Environmental Methodology 1: Greenhouse Gas Emissions

Topic Methodology

Basis for Conclusions

Table of Contents

Note to readers:

In this document, references to paragraph numbers and sections refer to the final version of *Greenhouse Gas Emissions Topic Methodology* that was approved by the Valuation Technical and Practitioner Committee of IFVI on September 5, 2024. References to paragraph numbers and sections in the Exposure Draft of *Greenhouse Gas Emissions Topic Methodology* are explicitly stated.

Background

BC1. The *Greenhouse Gas Emissions Topic Methodology* (henceforth, GHG Methodology) was developed as the first environmental Topic Methodology and establishes a framework for valuing the impacts of GHG emissions. The GHG Methodology was developed by the partnership between the International Foundation for Valuing Impacts (IFVI) and the Value Balancing Alliance (VBA) and serves as the first in a series of Topic Methodologies.

BC2. The GHG Methodology was developed by the technical staff and the VTPC beginning in June 2023. The development process involved a comprehensive review of the GHG impact valuation literature, including methods used previously by the Impact Weighted Accounts (IWA) project at Harvard Business School and VBA. Subsequent research sought alignment with established protocols, frameworks, and disclosure requirements by relevant standard setters. Throughout the process, expert consultation was regularly sought from various entities to better understand key technical aspects and to build strong relationships with peers in the ecosystem.

BC3. A priority of the GHG Methodology was to align to the greatest extent possible with data requirements for European Sustainability Reporting Standards (ESRS) E1: Climate Change, International Financial Reporting Standards,[1] (IFRS) S2: Climate-related Disclosures[2], and Global Reporting Initiative (GRI) 305: Emissions 2016.[3] Each of these require a reporting of full value chain GHG emissions and point to the GHG Protocol[4] as the primary resource for calculating GHG emissions. These same data requirements were adopted for the GHG Methodology.

BC4. As a starting point for the determination of outcomes, impacts, and monetary valuation, the GHG methodologies of the IWA and VBA were assessed. The methodology of IWA used individual monetary valuation coefficients from Steen (2019)[5] while the VBA methodology guided preparers to the social cost of carbon (SCC) framework. While these methodologies used different value factors, both methodologies were aligned in their approach. Both value the impacts on society by assessing the damages that affect the well-being of people stemming from GHG emissions.

BC5. Additional research and conversations with stakeholders explored another common approach to valuing the cost of GHGs: abatement costs. Abatement costs value GHG emissions by assessing the cost to avoid additional emissions or remove GHGs from the atmosphere (e.g. carbon dioxide removal cost or marginal abatement cost). While this approach can be useful in some contexts and can be complementary to the impact accounting methodology, it does not directly value impacts on society through changes in well-being and, therefore, did not align with the impact pathway framework outlined in *General Methodology 1: Conceptual Framework for Impact Accounting* (GM1).[6]

[1] ESRS. (2022). *Draft European sustainability reporting standards*.
[2] IFRS. (2023). *S2: Sustainability Disclosure Standard*.
[3] Global Reporting Initiative. (2016). *GRI 305: Emissions 2016*.
[4] GHG Protocol. (2004). *The Greenhouse Gas Protocol: A corporate eaccounting and reporting standard*.
[5] Steen, B. (2020). *Monetary valuation of environmental impacts: models and data*.
[6] IFVI. (2024). *General Methodology 1: Conceptual Framework for Impact Accounting*.

BC6. The SCC framework was chosen because it aligned with the impact pathway and served as the most sophisticated and widely accepted approach to valuing societal impacts of GHG emissions, used by corporates and governments. The SCC framework has existed for over thirty years and dozens of models have been developed within the SCC framework. An extensive assessment of each model was conducted along with key assumptions and decisions that went into each.

BC7. During the SCC literature review process, it became clear that significant advancements had occurred to the SCC models in just the last two years. Of note was the development of two new models: The Greenhouse Gas Impact Value Estimator (GIVE)[7] and the Data-driven Spatial Climate Impact Model (DSCIM).[8] Meetings were held with developers of both models as well as other developers and users in the SCC research space. In all these conversations, there was agreement that GIVE and DSCIM were significantly advanced over their predecessors and other peer models. A few reasons given for their sophistication included more extensive and globally representative input data, ability to model impacts to the year 2300, analysis that occurs at national or sub-national scales allowing for greater precision of analysis, more advanced approaches to human adaptation in response to climate events, and ability to estimate uncertainty through all components of the model. Engagement with the model developers also provided evidence that active updates of these models would occur, allowing the GHG Methodology to stay up to date with scientific understanding. Because of these extensive reasons, GIVE and DSCIM were selected to develop the value factor instead of an independent model being developed by IFVI and VBA.

BC8. The research phase also provided evidence that there were updated approaches to the discounting of future impacts to present value. Many references, including publications applying GIVE and DSCIM pointed to the use of a social discount rate of 2%, lower than previously used values. [9,10,11] This research also reinforced using a dynamic instead of static discount rate such as the Ramsey formula.[12] This more recent understanding led to the adoption of this approach.

BC9. Once the various decisions in selection the SCC framework were complete, the research phase then explored the extent to which the methodology aligned with frameworks or principles from other leading organizations in GHG accounting. In particular, CDP,[13] the Task-Force on Climate-Related Financial Disclosures (TCFD),[14] Science-based targets initiative (SBTi),[15] and planetary threshold principles were all considered. Research reinforced the importance of each of these frameworks in the GHG accounting and impact ecosystem. The methodology aligned with CDP disclosures who ask for a full value chain emissions accounting as well as the use of carbon pricing. For TCFD, the

[7] GIVE: Rennert, K. et al. (2022). *Comprehensive evidence implies a higher social cost of CO2*.
[8] The Climate Impact Lab. (2022). *Documentation for Data-driven Spatial Climate Impact Model (DSCIM): Version 092022-EPA*.
[9] Carleton, T., & Greenstone, M. (2022). *A guide to updating the US government's social cost of carbon*.
[10] Nesje, F. et al. (2023). *Philosophers and economists agree on climate policy paths but for different reasons*.
[11] U.S. Environmental Protection Agency. (2023). *EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances*.
[12] Ramsey, F. P. (1928). *A Mathematical Theory of Saving*.
[13] See https://www.cdp.net
[14] TCFD. (2022). *Task Force on Climate-related Finance Disclosures: Overview*.
[15] *SBTi Corporate Net-Zero Standard V1.2*. (2024)

guidance around categories of risk associated with GHG emission disclosures was seen as an important justification for using the GHG Methodology and incorporated into the logic of the introduction.

BC10. For SBTi and planetary thresholds, research explored the extent to which the value factor developed from the SCC could utilize these principles. The use of a dynamic cost of carbon where the impact varied relative to an entity's science-based targets. Ultimately, it was determined that a single cost of carbon was the correct approach to increase comparability, broaden uptake including by entities without emissions targets, and best represented the purpose of the social cost of carbon framework. However, SBTi and planetary threshold principles were reflected in the emissions projections that were used. The emissions projections followed a median scenario relative to the range of possible outcomes. In this scenario, emissions peak in 2026 and then gradually decline through the rest of the century. This scenario considers significant climate policy and actions by entities, meaning there is implicit consideration of the importance of target setting and reduced emissions. However, this inclusion is incomplete and future impact accounting work could further explore the incorporation of targets and thresholds.

BC11. Following the research phase, the technical staff, with guidance from the VTPC, prepared a draft of the GHG Methodology for public exposure. At the VTPC meeting on September 5, 2023, the technical staff the VTPC discussed Scope 3 data gaps, SCC models, and the social discount rate. Based on this conversation an Exposure Draft was prepared and reviewed by the VTPC, leading to discussion at the December 19, 2023 VTPC meeting. The Exposure Draft was approved by the VTPC for a public comment period by virtual ballot on January 2, 2024. The public comment period commenced on February 8, 2024 and closed on April 30, 2024.

BC12. The Exposure Draft contained a series of proposals for public comment. The Exposure Draft solicited targeted feedback on five aspects:

a. the use and presentation of the social cost of carbon, including the models and discount rate chosen;

b. the guidance and presentation for filling data gaps for Scope 3 emissions;

c. the clarity and usability of the equations for monetary valuation;

d. the importance of developing guidance on offset projects, purchased carbon credits, renewable energy certificates, and/or avoided emissions; and

e. feedback on additional proposals in the statement.

BC13. A total of 17 comment letters were received, containing 110 individual comments and representing a range of geographies and stakeholder groups. The largest number of responses came from those in sustainability consulting, impact investing, and non-profit organizations. The comment letters were generally supportive of the overall content and scope of the methodology. Many comments sought additional clarity or context, particularly around the details of the SCC models. All comments letters were reviewed in their entirety and taken into consideration for potential revisions to the GHG Methodology. This document does not provide a response to every comment submitted

but instead emphasizes areas of convergence in the feedback. Full comment letters can be read on the IFVI website.[16]

BC14. The basis for conclusions drawn by the VTPC is summarized below for each section of the GHG Methodology. Conclusions were based on research conducted prior to publishing the Exposure Draft and in response to the public comment period, the feedback received during the public comment period, the feedback received from the VBA piloting period,[17] and the objective of fulfilling the mandate of the IFVI and VBA partnership. Additional structural changes have been made, in alignment with changes to other Topic Methodology statements, to improve clarity and alignment with General Methodologies. The final version of the GHG Methodology was approved by the VTPC on September 5, 2024 and was published on September 17, 2024.

[16] https://ifvi.org/

[17] The feedback from the VBA piloting can be read on the VBA website: https://www.value-balancing.com/

1 Introduction

1.1 Document purpose

BC15. The GHG Methodology was developed to establish a standardized methodology to quantify the impacts of GHG emissions. The proposed purpose and scope were determined based on analysis of other environmental impact approaches in the ecosystem including the IWA and VBA methodologies, conversations among the technical staff about the topic and scope, and approval by the VTPC as part of the work plan for environmental topics. The GHG methodology serves as a single Topic Methodology within the broader impact accounting methodologies being developed by IFVI and VBA.

BC16. Section '1.1 Document Purpose' was consolidated to enhance flow and consistency across Topic Methodologies. A statement was added to reinforce the potential uses of the GHG Methodology. Statements about materiality and the linkages to other topic and industry methodologies were removed because the general nature of the statements led to some confusion.

1.2 Topic Description

BC17. Section '1.2 Topic Description' proposed an organizing definition for GHGs, provided context for where they originate, and described the impacts and importance they have for global society. The content of this section, particularly paragraphs [4 – 7], were developed using a synthesized understanding of GHGs coming from the United Nations Framework Convention on Climate Change (UNFCCC)[18] and the Intergovernmental Panel on Climate Change (IPCC).[19] No respondents commented on the content of these paragraphs.

BC18. A paragraph, [9], was added to establish a clear linkage between relevance, as defined in GM1, and value chain impact materiality. This paragraph states that the GHG Methodology includes value chain impacts and explains that these are considered because of their relevance from an impact materiality perspective. While the inclusion of value chain impacts is mentioned in other sections, this statement adds needed clarity to the introduction.

BC19. A second paragraph, [10], was added to provide examples where the application of the GHG Methodology could aid in decision-making. Several respondents made general comments about the importance of demonstrating how the application of the GHG Methodology could be used by entities. While this paragraph is not an exhaustive list of potential decisions that could be made using impact accounting, it stresses the importance of the GHG methodology in aiding decision-making and managing risk, not just quantifying impacts. Companion practitioner guides and case studies, including by IFVI and VBA, will continue to illustrate these uses.

1.3 Key Concepts and Definitions

BC20. Section '1.3 Key Concepts and Definitions' provides standardized definitions for five concepts that are important for using the GHG Methodology. The definitions were

[18] UNFCCC. (2024). *Glossary*.
[19] Calvin, K. et al. (2023). *IPCC, 2023: Climate Change 202. Synthesis Report*.

sourced from well-established organizations including the GHG Protocol, UNFCCC, and the IPCC.

BC21. One update was made from the Exposure Draft following public comment to maintain consistency with *General Methodology 2: Impact Measurement and Valuation Techniques* (GM2). The term 'discount rate' was renamed to 'social discount rate' both in this section and throughout the GHG Methodology. In the development of GM2, 'social discount rate' was determined to be a more broadly applicable term across different categories of potential preparers and to establish a distinction between discount rates used to discount well-being and discount rates used to discount financial values. There were no changes to the determination or application of the social discount rate. Respondents provided no other comments on this section.

1.4 Scope and Assumptions

BC22. Section '1.4 Scope and Assumptions' proposed what is and is not included within the boundaries of the GHG Methodology. Research reinforced the GHG Protocol as the primary resource for considering scope and alignment with standard setters. Aligning with the GHG Protocol led to the inclusion of all gasses emitted along the full value chain of an entity. The alignment with the GHG Protocol also aligns with data collected for other reporting standards that include coverage of all scopes (e.g. IFRS, ESRS, or GRI). This alignment outlines that a comprehensive assessment should include full scope emissions while simultaneously recognizing the challenges with Scope 3 emissions, necessitating guidance on addressing data gaps in Section 3.2.

BC23. Separate from emissions themselves, research was conducted around whether carbon offsets (developed or purchased), renewable energy certificates (RECs), and avoided emissions should be included within the scope of the GHG Methodology. The Exposure Draft proposed that all of these were out of scope to allow for clearer application of the GHG Methodology and to clearly delineate the impacts associated with GHG emissions specifically. This decision was reinforced during stakeholder engagements where concern was expressed about masking emissions impacts with offsets or 'greenwashing'. This topic was the subject of a targeted question during the public comment period because of the various perspectives on these topics.

BC24. Most respondents from public commenting were supportive of leaving these topics out of scope for this methodology but acknowledged that future development in a separate methodology would be important. VBA piloting feedback reinforces the request for more clarity on how impact accounting considers offsets and carbon credits either in a separate methodology or as a future addendum to this GHG methodology. A few respondents from public commenting stated that carbon offsets and purchased credits should not be considered at all because they are not a needed solution and could still mask emissions impacts, even if presented separately.

BC25. One respondent supported the idea of including avoided emissions within the GHG Methodology. Additional research was conducted to assess the role of avoided emissions in the methodology. Because the GHG Methodology proposes a full accounting based on realized emissions data, it was decided that any potential avoided emissions do not fit within the scope of the Topic Methodology. Because avoided emissions are calculated according to a different reference scenario in each context, they cannot be aggregated or

presented alongside other GHG impacts . However, this review also acknowledged that an assessment of avoided emission impacts could serve as a potential use-case for the GHG Methodology by comparing the results of GHG impacts with alternative benchmarks / reference scenarios. The production and use of the GHG Methodology to be used to assess avoided emissions will be prioritized in future work. Based on this respondent, the definition of avoided emission was also broadened to not only consider product-related emissions.

BC26. Based on various engagement with stakeholders, an additional review of the role of RECs was also explored. Because the GHG Protocol requires location-based and market-based (which include RECs) Scope 2 reporting, there was concern that not including them in the GHG Methodology would lead to lack of alignment with the GHG Protocol and standardized approaches used by entities. Additional debate and research determined that there is a clearly defined method for determining market-based emissions and that there are many contexts where they are useful. For these reasons, RECs are included within the scope of the GHG Methodology.

2 Impact Pathway

2.1 Summary

BC27. The Exposure Draft proposed the impact pathway for GHG emissions following the framework outlined in Section 4.5 of GM1. The impact pathway is the foundational framework for measuring and valuing impacts.

2.2 Description and Notes

BC28. The proposed inputs, outputs, outcomes, and impacts as well as the causal relationships linking each step were developed based on an extensive literature review and expert consultations. The research and consultations largely fell into two categories: (1) primary academic research that linked GHG emissions to environmental changes and/or well-being impacts or (2) existing GHG impact frameworks that synthesize and organize primary research into impact principles. Existing frameworks used to develop the impact pathway included those from the Impact Weighted Accounts Initiative,[20] the Value Balancing Alliance,[21] Capitals Coalition,[22] Transparent Project,[23] and WifOR.[24]

BC29. No respondents suggested that revisions should be made in defining components of the impact pathway. One responded asked for clarity about what types of impacts have not been captured in social cost of carbon models. The final version of the GHG Methodology has added a section in Appendix B that discusses model limitations (paragraphs [B25 – B28]) and a reference to Appendix B in paragraph [29].

BC30. The impact pathway was modified to separate environmental and human well-being outcomes in the outcomes section of Figure 2 and paragraph [26]. This was done to increase alignment with the definition of an outcome in GM1, the framework for well-being in GM2, and to ensure consistency across Topic Methodologies. Specifically, GM2 uses the framework of well-being from the OECD, categorized into current well-being dimensions and resources for future well-being. The GHG Methodology defines which of these well-being outcomes are affected in the outcomes section of the impact pathway.

[20] Impact-Weighted Accounts Project. (2022). *Practitioner Guide to Calculating Corporate Environmental Impact*.
[21] Value Balancing Alliance. (2021). *Methodology Impact Statement. Focus: Environment*.
[22] Natural Capital Coalition. (2021). *Natural Capital Protocol*.
[23] Project Transparent. (2023). *Standardized natural capital management accounting: A methodology promoting the integration of nature in business decision making*.
[24] WifOR Institute. (2023). *Underlying valuation approach, assumptions, and extrapolation.*

3 Impact Driver Measurements

BC31. Section 3 of the Exposure Draft proposed to guide preparers and users through the data needed to prepare impact accounts for GHG emissions. Three sections were presented that discussed the data requirements, how to source data and address with data gaps, and how the data requirements align with other sustainability reporting standards. To improve readability and accessibility of the document, section '3.3 Alignment with Reporting Standards' was moved to Appendix D. Table 1 illustrating alignment with ESRS, IFRS, and GRI was kept in the primary document and moved to section 3.1.

3.1 Data Requirements

BC32. The Exposure Draft proposed that a total accounting for GHG impact accounts should include Scopes 1, 2, and 3 of GHG emissions, as defined by the GHG Protocol.[25] Additionally, it proposed that all gases be converted to metric tons of CO_2 equivalents, separated into 4 categories, and supplemented with various notes and qualitative commentary. When questions arise, the GHG Protocol was proposed as the primary resource to guide preparers through calculations of GHG emissions.

BC33. The proposal to include a full accounting of Scope 1, 2, and 3 was explored through research and stakeholder engagement. Alignment with the data requirements for reporting to ESRS E1,[26] IFRS S2,[27] and GRI 305[28] was identified as a high priority. All of these standards require Scope 1, 2, and 3 emissions to be reported, aligning with the GHG Protocol. Additional analysis demonstrated that most emissions of an entity come from Scope 3 meaning that their exclusion of Scope 3 would lead to a large underestimation of impact. Therefore, the GHG Methodology includes a full accounting of Scope 1, 2, and 3 emissions. Preparers of impact accounts should adhere to this to the fullest extent possible.

BC34. The data requirements, particularly the separate presentation of Scope 1, 2, 3 upstream, and 3 downstream, were the subject of a targeted question during the public comment period. The Exposure Draft proposed that each category should be presented separately to increase transparency and decision-usefulness about where along the value chain most impacts from an entity occur. The majority of respondents and the feedback from VBA piloting were supportive of the separate presentation of upstream and downstream. Two comment letters suggest that data should be broken down into even further detail. One public comment respondent acknowledged the challenge of collecting scope 3 data suggesting that the data requirements may be too ambitious at this stage. One additional respondent stated that the level of granularity of the data may not be helpful to an investor who may not receive data in these categories. Because of the general support of the level of detail, the four categories were kept as defined in the Exposure Draft.

BC35. 'Table 1: Alignment with reporting standards' was moved to section 3.1 and modified to more clearly articulate the alignment with various reporting standards. Three categories of alignment with standard setters were developed: 'fully aligned', 'expands upon', or

[25] GHG Protocol. (2004). *The Greenhouse Gas Protocol: A corporate eaccounting and reporting standard*.
[26] ESRS. (2022). *Draft European sustainability reporting standards*.
[27] IFRS. (2023). *S2: Sustainability Disclosure Standard*.
[28] Global Reporting Initiative. (2016). *GRI 305: Emissions 2016*.

'independent' with associated definitions in a footnote. For the GHG Methodology, all data requirements are fully aligned with ESRS, IFRS, and GRI as indicated in Table 1.

3.2 Data Sources, Gaps, and Uncertainty

BC36. The Exposure Draft proposed that barriers exist that may limit preparers from having a complete accounting of GHG emissions. In an effort to faithfully represent all value chain emissions, the GHG Protocol was named as the primary resource to guide preparers through data collection and gaps. The GHG Protocol was chosen because it is the guidance for most entities and is referenced as the primary resource for collecting GHG emissions by major standard setters. In addition, there was concern that detailed guidance in the GHG Methodology that is distinct from the GHG Protocol may add confusion for preparers. The guidance in paragraphs [40 – 43] comes directly from the GHG Protocol, particularly *Greenhouse Gas Protocol (2011): Corporate Value Chain (Scope 3) Accounting and Reporting Standard*.[29]

BC37. The proposed guidance on data gaps and estimation was the subject of a targeted question during the public comment period. Several respondents were pleased with the alignment with the GHG Protocol to handle data gaps, particularly acknowledging that the GHG Protocol already has extensive guidance on this topic. Some respondents did ask for more detail on how to address data gaps proposing that examples and calculations could be presented. Additional review reinforced a need to continue to guide preparers through impact accounting. However, it was decided that this was best done in other documents which will continue to be developed by IFVI, VBA, and others in the impact accounting ecosystem.

[29] Greenhouse Gas Protocol. (2011). *Corporate value chain (scope 3) accounting and reporting standard*.

4 Outcomes, Impacts, and Valuation

BC38. In section '4: Outcomes Impacts and Valuation', the Exposure Draft proposed an approach to calculating entity GHG impacts by providing the necessary equations and value factor to use along with relevant background and context. This section is designed as the final step in the determination of GHG impacts and utilizes the impact driver data described in Section 3.

BC39. The clarity of the content in this section and the usability of the valuation equations were the subject of a targeted feedback question during the public comment period. Most respondents were highly supportive of the clarity of the equations and the calculation approach. However, several respondents as well as piloting VBA member companies asked for more clarification around various components of value factor development. These included questions about the climate projections used, the discount rate approach, and comparisons of the two models.

BC40. During the concurrent development of General Methodology 2, alignment across the General Methodology and Topic Methodologies was also reviewed. To better align with the principles of the impact pathway laid out in the General Methodologies, the organization of section 4 was updated. The section previously titled 'Value Factor' was separated into two sections. '4.2 Outcomes and Impacts', and '4.3 Monetary Valuation'. This structure allows preparers to better understand how the determination of outcomes and impacts is done separately from monetary valuation. The restructuring also brings added detail to sections 4.2 and 4.3 which address many of the public comments and VBA piloting feedback asking for clarity about the value factor and how the two models contribute to the estimated value.

BC41. To further address comments asking about SCC details, the text introducing the SCC framework that determines outcomes, impacts, and monetary valuation was moved to the beginning of the section. This section describes the rationale for using GIVE and DSCIM as the SCC models to develop the value factor, why the SCC was chosen over an abatement cost approach, and why the independent values from each model were averaged. The rationale included are the same as those described in paragraphs B6 and B6 of the Basis for Conclusions.

4.1 How to Calculate Impacts

BC42. The Exposure Draft proposed five equations to use to calculate impact using GHG emissions data. Equations 2 – 5 demonstrated how to multiply the value factor by GHG emissions data, separated into scopes 1, 2, 3 upstream, and 3 downstream. Equation 1 demonstrated how each of those impacts could be added together to determine a total impact for GHG emissions. This section reinforced the importance of considering each of the four scopes separately to increase transparency, comparability, and decision-usefulness.

BC43. Respondents to the public comment period were supportive of the presentation and clarity of this section and suggested no changes. Feedback from VBA piloting supported the separate presentation of the impacts of Scope 1, 2, 3 upstream and 3 downstream but also suggested that these should not be summed, as in equation 1. The concerns were that, across scopes, entities have different levels of control and that there are varying

levels of accuracy. Research revealed that ESRS E1 includes a total emissions reporting requirement and that an aggregated equation can be useful to certain preparers and users of impact information. For these reasons, equation 1 was kept unchanged along with the clear statements that the four scope categories should be considered and calculated separately.

BC44. Some respondents did encourage the GHG Methodology to require additional levels of granularity in the presentation of GHG impacts. One respondent asked for the methodology to utilize the 15 categories for scope 3 emissions from the GHG Protocol while another asked for added breakdown of scope 1 and 2. After review, a statement, paragraph [52], was added acknowledging that added levels of detail across all scopes likely will improve decision making. However, the breakdown of impacts into the four categories mentioned remained unchanged.

4.2 Outcomes and Impacts

BC45. Section '4.2 Outcomes and Impacts' proposed how the methodology determines the outcomes and impacts using the SCC models: GIVE and DSCIM. The organization of this section mirrors the structure of the SCC modules. This includes an explanation of the socioeconomic and emissions module, the climate module, and damage module.

BC46. Most respondents from public commenting and the piloting VBA member companies supported the use of the SCC framework but asked for more detail about certain features. In the Exposure Draft, many of the technical details were in 'Appendix B: Methodological Details' with the primary text pointing to the Appendix periodically. The restructuring and expanded detail in this section was in response to the high number of comments asking for clarity.

BC47. Specific comments asked for details around how exactly the value factor was determined, the climate scenarios used, differences between the two models, and a breakdown of each category of impact. The expanded detail provided in this section satisfies many of these comments. The information in this section is supported by expanded information in 'Appendix B: Methodological Details'. The GHG Methodology also now points more frequently to the Appendix to reinforce the information available.

4.3 Monetary Valuation

BC48. Similar to section 4.2, section '4.3 Monetary Valuation' provides added details about how the value factor is derived and is organized by describing the valuation technique used for each category of impact and the approach to discounting. Added details include the differences of the two models, a breakdown of each category of impact, and expanded detail about the social discount rate approach. These details have been included in paragraphs [55 - 56] or with footnotes pointing to the relevant section of Appendix B .

BC49. The Exposure Draft proposed a dynamic discount rate calibrated to meet a near-term target of 2%. The literature review revealed that a 2% social discount rate was reinforced by several recent publications,[30,31] matches real, risk-free interest rates observed over the

[30] Nesje et al. (2023): Philosophers and economists agree on climate policy paths but for different reasons.
[31] EPA. (2023): Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Science Advances.

last 30 years,[32] and follows a more equitable approach to valuing impacts on future generations. Utilizing a dynamic discount rate has also become recommended as it allows for calibration with economic growth and perceptions of discounting future impacts.

BC50. Most respondents had positive feedback in response to the targeted question about the approach to discounting. Many of the respondents stated clear support for the 2% target rate and the Ramsey formula including acknowledging that it aligned with prevailing understanding. Two respondents expressed concern that the discount rate was still too high citing concern that the value factor was still too low. Two other letters thought the discount rate was too low citing concern about it leading to a larger value factor that might slow uptake. Because of the prevailing consensus of recent research and the public comments supported the discounting approach, as well as the balance of perspectives suggesting changes, the discounting approach was kept as proposed in the Exposure Draft.

BC51. Several respondents asked for more detail about how the 2% dynamic discount rate was derived. In response, paragraph [56] was expanded to include added rationale for a 2% rate and the Ramsey formula. Added text also points to Appendix B paragraphs [B20 – B22] which has expanded the explanation of the discounting approach.

BC52. In the Exposure Draft, Box 2 proposed four criteria for why the SCC used to determine the value factor will be updated over time. These reasons included adjustments for inflation, updated damage functions that more fully represent the impacts of GHG emissions, updated estimation of future damages as they are closer to present day, and advancements to the approved models that align with principles and concepts laid out in the General Methodology. A respondent asked for clarification about the process for updating the SCC models. The updated GHG Methodology refers to an annual review of the literature for consideration of updates at that interval.

BC53. One respondent expressed concern that a single value factor is used for all greenhouse gasses. Social cost valuation techniques have been developed for methane and nitrous oxide separately from CO_2 and the respondent expressed concern that converting all gasses to CO_2e overestimates the impacts of these gasses, particularly methane. While social cost estimates do exist for some other gasses, there was concern that requiring certain gasses to be calculated separately with separate value factors would deviate significantly from the data requirements to align with ESRS, IFRS, and GRI. Therefore, the methodology has not been changed to require the separate calculation of methane and nitrous oxide. However, a footnote was added to paragraph [57] that references these alternative social costs and says that they could be considered if an entity has GHG data separated by each gas.

BC54. Piloting feedback of VBA member companies included the desire to provide context to the estimated value factor by providing an overview of SCC values calculated by different models and organizations. This was determined to go beyond the scope of the GHG Topic Methodology itself. Complementary documents or research could explore how the value factor compares to other models or organizations in the future.

[32] Carleton & Greenstone. (2022): A guide to updating the US government's social cost of carbon.

5 Future Development

BC55. Section ‘5 Future Development’ proposed several areas that had been identified as avenues of future development during the research process. These include the potential advancements in methods to quantify GHG emissions, advancements to SCC models, considerations of GHG offsets and carbon credits, and further incorporation of planetary thresholds and net-zero target frameworks into impact accounting.

BC56. While no respondents provided feedback directly on this section, a few changes were made that addressed broader comments. Specifically, language was added to acknowledge that data granularity could be improved in the future and gas-specific social costs could be explored. A clarification was made about the incorporation of carbon credits highlighting the development of credible frameworks in that space.

6 Appendices

BC57. In the Exposure Draft, the primary text of the methodology was supported by three appendices that provided a full glossary of relevant terms, additional methodological details around the development of the value factor, and guidance for value factors to apply to past and future years along with example calculations. The primary text was intentionally kept concise for clarity with the appendices allowing for additional detail that preparers and users of impact information might find useful.

BC58. 'Appendix A: Glossary' proposed a complete list of terms relevant to the GHG Methodology. Definitions for carbon dioxide removal and value of statistical life were added to support new text in the primary document. As mentioned previously, the definition of avoided emissions was broadened.

BC59. 'Appendix B: Methodological Details' proposed all details that may be needed to understand each SCC model used to develop the value factor. Some respondents asked for more details on some of the details that had been included in this appendix. To provide the needed clarity, some of the information in this section was moved to the main GHG Methodology. In other cases, this section was expanded upon with added detail. Notable additions include expanded details on the emissions scenarios used (paragraph [B7]), rationale for projections through the year 2300 (paragraph [B8]), additional explanation around the approach to discounting (paragraphs [B20 – B22]), explanation of each category of impact and linkage to the value factor (paragraphs {B23 – B24]), and model limitations (paragraph [B25 – B28]).

BC60. 'Appendix C: Future Value Factors' presents value factors from the year 2020 to 2035 to allow for backward- and forward-looking analyses by preparers and users. One respondent asked for a clarification for why the value factor increased each year. The values presented in Appendix C represent value factors for emissions occurring in those future years using the current SCC approach. These values are separate from the updating process that will occur in the methodology as updates to the SCC models occurs. The text clarified the rationale behind this increase.

BC61. 'Appendix D: Alignment with Reporting Standards' was moved from section 3.3. to the appendix. This was done to allow for added clarity in the main document while also providing more detail for preparers to understand the precise alignment across reporting standards.

BC62. 'Appendix E: Value Commission Transparency Report: Value Factor' has been added to demonstrate how the GHG emissions value factor aligns with various transparency criteria developed by the Value Commission.[33] The Value Commission brought together many experts to develop the Governance Framework for Valuation to drive transparency and accountability for application and use of value factors and valuations by organizations and businesses. The table in this appendix is organized similarly to early versions of the Value Commission framework. The final version of the Governance Framework for Valuation is expected to be published in early 2025.

[33] See https://capitalscoalition.org/project/the-value-commission/ for more information on the Value Commission.

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