annual emission factors (with annual matching of EACs), and broad geographic boundaries may obfuscate the accuracy of the emissions inventory, especially when accounting approaches that use more granular time intervals or more localized conditions would show different results.</p> <p>Additionally, the use of annual matching of contractual instruments to electricity consumption introduces significant uncertainties impacting the ability of users to make decisions related to facility siting, increases or decreases in electricity consumption, timing of demand shifts, and deployment of new technologies with reasonable confidence as to the integrity of the reported emission information. See criteria sections on scientific integrity and supporting decision-making that drives ambitious global climate action for more information.</p>

¹⁴² Scope 2 Guidance, section 4.3, p. 28; Corporate Standard, p. 59

Option A: Maintain Current Market-Based Method Requirements

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p>6. Comparability (not a current principle; subject to discussion in the ISB and TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed</p> <p>Generally, market-based to market-based comparisons across companies are possible, however comparability depends on the consistent application of key implementation details, such as standardized activity data, emission factor sources, market boundaries, data quality, and vintage criteria. Inconsistent use of these factors could undermine the ability to accurately compare emissions across reporting organizations and may lead to potential misinterpretations of environmental performance. As the current market-based method allows for broad use of temporal and geographic boundaries for contractual instruments, data choices may be more varied and therefore less comparable than if more granular requirements for data were consistency applied.</p>
<p><u>Support decision making that drives ambitious global climate action</u></p> <ul style="list-style-type: none"> Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 		<p>Mixed</p> <p>The current market-based method using annual activity data with annual matching of contractually owned emission factors from broad market boundaries may incentivize organizations to:</p> <ul style="list-style-type: none"> Make facility and operations-siting decisions based on the ability to make choices about energy supply.¹⁴³ Reduce energy consumption through energy efficiency measures and behavioral decisions.¹⁴⁴ Reduce electricity demand to minimize additional costs associated with purchasing contractual instruments at a premium above standard electricity costs. However, the market-based method runs the risk of providing less visibility on energy demand reduction if the price of this premium (and therefore the price of achieving zero emissions) is low.¹⁴⁵ Support low-carbon technologies directly and indirectly through the following actions:¹⁴⁶ <ul style="list-style-type: none"> Create on-site low-carbon energy projects Establish contracts, that include certificates, such as PPAs directly with low-carbon generators Negotiate with their supplier or utility to supply low-carbon energy to the company Switch to low-carbon electricity supplier or electricity project, where available Purchase certificates from low-carbon energy generation <p>Some of these actions, including seeking some forms of low-carbon electricity supply, siting facilities in locations based on the availability of clean energy supply, and decisions that reduce overall electricity purchases and consumption in aggregate, may contribute to ambitious climate actions. However, as discussed in the sections scientific integrity, accuracy, and relevance, some electricity supply actions incentivized by the current market-based method may not contribute to decarbonization of the electricity sector, and therefore may not support ambitious global climate action.</p>

¹⁴³ Scope 2 Guidance, section 4.3, p. 28

¹⁴⁴ Scope 2 Guidance, section 4.3, p.29

¹⁴⁵ Scope 2 Guidance, section 4.3, p. 30

¹⁴⁶ Scope 2 Guidance, section 4.3, p. 30

Option A: Maintain Current Market-Based Method Requirements

Support programs based on GHG Protocol and uses of GHG data

- Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality.
- Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information.

Mixed

A GHG inventory based on the current market-based method using annual matching of contractually owned emission factors to purchased and consumed electricity has mixed ability to support programs based on GHG Protocol and the various uses of GHG data.

Though the Scope 2 Guidance provides reporting options for disclosing information about purchases that go above and beyond the minimum criteria, the current Scope 2 Quality Criteria used for the market-based method are intended to be *“policy-neutral and represent the minimum features necessary for instruments to function together as a complete market-based allocation system for consumers.”*¹⁴⁷

The adoption of the current market-based method within regulatory climate disclosure rules and voluntary target setting programs demonstrates its broad interoperability with programs and policy worldwide. The current market-based method is used by several key programs, including:

- A reporting requirement within European Sustainability Reporting Standards (ESRS) mandated by the European Union Corporate Sustainability Reporting Directive (CSRD)
- Optional reporting information (if material) within IFRS S2 Climate-related Disclosures issued by the International Sustainability Standards Board (ISSB)
- An option for reporting scope 2 emissions within the Enhancement and Standardization of Climate-Related Disclosures for Investors Rule adopted by the United States Securities and Exchange Commission (U.S. SEC)
- A method for setting a scope 2 emission reduction target under the Corporate Net-Zero Standard within the Science Based Targets Initiative (SBTi)
- An interoperable method for renewable energy use target-setting and reporting of renewable energy use claims under RE100
- A method for scope 2 emissions disclosure under the Global Reporting Initiative (GRI) and Carbon Disclosure Project (CDP)

The effectiveness of the current market-based method in generating data for general users is mixed and largely depends on the intended use of the data. While the market-based method may provide an allocation of system-wide emissions based on total consumption using a minimum set of features necessary for instruments to function as a complete market-based allocation system, the use of annual data or broad geographic boundaries, and other considerations discussed in the scientific integrity criterion may limit the data’s usefulness for assessing a reporter’s grid-related risks and opportunities or for informing decision-making.

¹⁴⁷ Scope 2 Guidance, section 1.5.2, p. 8

Option A: Maintain Current Market-Based Method Requirements

Feasibility to implement

- Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable.
- GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.).
- For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation.

Mixed / yes

The current market-based method using annual activity data with annual matching of contractually owned emission factors has been widely implemented around the world, and by organizations at varying levels of maturity. However, in markets where data access is limited and differentiated clean energy supply options are unavailable, a market-based method cannot be reported.

The current emission factor hierarchy allows reporters to use a grid-average emission factor where they do not have access to a more precise emission factor. The next most precise emission factor, a residual mix, is not available in many regions globally, and without it, accurately apportioned electricity emission data under the market-based method is not realistic for all regions. Supporting the development of these datasets, and datasets that are more frequently updated, utilize consistent measurement methods, and are publicly available (free to access) would further facilitate feasibility of the market-based method.

B. Option B: Time and Location Matching

- Change Scope 2 Quality Criteria to require more temporally and spatially granular matching of emission factors derived from contractual instruments to electricity consumption, such as:
 - Criteria 4. Vintage: Change language to require hourly matching, e.g.:
 - ‘...**shall** be issued and redeemed for the same hour of consumption to which the instrument is applied’
 - Criteria 5. Market boundaries: Change language to require matching from ‘deliverable’ market boundaries (note: see discussion of ‘deliverability’ in the location-based method technical improvements section), e.g.:
 - ‘... **shall** be sourced from physically deliverable market boundaries in which the electricity consuming operations are located and to which the instrument is applied.’

Option B: Time and Location Matching	
Decision-Making Criteria	Evaluation
<p>Scientific integrity</p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>Mixed / Yes</p> <p>To evaluate if this proposed scope 2 market-based inventory method using more granular accounting requirements ensures sufficient scientific integrity and validity by adhering to the best applicable science and evidence, its performance is assessed within the context of its stated purpose and use cases as outlined above. In this context, it shows mixed to favorable alignment with the scientific integrity criteria. Note, this stated purpose and use case will be considered during the revision process.</p> <p>1. Estimating emissions based on contractual relationships to electricity supply</p> <p>The proposed market-based method provides an estimation of the reporting organization’s indirect emissions associated with their purchased and consumed electricity. This estimation is done similar to the existing market-based method, but instead requires the use of a more defined geographic area (‘deliverable’ market boundary inclusive of imported/exported energy) and time matching (hourly) for both activity data and emission factors. For reference, within research this approach has been referred to as “24/7” or “24/7 matching.”</p> <p>Under the time- and location-matching approach, the emissions reported in an organization’s scope 2 market-based inventory will increase or decrease as result of either corresponding increases or decreases in their activities (i.e., purchased and consumed electricity), changes in the emission intensity of hourly contractual supply procured by the reporting organization, or changes in the emission intensity of the residual mix of the grid region serving the reporting organization at the hourly interval of consumption.</p> <p>As described in detail in the scientific integrity section of Option A, recent research has demonstrated that closer consideration of time and location in scope 2 emissions accounting may result in better estimates of emissions based on contractual relationships. Studies that looked at the time and location of generation and consumption found that hourly matching generation from deliverable resources better approximates the portfolio of carbon-free resources serving an organization,¹⁴⁸ and that hourly matching takes seasonal and daily fluctuations in renewable energy supply into consideration.¹⁴⁹ As it relates to the use of hourly emission factors, one study found that other time intervals (like quarterly, monthly, or daily) represent an improvement over annual emission factors as they can capture seasonal fluctuations,¹⁵⁰ while other studies employed sub-hourly emission factors to enable even more granular analysis.¹⁵¹ Further discussion on the appropriate level of temporal and deliverable granularity is explored in other sections of this analysis and will be a topic for TWG consideration.</p>

¹⁴⁸ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400

¹⁴⁹ Scholta et al., “Shedding Light on Green Claims.”

¹⁵⁰ Scholta et al., “Shedding Light on Green Claims.”

¹⁵¹ Khan, Imran. “Importance of GHG emissions assessment in the electricity grid expansion towards a low-carbon future: A time-varying carbon intensity approach.” *Journal of Cleaner Production* 196 (2018): 1587-1599.

Option B: Time and Location Matching

Studies that looked at the geographic granularity of emission factors found that large, national boundaries are insufficiently granular to account for variation in energy generating resources¹⁵² and that emission factors that don't consider imports and exports (i.e., "generation-only" factors) can introduce significant errors in emissions estimations.¹⁵³ Furthermore, a recent study analyzing intra-regional transmission in the Electric Reliability Council of Texas (ERCOT) and PJM found significant differences in energy intensities within grid regions due to transmission constraints.¹⁵⁴ This research may indicate that even a 'deliverable' requirement may not be sufficiently granular for regions where transmission infrastructure can create significant bottlenecks.

In consideration of this research, the proposed time- and location-matched approach may improve the estimation of emissions based on contractual relationships to electricity supply, compared to the current market-based method, which enables annual matching from broad geographic regions.

2. Influencing electricity suppliers and generation resource supply mix across the grid

Studies that analyzed carbon-free procurement by commercial and industrial (C&I) participants in a voluntary market context¹⁵⁵ as well as in the context of hydrogen generation incentives¹⁵⁶ found that hourly matching strategies performed far better than annual matching strategies and other strategies sometimes referred to as 'carbon matching' or 'emissions matching' strategies. However, all the studies mentioned here included an additional constraint that procured renewable energy come from 'new' sources. Several definitions of 'new' were proposed in research, including resources that had not been built prior to the modeling period,¹⁵⁷ resources built within a five-year window,¹⁵⁸ or resources that would not otherwise be operating.¹⁵⁹

The extent to which a time and location matching requirement alone, without further constraints on resource eligibility such as a new resource requirement, can lead to a reporting organization's scope 2 inventory being aligned with grid-scale emission outcomes, is an important area of additional consideration. One research paper which modeled the consequential emissions impact of 24/7 matching for 1GW load in California without any restrictions on resource eligibility found no difference in emissions between the test case and the baseline case, indicating that the time and location matching requirement alone had no impact on the generation supply mix.¹⁶⁰ In general, the supply of carbon-free energy from existing firm resources like hydro, nuclear, and geothermal is the main factor in determining whether a time and location matching requirement requires additional constraints to influence the mix of generation resources on the grid.

With regard to the combination of temporal and geographic granularity requirements, some studies analyzed the emissions impact of relaxing either the temporal or geographic granularity requirement. One study found that requiring hourly matching but allowing for looser geographic matching (allowing generation to be sourced from a different grid zone) resulted in significantly higher consequential emissions

Scientific integrity (cont.)

¹⁵² de Chalendar et al., "Tracking Emissions," 25497-25502;

U.S. Environmental Protection Agency. "Summary Data." Last modified October 22, 2024. Accessed October 22, 2024. <https://www.epa.gov/egrid/summary-data>

¹⁵³ Ji et al., "Greenhouse Gas Emission Factors," 751-758;

Qu et al., "CO2 emissions embodied in interprovincial electricity transmissions in China," 10893-10902;

¹⁵⁴ Sofia, Sarah and Dvorkin, Yury. "Carbon Impact of Intra-Regional Transmission Congestion." *Resurety Inc., Johns Hopkins University*. (2024). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4972564

¹⁵⁵ Xu, et al. "System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies", 374-400;

Olson et al., "Consequential Impacts of Voluntary Clean Energy Procurement," July 2024;

¹⁵⁶ Ricks et al., "Minimizing Emissions from Grid-Based Hydrogen Production in the United States";

Haley, Ben and Jeremy Hargreaves. "45V Hydrogen Production Tax Credits – Three-Pillars Accounting Impact Analysis.";

¹⁵⁷ Xu, et al. "System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies", 374-400.

¹⁵⁸ Olson et al., "Consequential Impacts of Voluntary Clean Energy Procurement," July 2024;

¹⁵⁹ Zeyen, Elisabeth, Iegor Riepin, and Tom Brown. "Temporal Regulation of Renewable Supply for Electrolytic Hydrogen."

¹⁶⁰ Ricks et al., "Minimizing Emissions from Grid-Based Hydrogen Production in the United States.";

Option B: Time and Location Matching

<p>Scientific integrity (cont.)</p>	<p>than a strategy that required both, due to transmission constraints between grid zones.¹⁶¹ The same study found that relaxing the temporal requirement (weekly rather than hourly matching) while keeping the geographic matching requirement also resulted in significantly higher consequential emissions than a strategy that required both.¹⁶²</p> <p>4. Risk and opportunity assessment related to contractual relationships</p> <p>Per the considerations discussed above related to “Estimating emissions based on contractual relationships to electricity supply” there is a mixed <i>scientific basis</i> for use of the proposed market-based method with time and location matching of procured electricity to assess a reporter’s risks and opportunities related to emissions associated with their purchased and consumed electricity. Distinct from Option A, Option B may better align a reporter’s market-based purchasing activities with real-world risks and opportunities, such as energy resource availability, prices, climate change events, and economic factors.</p> <p>5. Enabling decision-making for consumers and companies</p> <p>As discussed above and in the location-based method technical improvements section, increasing the granularity of emission factors and activity data may result in an emissions inventory accounting framework that is better suited to informing decision-making. Furthermore, specific to the market-based method, new research on system-level impacts of renewable energy procurement decisions may show that the proposed option can better align the emission inventory of the reporting organization with the emissions of the grid they purchase and consume electricity from. However, as discussed previously in this section, the extent to which a time and location matching requirement alone can influence the generation resource mix requires further evaluation.</p>	
<p>GHG accounting and reporting principles</p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p>1. Relevance</p> <p>Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p>	<p>Mixed / Yes</p> <p>A GHG inventory based on the proposed market-based method using time and location matching of contractually owned emission factors to electricity consumption has mixed to favorable alignment with the relevance principle and how it reflects the GHG emissions of the company and serves the decision-making needs of users. As discussed in the scientific integrity section, research has shown that allocating emissions using more granular temporal and geographic emission factors may more accurately reflect the GHG emissions associated with electricity purchased and consumed by the reporting organization due to daily and seasonal fluctuations in generation resources, as well as important differences in emissions intensity across geographies and even within electricity grids due to transmission constraints.</p> <p>The proposed method may provide more relevant information for internal decision-making needs as it can encourage renewable energy procurement decisions that more closely align with the portfolio of energy resources needed to serve a company’s electricity demand in the precise locations where that energy generation is needed. For example, the proposed method can incentivize shifts toward procurement of more solar power during daylight hours, wind power during high production periods, and technologies like energy storage that can make better use of intermittent renewable energy resources. However, research has questioned whether a time and location matching requirement alone, without constraints such as project newness or additionality, can drive grid-wide emission reductions and support the development of new non-emitting projects on the grid, and therefore the proposed method may not provide users with all relevant tools necessary to reduce system-wide emissions.¹⁶³</p>

¹⁶¹ Ricks et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States.”

¹⁶² Ricks et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States.”

¹⁶³ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies”, 374–400.

Option B: Time and Location Matching		
<u>GHG accounting and reporting principles (cont.)</u>	<p><u>2. Completeness</u></p> <p>Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p>	<p>Yes</p> <p>A time- and location-matched approach can provide a means to ensure that all indirect GHG emission sources associated with activities within the reporting organization’s inventory boundary are accounted for (e.g., all activities, denominated in megawatt hours (MWhs), are accounted for in a complete scope 2 market-based method inventory).</p>
	<p><u>3. Consistency</u></p> <p>Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p>	<p>Yes</p> <p>The proposed time- and location-matched approach offers improved alignment with the principle of consistency by requiring organizations to track GHG emissions over time using contractually sourced emission factors that are matched hourly and sourced from renewable energy on the same grid as the reporting organization’s consumption. This approach strengthens alignment with the principle of consistency by reducing variation in reporting rigor and supporting a more consistent inventory reporting methodology.</p> <p>This requirement to match energy consumption with specific EACs on an hourly basis within the same grid enhances the consistency of performance tracking, as organizations must apply more uniform market boundaries, EAC vintages, residual mix data, and other parameters across reporting periods. By increasing the uniform application of these factors, the time- and location-matched approach provides a clearer structure for year-over-year tracking, though it still requires transparent documentation of any relevant changes over time.</p>
	<p><u>4. Transparency</u></p> <p>Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p>	<p>Yes</p> <p>The market-based method can provide a transparent and auditable means to estimating over time the pro rata shares of total system emissions based on electricity purchased and consumed within a defined geographic area and time period using contractually owned emission factor data. To produce a clear audit trail, use of emission rates conveyed by ownership of contractual instrument requires proof of ownership to the certificates or supplier-specific rate data. A time- and location-matched approach to the market-based method may ensure more consistent application of market boundaries, emission factor vintages, residual mix data, and other parameters.</p>

Option B: Time and Location Matching

<p>GHG accounting and reporting principles (cont.)</p>	<p>5. Accuracy</p> <p>Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p>	<p>Mixed / Yes</p> <p>The proposed time- and location-matched market-based method can provide a potentially more accurate approach to allocate the pro rata shares of total system emissions based on purchased and consumed electricity than the status quo market-based method.</p> <p>As it relates to the accuracy of calculating scope 2 emissions, the Corporate Standard and Scope 2 Guidance states that, <i>“reductions in indirect emissions (changes in scope 2 or 3 emissions over time) may not always capture the actual emissions reduction accurately. This is because there is not always a direct cause effect relationship between the single activity of the reporting company (purchasing and consuming energy) and the resulting GHG emissions on the grid. Generally, as long as the accounting of indirect emissions over time recognizes activities that in aggregate change global emissions, any such concerns over accuracy should not inhibit companies from reporting their indirect emissions.”</i>¹⁶⁴</p> <p>Therefore, to evaluate whether an accounting approach is sufficiently accurate requires an assessment of how actions incentivized by the approach change emissions in aggregate.</p> <p>As discussed in the scientific integrity section, the voluntary market activities incentivized by the proposed market-based method may lead to both system-wide reductions in emissions and new non-emitting energy resources, however, some research has pointed to a ‘newness’ requirement as an additional step needed to ensure this outcome. Further, research has shown that allocating emissions using hourly emission factors and deliverable geographic boundaries may increase the accuracy of the emissions inventory, due to hourly and seasonal fluctuations in generation resources and significant inter- and intra-grid differences in emissions intensity due to transmission constraints.</p> <p>Additionally, time and location matching may better support users in making decisions related to facility siting, increases or decreases in electricity consumption, timing of demand shifts, and deployment of new technologies with reasonable confidence as to the integrity of the reported emission information. See sections on scientific integrity and supporting decision-making that drives ambitious global climate action for more information.</p>
	<p>6. Comparability (not a current principle; subject to discussion in the ISB and TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed / Yes</p> <p>A time- and location-matched approach which requires the use of more granular activity data and emission factors would standardize data choices more than under the current market-based method and therefore improve comparability across organizations. However, different levels of data precision applied by different organizations may still limit the ability to compare market-based emissions across organizations, as is the case today.</p>

¹⁶⁴ Scope 2 Guidance, section 4.3, p. 28; Corporate Standard, p. 59

Option B: Time and Location Matching

Support decision making that drives ambitious global climate action

- Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals.
- GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals.
- Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals.

Mixed / Yes

The Scope 2 Guidance currently states that the market-based method may incentivize organizations to:

- Make facility and operations-siting decisions based on the ability to make choices about energy supply.¹⁶⁵
- Reduce energy consumption through energy efficiency measures and behavioral decisions.¹⁶⁶
- Reduce electricity demand to minimize additional costs associated with purchasing contractual instruments at a premium above standard electricity costs. However, the market-based method runs the risk of providing less visibility on energy demand reduction if the price of this premium (and therefore the price of achieving zero emissions) is low.¹⁶⁷
- Support low-carbon technologies directly and indirectly through the following actions:¹⁶⁸
 - Create on-site low-carbon energy projects
 - Establish contracts, that include certificates, such as PPAs directly with low-carbon generators
 - Negotiate with their supplier or utility to supply low-carbon energy to the company
 - Switch to low-carbon electricity supplier or electricity project, where available
 - Purchase certificates from low-carbon energy generation

The time- and location-matched market-based method requires hourly matching of energy use with EACs sourced from the same grid, providing a framework that encourages organizations to align their energy procurement with real-time renewable availability and geographical grid proximity. This approach can potentially drive more relevant decision-making in the context of climate goals by encouraging investments in renewables that meet location- and time-specific demand, rather than relying on annualized and geographically broad EAC purchases, which may have limited impact on actual grid decarbonization.

However, as noted in the sections on scientific integrity, accuracy, and relevance, time- and location-matching may not necessarily drive grid-level emission reductions or development of new non-emitting resources. Research suggests that while more precise temporal and geographic matching can improve the accuracy of emissions allocation, achieving genuine reductions requires not only accurate allocation but also reductions in overall system emissions to ensure alignment with global climate goals.

¹⁶⁵ Scope 2 Guidance, section 4.3, p. 28

¹⁶⁶ Scope 2 Guidance, section 4.3, p.29

¹⁶⁷ Scope 2 Guidance, section 4.3, p. 30

¹⁶⁸ Scope 2 Guidance, section 4.3, p. 30

Option B: Time and Location Matching

<p><u>Support programs based on GHG Protocol and uses of GHG data</u></p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>Mixed</p> <p>A time- and location-matched approach to the market-based method could presumably be used to meet purposes related to climate-related disclosure, target-setting, and performance tracking. Given that the time- and location-matched approach is generally a more precise version of today’s market-based method, the approach likely would not necessarily create issues with interoperability across policies and programs that have instituted use of the market-based method.</p> <p>As evidenced in the scientific integrity section, research on the system-level impacts of renewable energy procurement decisions may show that time and location matching can better align the emission inventory of the reporting organization with the emissions of the grid they purchase and consume electricity from. However, the extent to which a time and location matching requirement alone without constraints on resource eligibility (i.e., a new resource requirement) can influence the generation resource mix requires further evaluation.</p> <p>The feasibility of implementing this option may present challenges for interoperability with policies and programs that currently use the market-based method, such as legal disclosure requirements under IFRS S2 and ESRS E1. Given this sensitivity, further evaluation of how this proposal aligns with these criteria may be necessary.</p>
<p><u>Feasibility to implement</u></p> <ul style="list-style-type: none"> Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable. GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.). For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation. 	<p>Mixed</p> <p>Some organizations have begun calculating market-based emissions and transacting using time and location matching approaches.¹⁶⁹ These organizations have thus far utilized two approaches to do so, the first relies on turnkey time- and location-matched products from power suppliers, and the second requires managing a portfolio of electricity supply agreements to reach high-levels of time and location matching from non-emitting resources.¹⁷⁰</p> <p>To enable a time- and location-matched approach various data are needed, including hourly electricity consumption data, timestamped EACs, and an hourly residual mix factor. Without these, accurately apportioned electricity emission data under this approach is not realistic for all organizations across all geographic regions of the world. However, various initiatives are already underway to improve access to granular data.</p> <p>Aside from an increased volume of data when moving from annual to hourly matching under a time- and location-matched approach, integrating “deliverability” into market boundary requirements presents additional challenges with feasibility. Research shows that no single market boundary definition may work well in all contexts globally¹⁷¹.</p> <p>Given these challenges, time and location matching requirement may not be possible for organizations across a range of sizes, sophistication, and across various geographies. Some tools and resources are already being developed to support the adoption of time and location matching, including timestamped EACs and hourly residual mix emission factors, but further development is required.</p> <p>One proposal to increase the feasibility of this approach includes allowing for load profiles to be used as proxies for estimating hourly electricity consumption where hourly data is not available.¹⁷² This would not address the feasibility of obtaining hourly emission factor data. Further examination of this option is needed.</p>

¹⁶⁹ See power purchase agreements by [Google](#), [Microsoft](#), [Iron Mountain](#), the [US Federal Government](#).

¹⁷⁰ EPRI. “24/7 Carbon-Free Energy: Matching Carbon-Free Energy Procurement to Hourly Electric Load,” 2022. <https://www.epri.com/research/products/000000003002025290>.

¹⁷¹ Miller, Gregory, Gailin Pease, Wenbo Shi, Long Lam, Kathleen Spees, Jadon Grove, and Ivy Yang. “Where Matters: Integrating Deliverability into Voluntary Clean Energy Market Boundaries.” Singularity Energy and Brattle Group, August 2023. <https://singularity.energy/boundaries-report>.

¹⁷² W. Ricks and J. D. Jenkins, *The Influence of Demand-Side Data Granularity on the Efficacy of 24/7 Carbon-Free Electricity Procurement* (ZERO Lab, Princeton University, 2024).

C. Option C: Three Pillars (Time and Location Matching Plus Resource Newness)

- Change Scope 2 Quality Criteria to require time and location matching plus introduce a requirement for resource newness (facility age)
 - Criteria 4 & 5, same as in Option B
 - New Criteria: Resource newness or facility age, e.g.:
 - ‘... shall be sourced from resources with a commercial operation date or recommissioning date within [a specified number of] years from the reporting period to which the instrument is applied.’

Option C: Three Pillars	
Decision-Making Criteria	Evaluation
<p><u>Scientific integrity</u></p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>Mixed / Yes</p> <p>To evaluate if this proposed scope 2 market-based inventory method using more granular accounting requirements and an additional ‘newness’ requirement ensures sufficient scientific integrity and validity by adhering to the best applicable science and evidence, its performance is assessed within the context of its stated purpose and use cases as outlined above. In this context, it shows favorable alignment with the scientific integrity criteria. Note, this stated purpose and use case will be considered during the revision process.</p> <p style="text-align: center;">1. Estimating emissions based on contractual relationships to electricity supply</p> <p>The proposed three pillars market-based method provides an estimation of the reporting organization’s indirect emissions associated with their purchased and consumed electricity. This estimation is done similar to the existing market-based method, but instead requires the use of a more defined geographic area (‘deliverable’ market boundary inclusive of imported/exported energy) and time matching (hourly) for both activity data and emission factors. In addition, any EACs, contracted renewable energy, green tariffs, etc. used for this approach must be sourced from ‘new’ projects. A precise definition of ‘new’ remains necessary and requires closer consideration with the working group. For simplicity, this approach will be referred to as “three pillars” throughout the rest of this table, and refers to the time, location, and vintage of eligible resources.</p> <p>Under the three pillars approach, the emissions reported in an organization’s scope 2 market-based inventory will increase or decrease as result of either corresponding increases or decreases in their activities (i.e., purchased and consumed electricity), changes in the emission intensity of hourly contractual supply procured by the reporting organization, or changes in the emission intensity of the residual mix of the grid region serving the reporting organization at the hourly interval of consumption.</p> <p>As described in detail in the scientific integrity section of Options A and B, recent research has demonstrated that closer consideration of time and location in scope 2 emissions accounting may result in better estimates of emissions based on contractual relationships. Please see information provided in Option B on this topic. As described further below, the additional ‘newness’ requirement may further improve the estimation of emissions based on contractual relationships to electricity supply sources.</p> <p style="text-align: center;">2. Influencing electricity suppliers and generation resource supply mix across the grid</p> <p>As discussed in detail in Option B, studies that analyzed carbon-free procurement by C&I participants in a voluntary market context¹⁷³ as well as in the context of hydrogen generation incentives¹⁷⁴ found that hourly matching strategies performed better than annual matching strategies and other strategies sometimes referred to as ‘carbon matching’ or ‘emissions matching’ strategies. In addition, the third pillar of this approach (resource newness) was modeled at some level by most researchers.</p>

¹⁷³ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies”, 374–400;
 Olson et al., “Consequential Impacts of Voluntary Clean Energy Procurement,” July 2024
¹⁷⁴ Ricks et al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States.”;
 Haley, Ben and Jeremy Hargreaves. “45V Hydrogen Production Tax Credits – Three-Pillars Accounting Impact Analysis.”;
 Zeyen, Elisabeth, Iegor Riepin, and Tom Brown. “Temporal Regulation of Renewable Supply for Electrolytic Hydrogen.”

Option C: Three Pillars

One study found that under various future technology scenarios and under both a 10% and 25% C&I participation rate, annual matching had zero or negligible impact on system-level emissions outcomes, while a three pillars approach drove significant reductions.¹⁷⁵ The same study found that in California under a 25% C&I participation scenario, a three pillars approach that matched 98% and 100% of load reduced system-level emissions more than they would be reduced by removing the load from the system entirely.¹⁷⁶ One study analyzing the impact of a three pillars strategy in Germany found that with only 10% of C&I customers participating in a 100% matching scheme, system-wide electricity emissions were reduced by 14 MtCO₂ from a baseline of 118.8 MtCO₂ annually.¹⁷⁷ A review looking at results of several techno-economic research papers in the U.S. and EU for both C&I and hydrogen scenarios similarly found that strategies based on three pillars methods substantially reduced emissions at all locations, while annual and emissions matching strategies had minimal impact on additional renewable energy generation or emission reductions.¹⁷⁸

Researchers collectively identified several technological and economic factors under which the findings of their work may differ, these include:

- Regions with extremely high supply of clean firm power
- Future scenarios in which C&I demand increases significantly
- Policies such as aggressive renewable portfolio standards or lucrative economic incentives for renewable energy generation
- Scenarios where significant transmission or permitting delays impact project development

3. Risk and opportunity assessment related to contractual relationships

Per the considerations discussed above related to “Estimating emissions based on contractual relationships to electricity supply” there is a mixed to favorable *scientific basis* for use of the proposed market-based method with three pillars matching of procured electricity to assess a reporter’s risks and opportunities related to emissions associated with their purchased and consumed electricity. Distinct from Option A, and potentially more so than Option B, this approach may better align a reporter’s market-based purchasing activities with real-world risks and opportunities, such as energy resource availability, prices, climate change events, and economic factors.

4. Enabling decision-making for consumers and companies

As discussed above and in the location-based method technical improvements section, increasing the granularity of emission factors and activity data may result in an emissions accounting framework that is better suited to informing decision-making. Furthermore, specific to the market-based method, new research on system-level impacts of renewable energy procurement decisions may show that the proposed option can incentivize actions that have real world decarbonization effects. Furthermore, distinct from Option B, this proposed option may further align with the scientific integrity criteria by introducing an additionality heuristic criterion (i.e., resource newness) on eligible resources that helps ensure actions taken under this framework result in real grid decarbonization.

Scientific integrity (cont.)

¹⁷⁵ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.

¹⁷⁶ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies.” 374–400.

¹⁷⁷ Riepin, Iegor, and Tom Brown. “On the Means, Costs, and System-Level Impacts of 24/7 Carbon-Free Energy Procurement.” *Energy Strategy Reviews* 54 (2024): 101488. <https://doi.org/10.1016/j.esr.2024.101488>.

¹⁷⁸ Langer et al., “Does the purchase of voluntary renewable energy certificates lead to emission reductions? A review of studies quantifying the impact.”

Option C: Three Pillars

<p><u>GHG accounting and reporting principles</u></p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p><u>1. Relevance</u></p> <p>Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p>	<p>Yes</p> <p>A GHG inventory based on the proposed three pillars market-based method that introduces a time and location matching requirement alongside a ‘newness’ requirement in the Scope 2 Quality Criteria has favorable alignment with the relevance principle and how it reflects the GHG emissions of the company and serves the decision-making needs of users. As discussed in the scientific integrity section, research has shown that the proposed method of allocating emissions improves upon the current market-based method by more accurately reflecting the GHG emissions associated with electricity purchased and consumed by the reporting organization due to daily and seasonal fluctuations in generation resources, as well as important differences in emissions intensity across geographies and even within electricity grids due to transmission constraints.</p> <p>The proposed method may also provide more relevant GHG inventory information for external decision-making needs as it can encourage renewable energy procurement decisions that more closely align with the portfolio of energy resources needed to serve a company’s electricity demand in the precise locations where that energy generation is needed. For example, the proposed method can incentivize shifts toward procurement of more solar power during daylight hours, wind power during high production periods, and technologies like energy storage that can make better use of intermittent renewable energy resources. Furthermore, research has shown that the proposed approach can support the development of new non-emitting projects on the grid, and therefore the proposed method may provide users with a relevant tool to reduce system-wide emissions.¹⁷⁹</p>
	<p><u>2. Completeness</u></p> <p>Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p>	<p>Mixed</p> <p>More information is needed to clarify how this approach would account for all activities, specifically how emission factors would be applied to purchased and consumed electricity that does not meet the criteria of ‘newness’. Stakeholder feedback proposed use of supplier-specific emission factors, or a residual mix factor based on hourly matched and deliverable grid resources as solutions to ensure comprehensive coverage for electricity not sourced from three-pillar-compliant resources. In principle, this approach could ensure all purchased and consumed electricity is accounted for within the inventory boundary, but the specific methods and applications for supplier-specific, residual, or average grid factors for non-specified procurements require further detail. Clarity on these factors would help determine if the three pillars method aligns with the principle of completeness, similar to the coverage achieved by the current market-based emission factor hierarchy.</p>
	<p><u>3. Consistency</u></p> <p>Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p>	<p>Yes</p> <p>The proposed three pillars option shows alignment with the GHG Protocol principle of consistency by requiring that organizations track GHG emissions over time using contractually sourced emission factors based on three core criteria: hourly time matching, geographic alignment with the same grid, and sourcing from ‘new’ renewable energy projects. This structured approach reinforces consistency by minimizing variability in reporting rigor, promoting a more reliable year-over-year inventory reporting methodology.</p> <p>The three pillars option’s requirements to match energy consumption with renewable sources on an hourly basis and within a defined, deliverable grid boundary contribute to more standardized performance tracking. By necessitating uniform application of market boundaries, EAC vintages, and other critical parameters, the three pillars approach facilitates meaningful, consistent tracking over time, although transparent documentation of any relevant changes in methods or data remains necessary.</p>

¹⁷⁹ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.

Option C: Three Pillars

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p><u>4. Transparency</u></p> <p>Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p>	<p>Yes</p> <p>The market-based method can provide a transparent and auditable means to estimating over time the pro rata shares of total system emissions based on electricity purchased and consumed within a defined geographic area and time period using contractually owned emission factor data. To produce a clear audit trail, use of emission rates conveyed by ownership of contractual instruments requires proof of ownership to the certificates or supplier-specific rate data.</p> <p>Like the time- and location-matched approach, a three pillars approach to the market-based method may ensure more consistent application of market boundaries, emission factor vintages, residual mix data, and other parameters. It additionally introduces a requirement for resource newness, which would likely be auditable.</p>
	<p><u>5. Accuracy</u></p> <p>Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p>	<p>Yes</p> <p>The proposed market-based method can provide a more accurate approach to allocate the pro rata shares of total system emissions based on purchased and consumed electricity than the status quo market-based method.</p> <p>As it relates to the accuracy of calculating scope 2 emissions, the Corporate Standard and Scope 2 Guidance states that, <i>“reductions in indirect emissions (changes in scope 2 or 3 emissions over time) may not always capture the actual emissions reduction accurately. This is because there is not always a direct cause effect relationship between the single activity of the reporting company (purchasing and consuming energy) and the resulting GHG emissions on the grid. Generally, as long as the accounting of indirect emissions over time recognizes activities that in aggregate change global emissions, any such concerns over accuracy should not inhibit companies from reporting their indirect emissions.”</i>¹⁸⁰</p> <p>Therefore, to evaluate whether an accounting approach is sufficiently accurate requires an assessment of how actions incentivized by the approach change emissions in aggregate.</p> <p>As discussed in scientific integrity, the voluntary market activities incentivized by this proposed market-based method may lead to system-wide reductions in emissions and additional non-emitting generation resources. Furthermore, the three pillars of time matching, deliverability, and ‘newness’ may align this approach with the principle of accuracy more than approaches that require either time- and location-matching or additionality requirements but not both in combination. Regarding allocation of emissions, research has shown that using hourly emission factors and deliverable geographic boundaries may increase the accuracy of the emissions inventory, due to hourly and seasonal fluctuations in generation resources and significant inter- and intra-grid differences in emissions intensity due to transmission constraints.</p> <p>Additionally, the three pillars approach may better support users in making decisions related to facility siting, increases or decreases in electricity consumption, timing of demand shifts, and deployment of new technologies with reasonable confidence as to the integrity of the reported emission information. See sections on scientific integrity and supports decision-making that drives ambitious global climate action for more information.</p>

¹⁸⁰ Scope 2 Guidance, section 4.3, p. 28; Corporate Standard, p. 59

Option C: Three Pillars

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p>6. Comparability (not a current principle; subject to discussion in the ISB and TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed / Yes</p> <p>A three pillars approach, which requires the use of more granular activity data and emission factors and introduces a requirement for resource newness would standardize data choices more than under the current market-based method, so may improve comparability across organizations. However, different levels of data precision applied by different organizations may still limit the ability to compare market-based emissions across organizations, as is the case today.</p>
<p><u>Support decision making that drives ambitious global climate action</u></p> <ul style="list-style-type: none"> Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 		<p>Yes</p> <p>The Scope 2 Guidance currently indicates that the market-based method may incentivize organizations to:</p> <ul style="list-style-type: none"> Make facility and operations-siting decisions based on the ability to make choices about energy supply.¹⁸¹ Reduce energy consumption through energy efficiency measures and behavioral decisions.¹⁸² Reduce electricity demand to minimize additional costs associated with purchasing contractual instruments at a premium above standard electricity costs. However, the market-based method runs the risk of providing less visibility on energy demand reduction if the price of this premium (and therefore the price of achieving zero emissions) is low.¹⁸³ Support low-carbon technologies directly and indirectly through the following actions:¹⁸⁴ <ul style="list-style-type: none"> Create on-site low-carbon energy projects Establish contracts, that include certificates, such as PPAs directly with low-carbon generators Negotiate with their supplier or utility to supply low-carbon energy to the company Switch to low-carbon electricity supplier or electricity project, where available Purchase certificates from low-carbon energy generation <p>The proposed three pillars method aligns with supporting decision-making that drives ambitious global climate action by requiring hourly matching of EACs that are sourced from the same grid and come from 'new' resources. This approach supports actions that directly reflect the temporal and locational characteristics of renewable energy generation, encouraging companies to better align their purchased and consumed energy with available low-carbon resources and make informed decisions regarding facility siting, grid infrastructure, onsite generation and energy storage systems, and renewable resource investments.</p>

¹⁸¹ Scope 2 Guidance, section 4.3, p. 28

¹⁸² Scope 2 Guidance, section 4.3, p.29

¹⁸³ Scope 2 Guidance, section 4.3, p. 30

¹⁸⁴ Scope 2 Guidance, section 4.3, p. 30

Option C: Three Pillars

<p><u>Support decision making that drives ambitious global climate action (cont.)</u></p>	<p>By integrating the criteria of time matching, locational relevance, and resource newness, the three pillars method potentially offers a more accurate and meaningful allocation of emissions, as it more closely aligns organizations' procurement decisions to real-time grid dynamics and prioritizes new project development, which supports sector-specific decarbonization.</p> <p>However, as noted in the sections on scientific integrity, accuracy, and relevance, further definition of 'newness' and continued focus on aligning these attributes with real emissions reduction outcomes will be important to ensure that the method aligns with global climate goals and drives true reductions rather than merely reallocating emissions across the grid.</p>
<p><u>Support programs based on GHG Protocol and uses of GHG data</u></p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>Mixed</p> <p>A three pillars approach to the market-based method could presumably be used to meet purposes related to climate-related disclosure, target-setting, and performance tracking.</p> <p>Given the uncertainty around how this approach fully meets the completeness principle, it remains unclear whether this approach would impact interoperability with policies and programs that currently use a market-based method to account for all grid emissions.</p> <p>As evidenced in the scientific integrity section, while research on the system-level impacts of renewable energy procurement decisions may show that time and location matching can better align a reporting organization's emissions inventory with the emissions of the grid from which they purchase and consume electricity, the three pillars approach includes an additional 'newness' requirement that further improves the estimation of emissions based on contractual relationships to electricity supply sources. In addition, the three pillars approach substantially reduces system-wide emissions when compared to annual matching, time and location matching, and emissions matching approaches. Thus, it may be better suited for climate-related disclosure, target setting and performance tracking purposes than the status quo.</p> <p>The feasibility of implementing this option may present challenges for interoperability with policies and programs that currently use the market-based method, such as legal disclosure requirements under IFRS S2 and ESRS E1. Given this sensitivity, further evaluation of how this proposal aligns with these criteria may be necessary.</p>

Option C: Three Pillars

Feasibility to implement

- Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable.
- GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.).
- For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation.

Mixed / No

As discussed in Option B, organizations have begun calculating market-based emissions and transacting using time and location- matching approaches.¹⁸⁵ However, information on organizations incorporating ‘newness’ as a required third pillar is lacking, showing this approach may have mixed to unfavorable alignment with the feasibility criteria for organizations globally.

Challenges for the three pillars approach also include the need to establish consistent supplier-specific or residual emission factors to account for electricity not sourced from three-pillar-compliant resources, as well as the additional complexity in distinguishing compliant attributes from non-compliant ones across diverse electricity markets.

The three pillars approach has been closely examined in the context of issuing subsidies for grid-connected hydrogen production (electrolysis) and has been instituted into law in the European Union.¹⁸⁶ However, the European Union rule includes an interim period (until January 2030) during which matching of contractual instruments to electricity consumption need only be done on a monthly basis. Full matching (including hourly temporal matching) will go into effect in January 2030.

Research has shown that implementing a three pillars approach may be significantly more costly than other approaches, such as annual matching with additionality, and therefore may limit feasibility for a majority of organizations globally.¹⁸⁷

One proposal to increase the feasibility of this approach includes allowing for load profiles to be used as proxies for estimating hourly electricity consumption where hourly data is not available.¹⁸⁸ This would not address the feasibility of obtaining hourly emission factor data. Further examination of this option is needed.

¹⁸⁵ See power purchase agreements by [Google](#), [Microsoft](#), [Iron Mountain](#), the [US Federal Government](#).

¹⁸⁶ 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 fuels of non-biological origin, Document 02023R1184-20240610 (2023). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02023R1184-20240610>.

¹⁸⁷ Zeyen, et al., “Temporal Regulation of Renewable Supply for Electrolytic Hydrogen.”

¹⁸⁸ W. Ricks and J. D. Jenkins, *The Influence of Demand-Side Data Granularity on the Efficacy of 24/7 Carbon-Free Electricity Procurement* (ZERO Lab, Princeton University, 2024).

D. Option D: Introduce Additionality or Causality Test in the Scope 2 Quality Criteria

- Introduce new requirements to the Scope 2 Quality Criteria related to ‘additionality’ and/or ‘causality.’
- A precise definition of one or both terms in the context of scope 2 would need to be developed and further defined in the TWG process.
- Specific language change possibilities to be discussed with TWG.

Option D: Introduce Additionality or Causality Test in Scope 2 Quality Criteria	
Decision-Making Criteria	Evaluation
<p><u>Scientific integrity</u></p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>Mixed</p> <p>To evaluate if this proposed scope 2 market-based inventory method, which adds an additionality or causality requirement for the use of any contractual instruments, ensures sufficient scientific integrity and validity by adhering to the best applicable science and evidence, its performance is assessed within the context of its stated purpose and use cases as outlined above. In this context, it shows mixed alignment with the scientific integrity criteria. Note, this stated purpose and intended uses will be considered during the revision process.</p> <p>1. Estimating emissions based on contractual relationships to electricity supply</p> <p>The proposed market-based method provides an estimation of the reporting organization’s indirect emissions associated with their purchased and consumed electricity. This estimation would revise the Quality Criteria to require that any contractual instruments accounted for be “additional.” While stakeholder feedback supportive of this option expressed general interest in a variety of additionality and/or causality requirements, a precise definition of “additional” or “causal” requires closer consideration with the TWG. This could include requirements related to financial, regulatory, and technological additionality or other potential options.</p> <p>Under the proposed approach, the emissions reported in an organization’s scope 2 market-based inventory will increase or decrease as result of either corresponding increases or decreases in their activities (i.e., purchased and consumed electricity), changes in the emission intensity of contractual supply procured by the reporting organization, or changes in the emission intensity of the residual mix of the grid region serving the reporting organization.</p> <p>As described in detail in the scientific integrity assessments of Options A, B, and C, improving the allocation of grid emissions based on contractual relationships may require closer consideration of matching the time and location of energy generation and consumption. If this proposed approach to require additionality or causality allows for annual matching of emission factors with activity data across broad market boundaries it appears unlikely to align with the principle of scientific integrity as it relates to estimating emissions based on contractual relationships. If this proposed approach requires more granular temporal matching of emission factors with activity data and deliverable market boundaries, it increasingly resembles Option C (i.e., three pillars) with the notable difference in the potential definitions of “additionality” and/or “causality” from “newness”. Option C requires ‘resource newness’ without necessarily requiring project additionality tests for financial, regulatory, or technology additionality.</p> <p>2. Influencing electricity suppliers and generation resource supply mix across the grid</p> <p>Evaluating the impact of the proposed approach on the generation resource supply mix is complicated by different interpretations of how to define and scientifically evaluate any additionality or causality requirements. Additionality as defined in the context of carbon credit markets refers to a cause-and-effect relationship where a project can be described as additional if it would not have occurred in the absence of the</p>

Option D: Introduce Additionality or Causality Test in Scope 2 Quality Criteria

Scientific integrity (cont.)

cause.¹⁸⁹ Others have utilized the term “causality,” though are generally referring to the same definition as those who use “additionality.”¹⁹⁰ In assessing available research to date there appears to be limited to no true test of additionality’s ability to influence the electricity system’s generation resource mix and system-level emissions on the grid. Instead, because proving additionality requires the use of counterfactuals, much of the research on additionality uses a renewable energy project’s ‘newness’ as a proxy or heuristic for additionality. This is notably distinct from more commonly understood definitions of additionality related to project financing, regulatory surplus, etc. Several definitions of ‘new’ were proposed in research, including resources that had not been built prior to the modeling period,¹⁹¹ resources built within a five-year window,¹⁹² or resources that would not otherwise be operating absent the intervention.¹⁹³

One study that modeled system-wide impacts of an additionality requirement (defined as new resources only) on C&I load in California, Wyoming, and Colorado found that an additionality requirement alongside annual matching of contracted renewable energy had no or negligible impact on reducing consequential emissions at low levels of C&I market participation (10% and 25%).¹⁹⁴ Another study that focused on the impact of various strategies on emissions from hydrogen production in various western U.S. regions found similar results, indicating that a newness additionality requirement alone, without hourly and deliverability requirements, has significantly higher consequential emission impacts.¹⁹⁵ However, one study evaluating the impact of hydrogen incentives in Europe found that a newness-related additionality requirement alone, without an hourly matching requirement, can limit consequential emissions so long as electrolyzer demand is assumed to be flexible.¹⁹⁶ Finally, one study comparing several studies on hydrogen incentives found that the varying definitions of additionality and assumptions on long-run investment effects used by these models determines whether additionality requirements alone are enough to ensure minimal consequential emission impacts, or whether additional hourly requirements are necessary, identifying a potential need for research in this area.¹⁹⁷

3. Risk and opportunity assessment related to contractual relationships

Per the considerations discussed above related to “Estimating emissions based on contractual relationships to electricity supply” there is a limited *scientific basis* for use of the proposed market-based method with additionality/causality requirements for contractual instruments associated with procured electricity to assess a reporter’s risks and opportunities related to emissions associated with their purchased and consumed electricity. Further research is necessary to assess how this option aligns with real-world risks and opportunities, such as energy resource availability, prices, climate change events, and economic factors.

4. Enabling decision-making for consumers and companies

As discussed above and in the location-based method technical improvements section, the use of annual emission factors may not support accurate decision-making for companies based on their scope 2 inventory. Furthermore, specific to the market-based method, new research on system-level impacts of renewable energy procurement decisions may show that this proposed option does not necessarily support real world decarbonization effects without additional requirements such as more granular temporal and deliverable matching. If this proposed approach requires more granular temporal matching of emission factors with activity data *and* deliverable market boundaries it increasingly resembles Option C (i.e., three pillars) with the notable difference in the potentially definitions of “additionality”. Option C requires “resource newness” without necessarily requiring project additionality tests for financial, regulatory, or technology additionality.

¹⁸⁹ International Organization for Standardization. (2019). Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements. (ISO Standard No. 14064-2:2019). <https://www.iso.org/obp/ui/#iso:std:iso:14064:-2:ed-2:v1:en>

¹⁹⁰ Brander, Matthew and Bjorn, Anders. “Principles for Accurate GHG Inventories and Options for Market-based Accounting.” *The International Journal of Life Cycle Assessment*. (2023). 28:1248–1260 <https://doi.org/10.1007/s11367-023-02203-8>

¹⁹¹ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.

¹⁹² Olson et. al., “Consequential Impacts of Voluntary Clean Energy Procurement.”

¹⁹³ Zeyen et. al., “Temporal Regulation of Renewable Supply for Electrolytic Hydrogen.”

¹⁹⁴ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.

¹⁹⁵ Ricks et. al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States.” 014025.

¹⁹⁶ Zeyen et. al., “Temporal Regulation of Renewable Supply for Electrolytic Hydrogen.”

¹⁹⁷ Cybulsky et. al., “Producing Hydrogen from Electricity: How Modeling Additionality Drives the Emissions Impact of Time Matching Requirement.”

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<p><u>GHG accounting and reporting principles</u></p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p><u>1. Relevance</u></p> <p>Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p>	<p>Mixed</p> <p>A GHG inventory based on the proposed market-based method that introduces an additionality or causality requirement in the Scope 2 Quality Criteria has mixed alignment with the relevance principle and how it reflects the GHG emissions of the company and serves the decision-making needs of users. As discussed in the scientific integrity section, research has shown that the proposed method of allocating emissions using annual average emission factors may not accurately reflect the GHG emissions associated with electricity purchased and consumed by the reporting organization due to daily and seasonal fluctuations in generation resources, as well as important differences in emissions intensity across geographies and even within electricity grids due to transmission constraints.</p> <p>A market-based method using annual matching with an additionality or causality requirement may provide some relevant information for external decision-making needs as a methodology to provide information about an organization’s performance and procurement from new or ‘additional’ resources. For example, the proposed method could support the development of new renewable energy projects through mechanisms like power purchase agreements or virtual power purchase agreements, though it is unclear how the proposed approach would account for retail electricity products (e.g., renewable portfolio standards, green pricing programs, etc.) due to the additionality/causality requirement. Further, research has questioned whether an additionality/causality requirement alone, without more granular temporal and geographic requirements, can support system-level changes in emissions through development of new non-emitting projects on the grid,¹⁹⁸ and therefore the proposed method may not provide users with a relevant tool to reduce emissions.</p>
	<p><u>2. Completeness</u></p> <p>Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p>	<p>Mixed</p> <p>More information is needed to understand whether a market-based inventory which adds an additionality or causality requirement for the use of any contractual instruments would fulfil the principle of completeness.</p> <p>The current market-based method allows organizations to use contractual instruments or the residual mix to reflect the emission factor of all purchased and consumed electricity regardless of whether it is ‘additional.’ This means organizations can reflect all their electricity procurement activities within the inventory boundary, from all generation sources. If organizations are restricted to using contractual instruments only for procurements that meet an ‘additionality’ criterion, further information is necessary to understand how non-additional generation should be reported in order to fully assess how this approach aligns with the completeness principle. A residual mix could potentially be applied to account for non-additional electricity, though few details on how this would be implemented under the additionality/causality option have been provided.</p>

¹⁹⁸ Xu, et al. “System-Level Impacts of Voluntary Carbon-Free Electricity Procurement Strategies,” 374–400.; Ricks et. al., “Minimizing Emissions from Grid-Based Hydrogen Production in the United States.” 014025.

Option D: Introduce Additionality or Causality Test in Scope 2 Quality Criteria		
GHG accounting and reporting principles (cont.)	<p>3. Consistency</p> <p>Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p>	<p>Mixed</p> <p>A market-based inventory which adds an additionality or causality requirement shows mixed alignment with the principle of consistency. Requiring that organizations only account for renewable or emission-free energy sourced from projects that meet additionality or causality criteria promotes uniformity in reporting emissions reductions. However, the absence of requirements for hourly matching and geographic deliverability continues the existing variability in emission factors and activity data used by organizations, leading to potential inconsistencies in performance tracking over time. Transparent documentation of changes to data sources, boundaries, and methodologies remains necessary to support consistency under this approach.</p>
	<p>4. Transparency</p> <p>Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p>	<p>Mixed</p> <p>Without a clear method for testing additionality or causality, it is difficult to determine whether a market-based inventory allowing only claims to emission rates from electricity consumption that demonstrates project- or system-level additionality would fulfil the principle of transparency, and whether this information could be audited. Some proposed examples of additionality may be more transparent and auditable than others—for example, regulatory additionality may be more feasibly audited than financial additionality.</p>

Option D: Introduce Additionality or Causality Test in Scope 2 Quality Criteria

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p><u>5. Accuracy</u></p> <p>Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p>	<p>Mixed</p> <p>The proposed market-based method that introduces an additionality or causality requirement presents mixed alignment with the accuracy principle. While it offers a potentially improved approach for allocating system emissions based on purchased and consumed electricity, it retains uncertainties, especially when compared to more granular methods.</p> <p>As it relates to the accuracy of calculating scope 2 emissions, the Corporate Standard and Scope 2 Guidance states that, <i>“reductions in indirect emissions (changes in scope 2 or 3 emissions over time) may not always capture the actual emissions reduction accurately. This is because there is not always a direct cause effect relationship between the single activity of the reporting company (purchasing and consuming energy) and the resulting GHG emissions on the grid. Generally, as long as the accounting of indirect emissions over time recognizes activities that in aggregate change global emissions, any such concerns over accuracy should not inhibit companies from reporting their indirect emissions.”</i>¹⁹⁹</p> <p>Therefore, to evaluate whether an accounting approach is sufficiently accurate requires an assessment of how actions incentivized by the approach change emissions in aggregate.</p> <p>As discussed in scientific integrity, the voluntary market activities incentivized by this approach may lead to system-wide reductions in emissions and additional non-emitting generation resources, however, some research has pointed to hourly and deliverable matching requirements as additional steps needed to ensure this outcome. Further, allocation of emissions using annual emission factors (with annual matching of renewable energy purchases), and broad geographic boundaries may obfuscate the accuracy of the emissions inventory, especially when accounting approaches that use more granular time intervals or more localized conditions would show different results.</p> <p>Additionally, the use of annual matching of contractual instruments to electricity consumption introduces significant uncertainties impacting the ability of users to make decisions related to facility siting, increases or decreases in electricity consumption, timing of demand shifts, and deployment of new technologies with reasonable confidence as to the integrity of the reported emission information. For more information, see sections on scientific integrity and supports decision-making that drives ambitious global climate action.</p> <p>Therefore, the temporal and geographic matching requirements layered onto an additionality or causality requirement may impact the accuracy of outcomes.</p>
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¹⁹⁹ Scope 2 Guidance, section 4.3, p. 28; Corporate Standard, p. 59

Option D: Introduce Additionality or Causality Test in Scope 2 Quality Criteria

<p>GHG accounting and reporting principles (cont.)</p>	<p>6. Comparability (not a current principle; subject to discussion in the ISB and TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>Mixed</p> <p>Due to the variation in potential definitions of “additionality” and “causality” more information is needed to understand whether a market-based method which adds an additionality or causality requirement for the use of any contractual instruments would fulfil a comparability principle.</p> <p>Comparability depends on the use of a common methodology, so any criteria to demonstrate additionality would need to be standardized across different markets and organizations to allow for comparability. If this approach does not also require more granular matching of emission factors with activity data and deliverable market boundaries, variation in activity data and emission factors used could limit comparability as is the case today.</p>
<p>Support decision making that drives ambitious global climate action</p> <ul style="list-style-type: none"> Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 		<p>Mixed</p> <p>The Scope 2 Guidance currently provides that the market-based method may incentivize organizations to:</p> <ul style="list-style-type: none"> Make facility and operations-siting decisions based on the ability to make choices about energy supply.²⁰⁰ Reduce energy consumption through energy efficiency measures and behavioral decisions.²⁰¹ Reduce electricity demand to minimize additional costs associated with purchasing contractual instruments at a premium above standard electricity costs. However, the market-based method runs the risk of providing less visibility on energy demand reduction if the price of this premium (and therefore the price of achieving zero emissions) is low.²⁰² Support low-carbon technologies directly and indirectly through the following actions:²⁰³ <ul style="list-style-type: none"> Create on-site low-carbon energy projects Establish contracts, that include certificates, such as PPAs directly with low-carbon generators Negotiate with their supplier or utility to supply low-carbon energy to the company Switch to low-carbon electricity supplier or electricity project, where available Purchase certificates from low-carbon energy generation <p>The proposed additionality or causality requirement within the market-based method shows potential for supporting decision-making that encourages climate action by promoting investments in renewable energy projects that are more likely to be “additional,” meaning they might not have occurred without targeted support. By focusing on ‘additional’ resource development, this approach aims to contribute to renewable energy capacity growth that would not have otherwise occurred. However, as noted in the scientific integrity, accuracy, and relevance sections, significant uncertainties remain regarding whether the additionality requirement alone can consistently lead to meaningful system-level emissions reductions, particularly in the absence of specific temporal or geographic alignment.</p>

²⁰⁰ Scope 2 Guidance, section 4.3, p. 28

²⁰¹ Scope 2 Guidance, section 4.3, p. 29

²⁰² Scope 2 Guidance, section 4.3, p. 30

²⁰³ Scope 2 Guidance, section 4.3, p. 30

Option D: Introduce Additionality or Causality Test in Scope 2 Quality Criteria

<p><u>Support decision making that drives ambitious global climate action (cont.)</u></p>	<p>This lack of time-specific and location-specific criteria introduces uncertainty about how well emissions from these additional resources align with actual grid operations and emissions patterns. Without requirements for hourly and deliverable matching, this approach may not fully capture the operational dynamics of electricity grids, potentially resulting in emissions reporting that does not accurately represent the real-world impact of system-wide emission reductions.</p> <p>While additionality requirements could support sector-specific decarbonization by emphasizing new renewable projects, this option’s limited temporal and spatial precision may hinder the reliability of emissions data for informing robust, effective mitigation actions aligned with global climate goals.</p>
<p><u>Support programs based on GHG Protocol and uses of GHG data</u></p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>Mixed</p> <p>A market-based method that requires claims to meet additionality or causality tests could produce useful data for climate risk disclosure and performance as a company’s claimed emissions would reflect the emissions from generation they directly caused, however, this option is dependent on how additionality or causality is defined and tested. As discussed in the scientific integrity section, some combinations of other technical improvements with additionality (i.e. three pillars) may better estimate emissions and lead to systemic grid decarbonization than others (i.e. annual matching). Thus, this approach’s ability to support climate disclosure and target-setting is dependent on how additionality or causality is defined.</p> <p>Programs and policies with existing implementation of the market-based method may be unaligned with a new market-based method that requires additionality or causality, possibly leading to a lack of interoperability with programs.</p>
<p><u>Feasibility to implement</u></p> <ul style="list-style-type: none"> Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable. GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.). For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation. 	<p>Mixed</p> <p>If using annual emission factors and broad market boundaries, the proposed market-based method with an additionality or causality requirement shares several commonalities with the current market-based method approach discussed in Option A, and therefore shares some of the same feasibility considerations. If using more granular data, it shares some feasibility considerations with options B or C.</p> <p>A unique feasibility challenge compared to other options arises from the need to verify that claimed generation meets additionality or causality criteria, as well as to determine residual or default emission factors for purchased and consumed electricity that does not meet this standard, both of which add complexity to implementation.</p> <p>The introduction of an additionality or causality requirement would likely serve to limit availability of contractual instruments for organizations and could increase costs associated with procurement of instruments from non-emitting resources. The impact on other procurement methods in the market-based emission factor hierarchy (such as utility programs or residual mixes) is unknown and could create complications for organizations.</p> <p>Finally, the precise definition of additionality or causality will be an essential factor in evaluating the feasibility of the method.</p>

E. Option E: Replace Existing Market-Based Method with the Formula: ‘Scope 2 Emissions = Induced – Avoided Emissions’

- Adjust emissions calculation approach to quantify emissions ‘induced’ and emissions ‘avoided’, and net the two values using the formula: scope 2 emissions = induced emissions – avoided emissions
 - Induced emissions calculation: electricity purchased and consumed * locational marginal emission rate
 - Avoided emissions calculation: renewable energy purchase * marginal emission rate on grid where the purchase renewable energy was generated
- Under this option avoided emissions need not occur in the same region or time as where the reporting organization’s induced emissions occur.
- Some details of this option, such as whether the induced and avoided emissions calculations use annual or more granular emission factors, or follows a hierarchy, differ within proposals related to this option and would need to be defined.
- Specific language change possibilities to be discussed with TWG.

Option E: Replace Existing Market-Based Method with ‘Scope 2 Emissions = Induced – Avoided Emissions’	
Decision-Making Criteria	Evaluation
<p><u>Scientific integrity</u></p> <p>Approaches should ensure scientific integrity and validity, adhere to the best applicable science and evidence (including academic literature, modeling, or other research) and align with the latest climate science.</p>	<p>Mixed</p> <p>To evaluate if this proposed scope 2 market-based inventory method using an ‘induced’ and ‘avoided’ emissions calculation ensures sufficient scientific integrity and validity by adhering to the best applicable science and evidence, its performance is assessed where possible within the context of the method’s stated purpose and use cases as outlined above. In this context, it shows mixed to unfavorable alignment with the scientific integrity criteria. Note, this stated purpose and intended uses of the market-based method will be considered during the revision process.</p> <p>1. Estimating emissions based on contractual relationships to electricity supply</p> <p>The proposed market-based method provides a framework to estimate the reporting organization’s emissions associated with their purchased and consumed electricity (i.e., ‘induced’) and with contracted renewable energy or purchased EACs (i.e., ‘avoided’). This estimation uses an adaptation of project accounting calculation methods, and generally follows the formula of: scope 2 emissions = induced emissions – avoided emissions.</p> <p>In this formula the GHG emissions allocated from generation resources to the reporting organization are calculated based on the reporting organization’s load (i.e., their total purchased and consumed electricity) multiplied by the marginal emission rate of the regional grid where they are located. Avoided emissions reflect what GHG emissions were displaced by the reporting organization’s contracted renewable energy or purchased EACs. This would be calculated by multiplying the amount of contracted renewable energy or purchased EACs times the marginal emission factor of the grid where that generation occurs. The method emphasizes the avoided emissions need not occur in the same region or time as where the reporting organization’s induced emissions occur. Some details of the proposed approach vary, such as whether the induced emissions portion of the calculation is done using annual or more granular emission factors or a hierarchy. Most proposals for this option calculate ‘induced emissions – avoided emissions’ by considering all of an organization’s purchased and consumed electricity, along with all contracted renewable energy or purchased EACs, to determine the emissions induced or displaced. However, these calculations are performed without establishing a baseline or counterfactual scenario, leaving the reference point for assessing what is induced or avoided undefined.</p> <p>Under the proposed approach, the induced emissions reported by an organization will increase or decrease as result of any corresponding increases or decreases in their activities (i.e., the reporting organization’s load) and changes in the marginal emission intensity rate where they purchase and consume electricity. The avoided emissions reported by an organization will increase or decrease as result of any changes in the quantity of contracted renewable energy or purchased EACs and changes in the marginal emission intensity on the grid where that contracted renewable energy, purchased EACs, etc. occurs (noting this can be a different region from where energy consumption occurs).</p>

Option E: Replace Existing Market-Based Method with ‘Scope 2 Emissions = Induced – Avoided Emissions’

Scientific integrity (cont.)

Assessing the scientific integrity of this proposed option as an *inventory accounting method* is challenging due to the application of project accounting principles and methodologies (consequential) in its calculation. Consistent with the Corporate Standard and Scope 3 Standard, the Scope 2 Guidance reiterates it is an emission rate approach that uses generation-only emission factors representing emission rates that allocate the total quantity of physical emissions from the electric grid that occur during a reporting period to end-users. Inventory accounting across the scopes does not support inclusion of an “avoided emissions” approach due to important distinctions between corporate accounting and project-level accounting.²⁰⁴

The GHG Protocol suite of standards addresses this topic of inventory and project accounting frameworks. As stated in the Corporate Standard:

“The GHG Protocol Corporate Standard focuses on accounting and reporting for GHG emissions at the company or organizational level. Reductions in corporate emissions are calculated by comparing changes in the company’s actual emissions inventory over time relative to a base year... In contrast to corporate accounting, the [GHG Protocol for Project Accounting] focuses on the quantification of GHG reductions from GHG mitigation projects that will be used as offsets. Offsets are discrete GHG reductions used to compensate for (i.e., offset) GHG emissions elsewhere, for example to meet a voluntary or mandatory GHG target or cap. Offsets are calculated relative to a baseline that represents a hypothetical scenario for what emissions would have been in the absence of the project.”²⁰⁵

The GHG Protocol for Project Accounting similarly states:

“The Project Protocol is written for project developers, but should also be of interest to administrators or designers of initiatives, systems, and programs that incorporate GHG projects, as well as third-party verifiers for such programs and projects. Any entity seeking to quantify GHG reductions resulting from projects may use the Project Protocol. However, it is not designed to be used as a mechanism to quantify corporate or entity-wide GHG reductions; the Corporate Accounting Standard should be used for that purpose.”²⁰⁶

The Scope 2 Guidance further elaborates on the prospect of mixing inventory and project accounting methods:

“Any type of energy or energy attribute purchase via a contractual instrument shall be treated in scope 2 like all other product information—an emission rate in tons GHG/unit of output (here, kWh) rather than an avoided emissions estimation and deduction. Companies then apply the emission factor derived from the contractual instrument to a quantity of energy consumption (activity data), consistent with the usage boundaries of that instrument.”²⁰⁷

Critically, separately from an inventory, this proposed methodology could provide technical and strategic benefits for an organization as described in the Scope 2 Guidance:

“Companies can report the estimated grid emissions avoided by low-carbon energy generation and use, separately from the scopes. This type of analysis reflects the impacts of generation on the rest of the grid: for example, the emissions from fossil-fuel or other generation backed down or avoided due to the low-carbon generation. These avoided emissions estimations inherently represent impacts outside the inventory boundary. Avoided emissions estimations are not necessarily equivalent to global emissions reductions from additional projects and should therefore not be used to reduce a company’s footprint. However, quantifying avoided emissions provides several technical and strategic benefits, including:

- *Identifying where low-carbon energy generation can have the biggest GHG impact on system, based on the operating margin.*

²⁰⁴ Scope 2 Guidance, Section 4.2, page 27-28

²⁰⁵ Corporate Standard, Chapter 8, page 59

²⁰⁶ GHG Protocol for Project Accounting, Section 1.2, page 5

²⁰⁷ Scope 2 Guidance, Section 1.10, page 11

Option E: Replace Existing Market-Based Method with ‘Scope 2 Emissions = Induced – Avoided Emissions’

Scientific integrity (cont.)

- *Demonstrating that grid-connected generation provides a system-wide service in addition to conveying a specific emission rate at the point of production.*

This estimation should follow project-level methodology; see [GHG Protocol for Project Accounting](#) or [Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects](#). This may be most beneficial where a company has taken actions that avoid higher-carbon generation dispatch at the margins. [Examples of supply- and demand-side actions are provided.]²⁰⁸

For these reasons an evaluation of this proposed option's ability to estimate emissions based on contractual relationships to electricity supply as an *inventory* methodology is outside the scope of this analysis.

2. Influencing electricity suppliers and generation resource supply mix across the grid

Several recent studies have attempted to analyze the impacts of the proposed approach on real world grid decarbonization and have generally found mixed results. One study looking at the impacts and costs of a carbon matching strategy using marginal emission rates (MERs) to guide renewable energy sourcing found that carbon matching was effective at displacing 100% of induced emissions at a fraction of the cost of annual and hourly matching strategies.²⁰⁹ However, other studies have pointed to the fact that the study's use of short-run MERs ignores how changes in electricity consumption would impact the structural evolution of the grid, and instead only capture how the grid would respond to changes at a snapshot in time.²¹⁰

Several other studies that utilize capacity expansion modeling, which considers both operational and structural changes to the grid, to measure the impacts of a carbon matching strategy have shown that the strategy may not result in significant changes in generation supply on the grid. One study that looked at the impact of carbon matching in California, Wyoming, and Colorado found that at low C&I participations rates (10% and 25%) carbon matching had a negligible impact on system-level emission outcomes.²¹¹ At higher C&I participation rates (50% and 100%) the study found that carbon matching in California had a more substantial emission impact but was still less than half the benchmark rate equivalent to removing the load from the grid entirely.²¹²

3. Risk and opportunity assessment related to contractual relationships

For reasons stated above, an evaluation of this proposed option's ability as an *inventory* methodology to inform risk and opportunity assessment related to contractual relationships is outside the scope of this analysis.

4. Enabling decision-making for consumers and companies

The proposed approach, utilizing MERs to guide renewable electricity procurement decisions, shows mixed alignment with the science related to decision-making for consumers and companies. MERs may represent a more precise tool for estimating the emission impacts of decisions to add or subtract electricity load from the grid than average emission factors,²¹³ and therefore may also be a more useful tool for siting renewable energy projects in locations that will have the greater emission impacts.²¹⁴ However, while theoretically purpose-built for estimating emission impacts, researchers have questioned whether MERs are useful in estimating impacts from large, permanent, or policy-

²⁰⁸ Scope 2 Guidance, Section 6.9, page 52

²⁰⁹ He, Hua, Aleksandr Rudkevich, Xindi Li, Richard Tabors, Alexander Derenchuk, Paul Centolella, Ninad Kumthekar, Chen Ling, and Ira Shavel. "Using Marginal Emission Rates to Optimize Investment in Carbon Dioxide Displacement Technologies." *The Electricity Journal* 34, no. 9 (2021): 107028. <https://doi.org/10.1016/j.tej.2021.107028>.

²¹⁰ Wilson Ricks, Pieter Gagnon, Jesse D. Jenkins. Short-run marginal emission factors neglect impactful phenomena and are unsuitable for assessing the power sector emissions impacts of hydrogen electrolysis. *Energy Policy*, Volume 189, 2024. <https://doi.org/10.1016/j.enpol.2024.114119>.

²¹¹ Qingyu Xu et al., "System-level Impacts of Voluntary Carbon-free Electricity Procurement Strategies," *Joule* 8, no. 2 (January 11, 2024): 374–400, <https://doi.org/10.1016/j.joule.2023.12.007>.

²¹² Qingyu Xu et al., "System-level Impacts of Voluntary Carbon-free Electricity Procurement Strategies," *Joule* 8, no. 2 (January 11, 2024): 374–400, <https://doi.org/10.1016/j.joule.2023.12.007>.

²¹³ Elenes, Alejandro GN, Eric Williams, Eric Hittinger, and Naga Srujana Goteti. "How well do emission factors approximate emission changes from electricity system models?." *Environmental Science & Technology* 56, no. 20 (2022): 14701-14712.

²¹⁴ WattTime. *ACCOUNTING FOR IMPACT Refocusing GHG Protocol Scope 2 methodology on 'impact accounting'*. 2022. <https://watttime.org/wp-content/uploads/2023/12/WattTime-AccountingForImpact-202209-vFinal2.pdf>

Option E: Replace Existing Market-Based Method with ‘Scope 2 Emissions = Induced – Avoided Emissions’		
<p>Scientific integrity (cont.)</p>		<p>driven projects, for which the consideration of structural impacts to the grid in addition to operational impacts are necessary.²¹⁵ In contrast, long-run marginal emission factors, which do consider induced structural changes to the grid, are potentially more decision-useful and accurate in predicting emission changes from procurement decisions made by reporting organizations.²¹⁶</p> <p><i>“The baseline emissions for a grid-connected project activity are estimated by determining the GHG emissions of the sources of electricity that the project activity displaces or avoids. A key assumption of these guidelines is that a project activity can displace or avoid the operation of existing grid-connected power plants and/or the construction and operation of new power plants. Further, it is assumed that these effects can be distinguished and separately assessed. Generation displaced from existing power plants is referred to as the “operating margin” (OM). Generation from potential new capacity, whose construction is avoided due to the project activity, is referred to as the “build margin” (BM).”²¹⁷</i></p> <p>In addition, evaluating the science related to decision-making for the proposed approach requires an assessment of whether decisions incentivized by the approach result in real world impacts. As discussed in this section above, evidence is mixed as to the degree that the proposed approach can influence real world changes to the grid.</p>
<p>GHG accounting and reporting principles</p> <p>Approaches should meet the GHG Protocol accounting and reporting principles of accuracy, completeness, consistency, relevance, and transparency.</p> <p>Additional principles should be considered where relevant: conservativeness (for GHG reductions and removals), permanence (for removals), and comparability (TBD, subject to TWG and ISB discussions). Options may present tradeoffs among principles which should be evaluated.</p>	<p>1. Relevance</p> <p>Ensure the GHG inventory appropriately reflects the GHG emissions (and removals, if applicable) of the company and serves the decision-making needs of users – both internal and external to the company.</p>	<p>N/A</p> <p>A GHG inventory based on the proposed market-based method that nets induced and avoided emissions using marginal emission factors has unclear alignment with the Corporate Standard’s relevance principle for inventory accounting.</p> <p>As discussed in the scientific integrity section, the proposed approach represents a fundamentally different accounting method that is grounded in consequential accounting (used to estimate emissions impacts of actions) as opposed to attributional accounting (used to allocate emissions to end users based on activity data), and therefore may not be possible to assess using GHG accounting and reporting principles from the Corporate Standard. The proposed approach also does not strictly follow guidelines set forth in the <i>GHG Protocol for Project Accounting or Guidelines for Quantifying GHG Reductions from Grid Connected Electricity Projects</i>, as there is no discussion of the construction of baseline and project scenarios in proposals submitted to the Secretariat, and therefore analyzing the proposed approach against the principles identified in the Project Accounting standard may also not be possible.</p> <p>The proposed method may provide some relevant information for external decision-making needs as it may encourage renewable energy procurement in regions where the consequential impact of new non-emitting resources is highest, however, as discussed in the scientific integrity section the use of short-run marginal emission rates may omit valuable information about the structural evolution of the grid and therefore might not be an appropriate tool for guiding these procurement decisions. In addition, research has shown that the proposed approach may not result in system-wide emission reductions on the grid.²¹⁸</p>

²¹⁵ Wilson Ricks, Pieter Gagnon, Jesse D. Jenkins. Short-run marginal emission factors neglect impactful phenomena and are unsuitable for assessing the power sector emissions impacts of hydrogen electrolysis. *Energy Policy*, Volume 189, 2024. <https://doi.org/10.1016/j.enpol.2024.114119>.

²¹⁶ P.J. Gagnon, J.E.T. Bistline, M.H. Alexander, W.J. Cole, Short-run marginal emission rates omit important impacts of electric-sector interventions, *Proc. Natl. Acad. Sci. U.S.A.* 119 (49) e2211624119, <https://doi.org/10.1073/pnas.2211624119> (2022).

²¹⁷ Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects, section 2.3, p. 11

²¹⁸ Qingyu Xu et al., “System-level Impacts of Voluntary Carbon-free Electricity Procurement Strategies,” *Joule* 8, no. 2 (January 11, 2024): 374–400, <https://doi.org/10.1016/j.joule.2023.12.007>.

Option E: Replace Existing Market-Based Method with ‘Scope 2 Emissions = Induced – Avoided Emissions’

<p><u>GHG accounting and reporting principles (cont.)</u></p>	<p><u>2. Completeness</u></p> <p>Account for and report on all GHG emissions (and removals, if applicable) from sources, sinks, and activities within the inventory boundary. Disclose and justify any specific exclusions.</p>	<p>N/A</p> <p>While this option does provide a means to account for all activities (i.e., all purchased and consumed energy), the proposed option diverges from traditional corporate inventory methods by relying heavily on a consequential rather than attributional approach.</p> <p>Consistent methodologies and transparent documentation of assumptions would be essential to support performance tracking but does not resolve the fundamental misalignment with inventory principles.</p>
	<p><u>3. Consistency</u></p> <p>Use consistent methodologies to allow for meaningful performance tracking of GHG emissions (and removals, if applicable) over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.</p>	<p>N/A</p> <p>The proposed option diverges from traditional corporate inventory methods by relying heavily on a consequential rather than attributional approach.</p> <p>Consistent methodologies and transparent documentation of assumptions would be essential to support performance tracking but does not resolve the fundamental misalignment with inventory principles.</p>
	<p><u>4. Transparency</u></p> <p>Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.</p>	<p>N/A</p> <p>The proposed option diverges from traditional corporate inventory methods by relying heavily on a consequential rather than attributional approach.</p> <p>Consistent methodologies and transparent documentation of assumptions would be essential to support but does not resolve the fundamental misalignment with inventory principles.</p>
	<p><u>5. Accuracy</u></p> <p>Ensure that the quantification of GHG emissions (and removals, if applicable) is systematically neither over nor under actual emissions (and removals, if applicable), and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.</p>	<p>N/A</p> <p>The proposed option diverges from traditional corporate inventory methods by relying heavily on a consequential rather than attributional approach.</p> <p>Consistent methodologies and transparent documentation of assumptions would be essential to support but does not resolve the fundamental misalignment with inventory principles.</p>

Option E: Replace Existing Market-Based Method with ‘Scope 2 Emissions = Induced – Avoided Emissions’		
<u>GHG accounting and reporting principles (cont.)</u>	<p>6. Comparability (not a current principle; subject to discussion in the ISB and TWG)</p> <p>Apply common methodologies, data sources, assumptions, and reporting formats such that the reported GHG inventories from multiple companies can be compared.</p>	<p>N/A</p> <p>The proposed option diverges from traditional corporate inventory methods by relying heavily on a consequential rather than attributional approach.</p> <p>Consistent methodologies and transparent documentation of assumptions would be essential to support but does not resolve the fundamental misalignment with inventory principles.</p>
<p><u>Support decision making that drives ambitious global climate action</u></p> <ul style="list-style-type: none"> • Approaches should advance the public interest by informing and supporting decision making that drives ambitious actions by private and public sector actors to reduce GHG emissions and increase removals in line with global climate goals. • GHG Protocol accounting frameworks should accurately and completely measure emissions such that the resulting GHG data informs effective individual and systemwide GHG mitigation action in line with global climate goals. Accounting approaches should not support or incentivize actions that are contrary to global climate goals. • Approaches should provide the necessary information to support sector-specific decarbonization in line with climate goals. 	<p>Mixed</p> <p>The Scope 2 Guidance currently provides that the market-based method may incentivize organizations to:</p> <ul style="list-style-type: none"> • Make facility and operations-siting decisions based on the ability to make choices about energy supply.²¹⁹ • Reduce energy consumption through energy efficiency measures and behavioral decisions.²²⁰ • Reduce electricity demand to minimize additional costs associated with purchasing contractual instruments at a premium above standard electricity costs. However, the market-based method runs the risk of providing less visibility on energy demand reduction if the price of this premium (and therefore the price of achieving zero emissions) is low.²²¹ • Support low-carbon technologies directly and indirectly through the following actions:²²² <ul style="list-style-type: none"> ○ Create on-site low-carbon energy projects ○ Establish contracts, that include certificates, such as PPAs directly with low-carbon generators ○ Negotiate with their supplier or utility to supply low-carbon energy to the company ○ Switch to low-carbon electricity supplier or electricity project, where available ○ Purchase certificates from low-carbon energy generation <p>As this approach departs from standard attributional accounting, where in scope 2, emissions are based on combustion-only emission rates of generated electricity that is purchased and consumed by the reporting entity, rather than avoided emissions estimates, it may complicate efforts to align with broader GHG Protocol Corporate Standard reporting for reliable inventory tracking.</p> <p>Further, as discussed above reliance on short-run MEFs to estimate induced emissions may fail to account for how long-term structural changes to the grid will affect grid decarbonization. This limitation could make MEF-based emissions data less reliable for stakeholders’ planning and tracking progress toward climate goals. In contrast, long-run marginal factors or additional structural considerations may provide a more accurate basis for understanding the enduring impacts of emissions avoidance efforts. Consequently, while this method could support sector-specific decision-making when applied in specific cases, its alignment with system-wide decarbonization goals remains unclear without more evidence on actual reductions and potential for misinterpretation.</p>	

²¹⁹ Scope 2 Guidance, section 4.3, p. 28

²²⁰ Scope 2 Guidance, section 4.3, p.29

²²¹ Scope 2 Guidance, section 4.3, p. 30

²²² Scope 2 Guidance, section 4.3, p. 30

Option E: Replace Existing Market-Based Method with ‘Scope 2 Emissions = Induced – Avoided Emissions’	
<p>Support programs based on GHG Protocol and uses of GHG data</p> <ul style="list-style-type: none"> Approaches should promote interoperability with key mandatory and voluntary climate disclosure and target setting programs that are based on GHG Protocol standards, where appropriate, while ensuring policy neutrality Approaches should support appropriate uses of the resulting GHG data and associated information by various audiences, including GHG programs, reporting companies, stakeholders, and other users of the resulting GHG information. 	<p>Mixed / No</p> <p>Because this approach is incompatible with the current attributional inventory approach as defined by the GHG Protocol Corporate Standard, the method would not be interoperable with existing policies and programs that have used GHG Protocol standards.</p> <p>Despite the lack of compatibility with the existing inventory approach and the programs and policies that use it, reporting of emission impacts may generate useful information about a company's climate-related actions, impacts and/or performance.</p> <p>However, as discussed in the decision-making section, although the approach can support sector-specific decision-making when applied in specific cases, it is unclear how it would be able to facilitate system-wide decarbonization goals without more evidence on the actual reductions it may enable.</p>
<p>Feasibility to implement</p> <ul style="list-style-type: none"> Approaches which meet the above criteria should be feasible to implement, meaning that they are accessible, adoptable, and equitable. GHG Protocol accounting approaches should support broad adoption of GHG Protocol standards, including in voluntary and regulatory settings, and consider different users (level of capacity, resources, geography, regulatory environments, etc.). For aspects of accounting approaches that meet the above criteria but are difficult to implement, the GHG Protocol should aim to improve feasibility, for example, by providing guidance and tools to support implementation. 	<p>Mixed</p> <p>This proposed approach is technically feasible to implement and has been supported by numerous corporates based primarily in the U.S. and EU.²²³ The feasibility of the proposed approach relies on the existence of marginal emission factors, which are available in some regions of the world, but may not be available in all geographies. Whether the proposed approach utilizes annual, or more granular temporal and geographic emission factors is another consideration that may impact feasibility.</p> <p>While the proposed approach may be technically feasible, there is no track record of the proposed approach having been implemented at scale, and therefore it is difficult to assess real-world feasibility. The Secretariat acknowledges that implementation of the proposed approach to date may be constrained by the fact that it does not currently fit within the accounting framework outlined in the Corporate Standard and Scope 2 Guidance. Further analysis of the feasibility of this approach using real-world examples is necessary.</p>

²²³ Emissions First Partnership, <https://www.emissionsfirst.com/>