

Accounting and Reporting of GHG Emissions from Real Estate Operations

Technical Guidance for the Financial Industry

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Partnership



G R E S B

GRESB, Netherlands



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PCAF Partnership for
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Financials

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Our approach to this Technical Guidance

The development of this guidance has been carried out in three stages of consultation beyond the combined expertise of the PCAF, GRESB, and CRREM teams. After the development of the first draft, it was shared with experts in the networks of the three partners, selected for their diversity of views and knowledge of the GHG accounting space in real estate. This was followed by a [public consultation](#) from May through June 2022 during which the draft guidance was available online and feedback was collected through a survey. Finally, the partners undertook a series of engagements with the GHG Protocol, UN-convened Net-Zero Asset Owner Alliance, and the Science Based Targets initiative, to align on the interaction between the GHG Protocol and the PCAF GHG accounting standard methodologies. The resulting document represents a concerted effort to help all actors along the real estate financial value chain understand and implement best practice GHG accounting for their real estate operations. Thank you to all who took part in this process.

Positioning of this Technical Guidance with regard to the PCAF Standard

This technical guidance document is developed to complement PCAF's Global GHG Accounting and Reporting Standard for the Financial Industry. It contains specific accounting and reporting recommendations for commercial real estate to allow further consistency in reporting for financial institutions. This document is intended for guidance only. In case of doubt, the requirements stipulated in the PCAF Standard always prevail for accounting and reporting of scope 3 category 15 emissions. In particular, disclosure of financed emissions using the methods presented in this document would be additional to disclosure as prescribed by the PCAF Standard and thus, not mandatory under the requirements stipulated in the PCAF Standard.

About GRESB

Mission-driven and investor-led, GRESB is the environmental, social and governance (ESG) benchmark for real assets. It works in collaboration with industry to provide standardized and validated ESG data to the capital markets. The GRESB 2022 Real Estate benchmark covered more than 1,800 property companies, real estate investment trusts (REITs), funds, and developers. Its coverage for infrastructure includes more than 800 infrastructure funds and assets. Combined, GRESB represents over USD 8.6 trillion in real asset value. More than 170 institutional investors constituting over USD 51 trillion in assets under management use GRESB data to monitor their investments, engage with their managers, and make decisions that lead to a more sustainable real asset industry. The GRESB Foundation – an independent, non-profit foundation – owns and governs the GRESB Standards upon which the GRESB Assessments are based.

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About PCAF

The Partnership for Carbon Accounting Financials (PCAF) is a global, industry-led initiative of financial institutions that work together to develop and implement a harmonized approach to assess and disclose the greenhouse gas (GHG) emissions associated with loans and investments, known as financed emissions. As of February 2023, over 360 financial institutions have committed to the initiative. In November 2020, PCAF published the first-ever Global GHG Accounting and Reporting Standard for Financial Industry, which covers the financed emissions of loans and investments in commercial real estate, mortgages, and various other asset classes. PCAF collaborates with several organizations, institutions, and coalitions, including CDP, the Science Based Targets initiative (SBTi), and the UN-convened Net-Zero Asset Owner Alliance (NZAOA). PCAF is supported by Guidehouse, a global consulting firm specializing in energy, sustainability, risk, and compliance for the financial industry. Guidehouse serves as the Secretariat of PCAF, providing technical support to PCAF signatories in the development and implementation of the Global GHG Accounting and Reporting Standard for the Financial Industry.

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About CRREM

The Carbon Risk Real Estate Monitor (CRREM) initiative has derived decarbonization pathways that translate the ambitions of the Paris Agreement (to limit global warming to 1.5°C by the end of the century) into regionally- and property-type-specific trajectories against which real estate assets and portfolios can benchmark themselves. The pathways and the developed free-ware tool can be used to derive quantitative figures regarding “transition risk” (in this case, the risk of assets being stranded due to regulatory incompliance or market obsolescence). The non-for-profit-initiative is supported by the EU Commission, Laudes Foundation as well as APG, PGGM, Norges Bank Investment Management (NBIM).

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Executive Summary

Climate change, as well as the counteractive voluntary and regulatory efforts to mitigate greenhouse gas (GHG) emissions in alignment with the ambitions of the Paris Agreement, is already having a significant impact on the financial performance and value of real estate assets. Consequently, organizations that own, finance, occupy, or manage properties face growing financial exposure to these climate-related risks. In parallel, many financial institutions are committing to various goals including reducing their financed emissions to net zero by (at the latest) 2050 and mobilizing capital markets in the global transition to a low-carbon economy.

Credible GHG emissions information enables institutions to assess climate-related transition risks in line with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD), set science-based targets, inform their strategies for climate action, and disclose progress to relevant stakeholders.

The GHG Protocol's Corporate Accounting and Reporting Standard (Corporate Standard) is the most widely used basis for the accounting and reporting of GHG emissions. The PCAF Global GHG Accounting and Reporting Standard for the Financial Industry (PCAF Standard) refines and extends the GHG Protocol's accounting rules for scope 3 category 15 (investments) emissions, or so-called "financed emissions", with an aim to provide detailed guidance per asset class.

The accounting and reporting of financed emissions for the 'real estate' asset class differs from that of corporate emissions. Corporate reporting boundaries often deviate from building (asset-level) reporting boundaries. For many accounting and reporting purposes, especially that of financial institutions, all GHG emissions emitted within the building boundary must be included in either scope 1, 2, or 3. GRESB, PCAF and CRREM support this so-called 'whole-building approach' which takes a holistic view of the asset. To decarbonize an entire property or benchmark a building's operational emissions profile against that of its peers, it is crucial to have a complete understanding of all emissions from an asset.

GHG accounting can be used for various purposes: annual reporting, regulatory disclosure, and validated target setting or more exploratory endeavors including the estimation of transition risk and strategic asset management. While many of the same GHG accounting principles are used regardless of the intended purpose, some occasions require additional methodological constraints to ensure clear, consistent, and comparable outputs. Some methods are useful for purposes such as the forward-looking management of transition risk, but such practices might not be appropriate for the disclosure of real performance for reporting practices.

This document is the first version of a jointly developed technical guidance for accounting and reporting GHG emissions from real estate operations. It is intended for financial institutions (banks and investors), and, insofar as they require standardized information, for their underlying real estate assets, asset managers, and companies. The purpose of this document is to provide stakeholders with transparent, consistent, and harmonized guidelines for the accounting and reporting of real estate-related operational emissions. Such guidelines are crucial to the credibility

of information on financed emissions and the subsequent decision-making by investors. It serves as a best practice document with additional specifications to the PCAF Standard on a range of technical, data, and standards issues relating to GHG from real estate operations. To ensure transparency and robustness, this document has been circulated for public consultation prior to final publication.

Main clarifications and key recommendations included in this technical paper are:

- Clarification on the interaction between corporate GHG accounting and accounting of financed emissions;
- Differentiation between GHG accounting for reporting and for other purposes (e.g., transition risk management);
- Clear definitions for GHG emissions from real estate and differentiation of various categories, including a review of operational carbon vs. embodied carbon in the real estate sector;
- Application of the GHG Protocol Corporate Standard for real estate;
- The importance of capturing all relevant emissions via the whole-building approach;
- Clarification on emissions scope delineation and attribution for various financial actors and boundaries between tenant and landlord emissions; and
- Recommendations for the application of market- and location-based emission factors; estimation of incomplete data; handling of energy flux measurement; floor space measurement; as well as for quality assurance and verification; and other technical topics.

Introduction

The Paris Agreement aims to limit global warming to well below 2°C, with aspirations toward 1.5°C, to mitigate the worst impacts of catastrophic climate change.¹ These high-level, long-term goals need to be supported with policy actions that allocate decarbonization responsibilities across economic sectors, countries, actors, and assets. All market participants need to understand their role in the fight against climate change and align their operations with this goal. However, how to achieve alignment with the goals of the Paris Agreement at the asset level must be clearly defined and presents a major challenge for financial institutions (FIs).

Additionally, the large economic, environmental, and social rebalancing required by global environmental and economic systems to decarbonize to the degree necessary, has introduced the concept of ‘transition risk’. Transition risk concerns the risks related to the global transition to a low-carbon economy. In the real estate sector, transition risks manifest with the introduction of tighter emission reduction policies, higher carbon and energy costs, shifts in market preferences towards zero-emission properties, and the technological, organizational and behavioral challenges of achieving high energy efficiency. It is consequently of high priority for FIs and other organizations to disclose GHG emissions and transition risks of their assets to stakeholders in a clear and transparent manner.

GHG accounting allows for FIs to measure, aggregate, and disclose their emissions to address these challenges, including alignment with global goals and assessment of linkages between the emissions of their assets and their financial performance.

In practice, however, there remain major challenges to be addressed or overcome related to data collection, measurement, calculation, or accounting methodologies for different purposes -- from regulatory disclosure and reporting to exploratory risk management -- and the transparent presentation of GHG emissions within the real estate sector. In particular, the responsibilities for these emissions, and subsequently the reporting requirements, are usually distributed amongst different stakeholders – primarily landlords and tenants – making it difficult to derive clear and consistent implications for investors and financing banks.

This paper predominately focuses on operational emissions. However, embodied carbon is an important source of GHG emissions in real estate accounting, and they can and should be measured or estimated in every project to activate the best possible solution. Due to the focus of this guidance on the accounting and reporting of actual in-use / operational emissions in real estate and, consequently, the aim for real emissions reductions, carbon offsetting is not addressed in this paper.

¹ According to the Intergovernmental Panel on Climate Change (IPCC) Special Report: Global Warming of 1.5°C (2018) global temperature increase must be capped at 1.5°C to avoid the worst climate change effects.

This document is the first version of a technical guidance for accounting and reporting of GHG emissions from real estate operations. It is intended for financial institutions (banks and investors), and, insofar as they require standardized information, for their underlying real estate assets and companies. Its purpose is to provide financial institutions with transparent, consistent, and harmonized guidelines for the accounting and reporting of real estate-related emissions. It includes accounting guidance for both investors and banks, direct and indirect investments, equity and debt, full ownership, and joint partnerships, under a variety of consolidation approaches. It serves as a best practice document with additional specifications to PCAF's Global GHG Accounting and Reporting Standard for the Financial Industry on a range of technical, data, and standards issues relating to GHG from real estate.

The report is divided into three main sections:

1. **GHG accounting.** The first section explores and clarifies basic differences between various accounting requirements and the main frameworks available to support corresponding reporting.
2. **GHG emissions in the real estate sector.** The second section outlines the data collection and GHG accounting requirements related to the accounting of operational GHG emissions of properties.
3. **Guidance and recommendations.** The third section explores the main barriers that financial institutions encounter in the process of estimating and disclosing climate-related risk and accounting on GHG emissions, as well as provides best practice guidance on how these challenges should be handled.

GHG Accounting

What is GHG accounting?

GHG accounting is a necessary step for organizations to manage, align, and control their emissions. Accounting here refers to the processes required to measure the amount of GHGs emitted, avoided, or removed by an entity (e.g., asset or company) over a specific period of time. It allows companies or entities to monitor and report these emissions in line with other accounting practices – e.g., financial reporting.

GHG accounting processes evaluate and set targets, as well as plan GHG reduction strategies and actions more quickly and cost-effectively. The most used standards available for companies to monitor and report GHG emissions (based on emissions associated with final consumption)² are those of the GHG Protocol and ISO 14064.³

While carbon dioxide (CO₂) is often viewed as the primary harmful GHG emitter, it is by no means the only gas that needs to be considered. According to the Kyoto Protocol, GHGs include CO₂, methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆), and nitrogen trifluoride (NF₃).⁴ While “carbon accounting” and related terms (e.g. carbon footprint, carbon intensity) are often used to refer to their GHG counterparts (e.g. GHG accounting, etc.), including the conversion of these other GHGs into so-called ‘carbon dioxide equivalents’ [CO₂e], it is recommended to clearly use the term “GHG accounting” when referring to more than just carbon dioxide emissions.

Importance and applications of GHG accounting

GHG accounting of loans and investments is crucial to increasing transparency and ensuring aggregated GHG figures do not exceed defined thresholds. As such, it is a crucial step in limiting dangerous global warming and achieving the goals of the Paris Agreement. Furthermore, due to the rising prevalence of transition risks across the global economy, it is of high importance for financial institutions to assess these risks related to their real estate portfolios, a particularly exposed sector, and constantly report the GHG emissions (and disclose the ongoing reduction). GHG accounting allows financial institutions to reveal the linkage between financial performance and GHG emissions of their real estate assets to their stakeholders.

A distinction must be made between GHG accounting for regulatory disclosure and reporting purposes, and for metric production for other purposes such as risk management, target setting, or benchmarking.

2 Production-based methodologies, in which emissions are calculated based on energy generation and other sector processes, are generally used for national accounting purposes. The reporting methodology for national accounting was established by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, which were revised in 2013. As signatory to the Kyoto Protocol and Annex I party of the United Nations Framework Convention on Climate Change (UNFCCC), the participating countries are required to report their GHG emissions to the United Nations annually.

3 The standard ISO 14064 ‘specifies principles and requirements at the organization level for quantification and reporting of GHG emissions and removals. It includes requirements for the design, development, management, reporting and verification of an organization’s GHG inventory.’ (ISO, 2018).

4 UNFCCC, 2012; ICMS, 2021, p. 26.

Reporting is meant to give a standardized and consistent view of real performance, or what happened in a given time period. It provides the best understanding of either past or present data. Reporting and disclosure on GHG emissions is an essential aspect of the wider area of non-financial reporting, including Environmental, Social, and Governance (ESG) information, which is of increasing interest to stakeholders spanning the investment community to the broader public. GHG accounting is also central to climate-related disclosures (see *Appendix I*)⁵.

GHG accounting principles and methods also serve as the basis for other uses such as benchmarking, target setting, risk management, etc. However, these other purposes may take advantage of additional methods that modify the actual GHG performance and thus might be inappropriate for reporting, in which standardization and the reflection of real performance is paramount. Such methods might use different boundaries, incorporate assumptions about the future to predict and project, normalize various aspects of the data, or include artificial intelligence- or machine learning-based processing of data. Some of these technical methods, their recommended use and requirements for reporting are presented in the *Guidance and Recommendations* section of this document.

Similarities of GHG accounting for reporting purposes and metric production for other purposes are:

- Often based on the same intensity metrics.
- Should cover all seven GHGs, not just carbon dioxide.
- Should follow the GHG Protocol Corporate Standard⁶ where possible.

Potential differences between GHG accounting for reporting purposes and metric production for other purposes are:

- GHG accounting for reporting purposes considers past or present data, whereas risk management takes past or present GHG data as a starting point and incorporates forward-looking data to create projections.
- Risk management has greater flexibility regarding assumptions and methodological alterations.

GHG accounting alone cannot provide a full picture of how a real estate asset is likely to perform in a net-zero world. Other factors that finance providers need to consider include an understanding of the sophistication of energy markets where the assets are located, the granularity of metered data, and the tenant's ability to purchase electricity from their retailer of choice. Effective energy benchmarking programs with mandatory disclosure provide market recognition of performance. Finally, data collection is essential, but limited information is often the main challenge in calculating (financed) emissions. However, such limitations should not hinder financial institutions and other corporates from starting their GHG accounting journeys.

5 This technical guidance helps financial institutions to align with upcoming mandatory and voluntary reporting requirements, e.g. from the International Sustainability Standards Board (ISSB), European Banking Authority (EBA), European Sustainability Reporting Standards (ESRS), and US Securities and Exchange Commission (SEC).

6 Detailed in following section.

Corporate GHG accounting

The GHG Protocol's A Corporate Accounting and Reporting Standard⁷ (Corporate Standard) provides an accounting and reporting framework including standards, guidelines, and tools. The Corporate Standard was first published in 2001, with a revised edition released in 2004, and establishes a framework to measure and report GHG emissions from private and public sector operations, value chains, and mitigation actions.

The GHG Protocol defines three different scopes of carbon emissions – scope 1 referring to direct GHG emissions, scope 2 referring to indirect GHG emissions from supplied electricity, heating, and cooling, and scope 3 referring to other indirect GHG emissions (see *Appendix II*). Generally, the scopes approximate the level of control an organization has with respect to the emissions (direct or indirect) of each scope and their capacity to reduce them. Besides its application for reporting, this approach is useful in developing carbon reduction plans and is widely adopted by most enterprises. The alignment of data collection, management methodologies and calculation methods ensure interoperability with other reporting initiatives that have adopted the Corporate Standard.

The GHG Protocol Scope 2 Guidance⁸ (Scope 2 Guidance) from 2015 is an amendment to the Corporate Standard. It provides clarifications, updated requirements and best practices on scope 2 accounting and reporting, especially on the location-based and market-based method (see section *Location-based vs. market-based method* for further guidance).

The Corporate Value Chain (Scope 3) Accounting and Reporting Standard⁹ (Scope 3 Standard) is another supplement to the Corporate Standard published in 2011 to provide accounting and reporting requirements for scope 3 emissions. The Scope 3 Standard categorizes scope 3 emissions into 15 categories. The Technical Guidance for calculating scope 3 Emissions¹⁰ is yet another supplement published in 2013.

Financed Emissions

“Financed emissions” refer to GHG emissions associated to loans and investment portfolio (equity or debt) falling into a financial institution's scope 3 category 15.¹¹

As per the GHG Protocol¹²:

Cat 15. Investments: This category includes emissions associated with the reporting company's investments in the reporting year, not already included in scope 1 or scope 2. This category is applicable to investors (i.e., companies that make an investment with the objective of making a profit) and companies that provide financial services. Investments are categorized as a downstream scope 3 category because the provision

7 GHG Protocol, 2004.

8 GHG Protocol, 2015.

9 GHG Protocol, 2011a.

10 GHG Protocol, 2013.

11 PCAF, 2022.

12 GHG Protocol, 2013, p. 136.

of capital or financing is a service provided by the reporting company. Category 15 is designed primarily for private financial institutions (e.g., commercial banks), but is also relevant to public financial institutions (e.g., multilateral development banks, export credit agencies, etc.) and other entities with investments not included in scope 1 and scope 2.

Accounting for financed emissions, including those from their real estate portfolio, enables financial institutions to methodically measure, aggregate, and disclose these important emissions at a fixed point in time, in line with financial accounting periods.¹³ These disclosures are crucial to understand the climate impact of loans and investments – i.e., the contribution to global GHG emissions – as well as to engage in science-based target setting, climate-related transition risk management and the steering of their portfolios towards net-zero financed emissions.

To further detail the accounting and reporting requirements of scope 3 category 15 specifically for financial institutions, the PCAF Global GHG Accounting and Reporting Standard (PCAF Standard) was developed. The financed emissions part of the PCAF Standard (Part A) is most relevant and sets the basic requirements for this real estate guidance.

Consolidation approach and GHG accounting of Real Estate

In GHG accounting, defining the organizational boundary is key. This step determines which operations are included in the company's organizational boundary and how emissions from each operation are consolidated by the reporting company. As detailed in the GHG Protocol Corporate Standard, a company has three options for defining its organizational boundaries as shown in table 1-1.

TABLE 1-1: CONSOLIDATION APPROACHES

Consolidation approach	Description
Equity share	Under the equity share approach, a company accounts for GHG emissions from operations according to its share of equity in the operation. The equity share reflects economic interest, which is the extent of rights a company has to the risks and rewards flowing from an operation.
Financial control	Under the financial control approach, a company accounts for 100 percent of the GHG emissions over which it has financial control. It does not account for GHG emissions from operations in which it owns an interest but does not have financial control.
Operational control	Under the operational control approach, a company accounts for 100 percent of the GHG emissions over which it has operational control. It does not account for GHG emissions from operations in which it owns an interest but does not have operational control.

SOURCE: GHG PROTOCOL CORPORATE ACCOUNTING AND REPORTING STANDARD, 2004

13 PCAF, 2022.

The GHG Protocol defines financial and operational control as:

- Financial control = the reporting entity has the ability to direct the financial and operating policies of the operation with a view to gaining economic benefits from its activities.¹⁴
- Operational control = the reporting entity or one of its subsidiaries has the full authority to introduce and implement its operating policies at the operation.¹⁵

According to GHG Protocol Corporate Standard, companies should use a consistent consolidation approach across the scope 1, scope 2, and scope 3 inventories. The selection of a consolidation approach affects which activities in the company's value chain are categorized as direct emissions (i.e., scope 1 emissions) and indirect emissions (i.e., scope 2 and scope 3 emissions) as well as which share of emissions is reported.

A transparent allocation of emissions to the scopes of individual stakeholders is crucial for all institutions that report carbon emissions independently. Companies must account for and report emissions from each scope separately. Generally, each stakeholder involved in the construction, operation, finance, and maintenance of a building has their own possibilities to influence carbon emissions (see section *Whole-building approach* for more details).

Operations or activities that might not be captured in a company's scope 1 and scope 2 inventories as a result of the organizational boundary definition (e.g., leased assets, investments, and franchises) may become relevant when accounting for scope 3 emissions.

For example, if a company selects the operational control approach, 100% of the emissions from any asset the company controls are included in its scope 1 and 2 emissions, but emissions from any asset the company wholly or partially owns but does not control (e.g., lending or minority investments) are excluded from its direct emissions and would be included in its scope 3 inventory.

The emissions resulting from a commercial bank's loan-book, as well as its minority equity or bond investments in a real estate company, fall under downstream emissions. More precisely, these emissions fall under scope 3 category 15 (investments) of the Corporate Standard. According to the scope 3 Standard, GHG emissions from loans and investments should be allocated to the reporting financial institutions based on the proportional share of lending or investment in the borrower or investee. The PCAF Standard builds on the GHG Protocol's accounting rules for scope 3, category 15 (investments), and provides detailed guidance per asset class.

At the asset (building) level, the Corporate Standard dictates that specific emissions may be categorized and reported as either scope 1, 2, or 3 depending on the delineation of organizational boundaries, choice of consolidation approach (see above), and the type of lease agreements in place. This works well for corporate reporting because each business can report in a manner that most appropriately reflects its situation and reporting purpose. However, when aggregating information about GHG emissions to the portfolio level, the choice of organizational boundaries

¹⁴ GHG Protocol, 2004, p. 17.

¹⁵ GHG Protocol, 2004, p. 18.

and consolidation approach can no longer be determined by the individual assets and companies. Instead, a single method must be imposed upon each asset so that the emission scopes retain their physical meanings upon aggregation. Therefore, while the accounting of financed emissions will leverage the same framework and vocabulary of the GHG Protocol, additional constraints must be placed upon the consolidation approach used to ensure that the resulting portfolio-level information serves the purposes required by financial institutions (see section on *The GHG Protocol Corporate Standard and the PCAF Standard* for more information).

Summary points of section *GHG Accounting*:

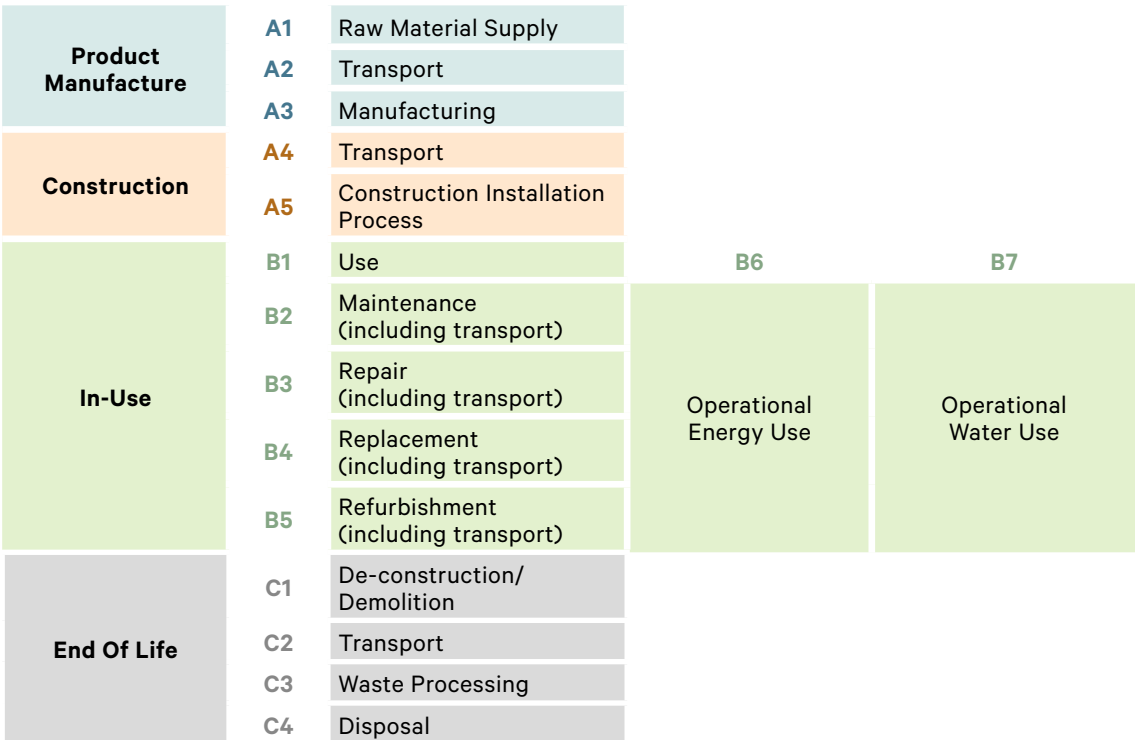
- GHG accounting enables financial institutions to manage, align, control, and report emissions in a transparent, robust, and standardized manner. Standardized processes and methodologies facilitate the setting of climate-related targets, align with broader ESG and climate-related initiatives (e.g. TCFD) and monitor progress against such efforts more quickly and cost-effectively. Moreover, financial institutions are able to participate in benchmarking initiatives, reveal linkages between financial performance and GHG emissions, and assess and mitigate transition risks.
- Even though there are many similarities, it makes a difference if accounting is applied for reporting, which is meant to give a standardized and consistent view of real performance, or other purposes such as target setting and risk management, with more flexibility regarding assumptions and methodological alterations – e.g., forward-looking and/or normalized data.
- The GHG Protocol's Corporate Standard is the most widely used basis for GHG accounting, establishing a framework to measure and report GHG emissions from private and public sector operations, value chains, and mitigation actions. The PCAF Standard builds on the Corporate Standard and provides a standardized approach to account for financed emissions with detailed guidance per asset class.
- It is particularly crucial for financial institutions to assess, track, and disclose the emissions of their building portfolios or loan books and continuously monitor performance related to emissions reduction, regardless of whether those emissions are accounted for as their scope 1, 2 or 3 emissions.
- Defining the organizational boundary is a key step in GHG accounting. A company has three options for defining its organizational boundaries as defined in the GHG Protocol Corporate Standard: equity share, financial control, and operational control. Companies should use a consistent consolidation approach across the scope 1, scope 2, and scope 3 inventories.

GHG Emissions in the Real Estate Sector

A built asset’s overall GHG footprint consists of operational and embodied carbon emissions, and these emissions occur throughout the whole life cycle¹⁶ of the building.

Standards that define the different sources of carbon emissions in buildings are CEN/TC 350¹⁷ and the application of EN 15978¹⁸. EN 15978 identifies four stages in the life of a building: product manufacture, construction, in-use, and end-of-life (see Figure 2-1).¹⁹ It also details subcategories to pinpoint specific sources of emissions.

FIGURE 2-1: EN 15978 BUILDING LIFE-CYCLE STAGES



SOURCE: EN 15978, BSI, 2011.

16 A life cycle assessment (LCA) seeks to ‘quantify and address the environmental aspects and potential environmental impacts throughout a product’s life cycle from raw material extraction through to end-of-life waste treatment’ (GHG Protocol, 2011b, p. 21). The product life cycle is defined by different standards, including ISO 14040:2006 (ISO, 2006a) and ISO 14044:2006 (ISO, 2006b). The GHG Product Life Cycle Accounting and Reporting Standard (GHG Protocol, 2011b) seeks to consistently report and quantify LCA analyses.

17 European Committee for Standardization CEN/TC 350 – Sustainability of construction works.

18 BSI, 2011.

19 EN 15978 also identifies a stage D, which outlines benefits and loads beyond the building lifecycle including reuse, recovery, recycling, and exported energy. These modules will be of great importance for advancements in the built environment with regard to circularity.

‘Product Manufacture’ includes the extraction of raw materials (A1), transport to a point of manufacture (A2) and the process of transforming them into construction products (A3). ‘Construction’ involves the transportation of construction products to site (A4) and the on-site construction processes involved in assembling them into a building (A5). ‘In-Use’ covers the use (B1) – emissions resulting from the use of building elements/materials e.g., concrete carbonation, maintenance (B2), repair (B3), replacement (B4), and refurbishment cycles (B5) of the building components as well as the consumption of energy (B6) and other resource use (B7) during its occupation. In the final stage, ‘End-of-Life’, the building is deconstructed or demolished (C1), and its redundant components transported (C2) off-site, processed (C3), and disposed (C4).

Embodied Carbon

Embodied carbon emissions can be defined as the total GHG emissions generated to produce, maintain, and dispose of a built asset. This includes what is known as “upfront embodied carbon”²⁰ — related to the extraction, manufacturing, transportation and assembly of every building material used to build an asset (identified in modules A1 to A5 in figure 2-1 above) — and “downstream embodied carbon”²¹ — related to materials and processes to maintain the building during the use stage, and end of life treatment of the building elements/materials after its use (identified in modules B1 to B5, and C1 to C4 in figure 2-1 above). Downstream embodied carbon emissions exclude module B6 and B7, which are categorized as operational modules.

The upstream embodied carbon (A1-A5) of existing buildings can generally be regarded similar to “sunk costs” in economics. That is, carbon that is already locked in the building envelope and carbon that has been released in all upstream activities that led to building construction have already been released and are out of range of incentivized reduction.²² Therefore, the focus of GHG emission reductions in operation is the in-use-phase. According to EN 15978, operational carbon emissions are those caused by the energy consumed by building-integrated technical systems during the operation of the building. Operational carbon emissions include heating, cooling, ventilation, lighting, cooking, IT and equipment, and, in some cases, fugitive emissions. Following EN 15978 classification, these emissions fall within stage B6.

Emissions from energy used to pump water in B7 are not included in the scope of this guidance as they are captured by a different set of stakeholders. Similarly, emissions generated from the off-site processing of waste generated by the building are not included.

Historically, the operational stage has usually constituted the largest source of emissions during the lifetime of the building. However, this is quickly changing in many countries and in general the proportion between embodied and operational carbon in the life cycle of building components is often underestimated. Even without considering any future grid decarbonization, embodied

²⁰ WGBC, 2019.

²¹ WGBC, 2019.

²² There are efforts to inventory materials in standing buildings for the purpose of re-using and recycling them in end-of-life stage of the buildings. Such efforts may eventually lead to the reduction of embodied carbon of the buildings into which these materials are re-purposed.

carbon from newly constructed buildings from today until 2050 may equal their cumulative operational GHG emissions in the same period.²³

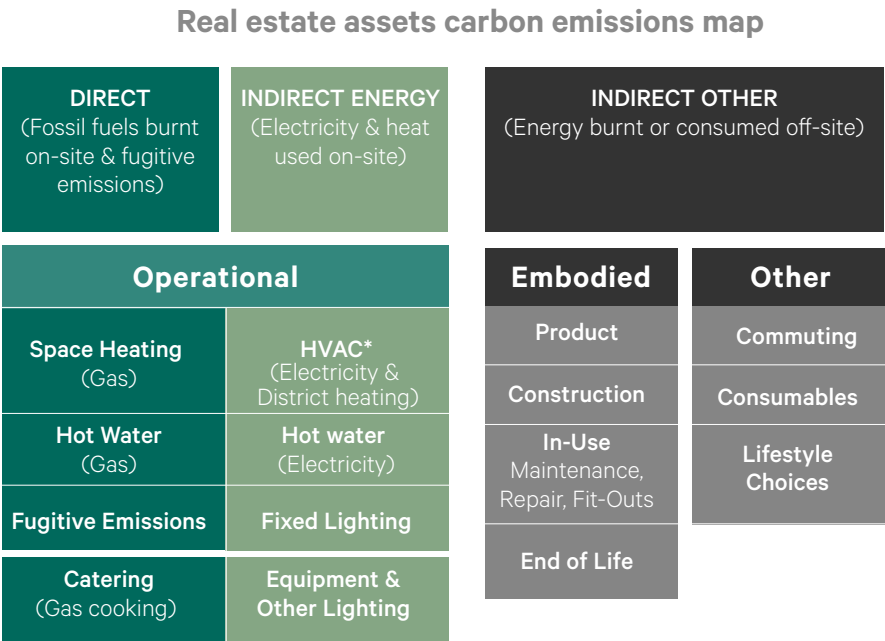
The guidance and recommendations in this document are focused on operational emissions (B6). However, embodied carbon and emissions over the entire lifecycle of buildings are extremely important, and data and reporting on whole lifecycle emissions of buildings will very likely be required in the near future.

Operational GHG Emissions

DIRECT AND INDIRECT EMISSIONS

GHG emissions from buildings arise from the energy consumption leading to direct and indirect CO₂ emissions and they are resulting from leakages of fluids in cooling and heating systems that could lead to fluorinated gases (F-gases). The energy consumption of buildings and the associated GHG emissions consists of various categories. Figure 2-2 shows an overview of these.²⁴ Two crucial differentiations of emissions occur between direct and indirect emissions, and between operational and embodied carbon.

FIGURE 2-2: GHG EMISSIONS IN BUILDINGS



*HVAC: Heating, Ventilation & Air Conditioning
SOURCE: CRREM

23 Bionova Ltd., 2018. / according to IEA, 2021: Additional floorspace will grow from 244 bn m² in 2020 to approx. 4.27 bn m² in 2050. The growth of approx. 1.83 bn m² multiplied by just e.g. 500 kg/CO₂e/m² would already closely match the remaining operational budget in that period.

24 The figure does not intend to provide an exhaustive list of all possible emission sources, but an illustrative example of the most common situation (emissions from waste and water consumption are not included here), e.g., in the EU there is the further differentiation between regulated (covered by the EPCs) and unregulated emissions (see *Appendix IV* for an overview).

In the context of real estate, direct emissions occur within the site boundaries (through fuel burning and refrigerant leakages), whereas indirect emissions are released off-site (including the generation of electricity consumed in the building or the use of district heating and/or cooling).

As described above, the Corporate Standard classifies emissions into three ‘scopes’.²⁵ This classification is closely related to the concept of direct and indirect emissions, highlighted in Figure 2-2. Importantly, scope 1, 2, and 3 emissions are described below using generalized patterns of ownership most often seen in corporate reporting. The ‘scope’ of a particular emission is determined by the role of the reporter and purpose of reporting and, as mentioned in the previous chapter, by the chosen consolidation approach (i.e., equity share, financial control, operational control approach). The selection of a consolidation approach affects which activities in the company’s value chain are categorized as direct emissions (i.e., scope 1 emissions) and indirect emissions (i.e., scope 2 and scope 3 emissions). For financial institutions reporting on the GHG emissions from real estate operations, please refer to the *GHG Protocol Corporate Standard* and the *PCAF Standard* section below.

Scope 1 – Direct emissions: fossil fuels and refrigerant losses

Scope 1 includes all direct GHG emissions from sources the organization owns or controls. Regarding buildings, the primary source of scope 1 emissions is the burning of fossil fuels and, to a lesser extent, biomass to produce heat – e.g., for power generation, space heating, production of domestic hot water, and cooking. Fuels used in the built environment can be gaseous (e.g., natural gas), liquid (e.g., heating oil), or solid (e.g., coal and biomass).

Another significant source of direct GHG emissions in the building sector is the fugitive emissions released through the leakage of fluorinated gases (F-gases) (including HFCs and PFCs) during the use, regular refilling, and disposal of refrigeration and air conditioning equipment.²⁶ Fluorinated gases are emitted “primarily from cooling/refrigeration and insulation with foams”. Emissions associated with cooling or refrigeration are regarded as direct emissions, whereas emissions produced during manufacturing insulation materials rank among indirect emissions (embodied carbon). Since these gases are not directly related to heating and energy consumption, they are often overlooked and not tracked at all.

In Europe they amount to approximately 18% of all GHG combusted/emitted on site.²⁷ Global emissions from F-Gases amount to 1.7 Gt CO₂e annually.²⁸ According to the IPCC, buildings account for ‘an eighth to a third of F-gases’.²⁹ Other sources convey percentages up to more than 50%.³⁰ For some commercial real estate assets, retail properties in particular, these emissions can account for up to 20 to 30% of the overall CO₂e intensity.³¹ In very energy efficient buildings this share can be even higher. The Phase-Down Pathway for F-Gas emissions was already agreed by the Montreal Protocol’s Kigali Amendment in 2016. All countries are divided into two sections:

25 GHG Protocol, 2004, p. 25.

26 GRI, 2016.

27 EEA, 2021.

28 Olivier and Peters, 2020.

29 IPCC, 2014. / De Graaf et. al, 2021.

30 UNEP, 2011.

31 CRREM analysis for a European retail owner with more than 500 stores.

Article 5 and Non-Article 5 countries. Article 5 countries are committed to a less ambitious phase down. The non-article 5 countries are committed to undergo a much faster phase down. Legislators are allowed to deploy a faster track.

Scope 2 – Indirect emissions: electricity and district heating/cooling

Scope 2 emissions include indirect “emissions from the generation of purchased or acquired electricity, steam, heat, or cooling”.³² In buildings, the typical source of scope 2 emissions is electricity consumption, but the emissions from purchased heat or cooling are also included — e.g., heat or cooling purchased from district heating or cooling networks.

The GHG Protocol defines two calculation methods for the measurement of scope 2 emissions:

- 1 The **location-based method** quantifies scope 2 GHG emissions based on average emissions intensity of the electricity grids within which the energy consumption occurs. Emission factors (EFs) are often defined using national boundaries, but can also be based on subnational, or even local, boundaries.
- 2 The **market-based method** quantifies scope 2 GHG emissions based on emissions associated with the generators from which the entity purchases electricity. As such, the market-based method reflects the choices an entity makes on its electricity supply, providing a mechanism to account for renewable electricity purchases that reduce emissions.

See the *Location-based and Market-based Methods* section in the *Guidance and Recommendations* below.

Scope 3 – Other indirect emissions

A scope 3 emission can be defined as an ‘other indirect greenhouse gas emission, other than purchased energy-related GHG emissions, which is a consequence of an organization’s activities, but arises from GHG sources that are owned or controlled by other organizations.’³³ The boundary of scope 3 GHG emissions can be defined very broadly depending on the reporting objective, including upstream and downstream emissions from various parts of a value chain.

³² GHG Protocol, 2015.

³³ ISO, 2018.

CALCULATION OF OPERATIONAL GHG EMISSIONS FROM BUILDINGS

Organizations often focus their data gathering efforts on energy consumption [kWh] and related intensity metrics (e.g. [kWh/m²/y]). These metrics help organizations differentiate energy consumed from different sources, and enable benchmarking, like-for-like comparison, and optimization over time.

The most common method to calculate the operational carbon emissions of buildings is by converting the amount of energy consumed in the asset (kWh) and other GHGs emitted on site (e.g., fluorinated gases) into carbon equivalent emissions (kgCO₂e). This conversion is done by means of EFs, also called conversion factors, carbon factors, fuel intensity factors. These are energy/fuel source-specific coefficients, generally expressed in kgCO₂e/kWh or kgCO₂e/m³ of gas, that are normally calculated or validated by national or supra-national administrations for consistent GHG calculation and reporting within their geographical boundaries.³⁴

Static EF: The EFs of some energy sources, often various types of fuels, can be considered static, both geographically and temporally. Despite the differences in the upstream emissions associated with the extraction and transportation of the fuels, the variation in the overall carbon intensity of a particular fuel type³⁵ from different locations is often negligible as the emissions that are released during the burning process constitute the grand majority of its supply chain emissions. Nevertheless, some static values vary geographically (e.g., natural gas EFs in the US and Canada), so localized and updated static EFs should be sought out periodically using the best available sources.

Variable EF: The EFs of electricity, district heating, district cooling, and biomass vary geographically and temporally. The EF of electricity varies depending on the mix of energy sources used to generate it and on the local infrastructure, which are largely dependent on each country's energy policy and strategies.³⁶ These EFs can also be projected over time considering the introduction of policies to change the fuel mix or expected grid decarbonization in the future.³⁷ Figure 2-3 illustrates a projected EF trajectory for the UK electricity grid.

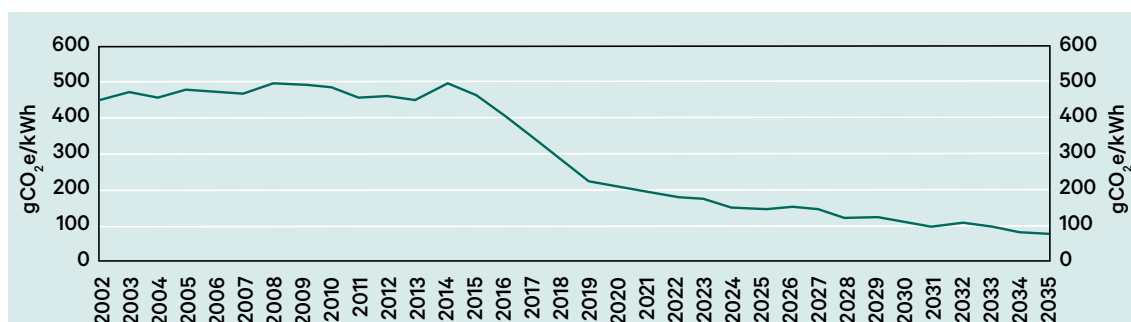
34 The calculation of emission factors for end-use energy sources in buildings often exclude the upstream carbon emissions released by fuel management, including 'well-to-tank' (extraction), transportation, conversion processes, and transmission and distribution losses (T&D) from the electricity grid. These upstream emissions vary depending on the energy source and location of extraction point. For electricity used in buildings, emission factors do not account for 100% of all emissions (since part of the emissions are according to the GHG protocol allocated to the energy sector). Similarly, for fuels which are burned onsite, fuel emission factors often reflect only a portion of the total emissions emitted in the supply of the fuel.

35 See GHG Protocol GHG Emissions Calculation Tool, 2020.

36 According to data from European Environment Agency the emission factors of electricity in France (0.0348 kgCO₂/kWh) and Sweden (0.0105 kgCO₂/kWh) are low because of the high proportion of nuclear and renewable energy sources in their fuel mix. On the other hand, the factors for Greece (0.8299) and Ireland (0.4556) are much higher due to the high proportion of fossil fuels used to generate electricity.

37 All signatories submitting Nationally Determined Contributions (NDCs) in accordance with their commitments arising from the Paris Agreement are promoting the decarbonization of the electricity grid until 2050, including the integration of a higher proportion of renewable and potentially also nuclear energy sources.

FIGURE 2-3: PAST AND FUTURE PROJECTIONS (2002-2035) OF UK ELECTRICITY GRID FACTOR (GCO₂E/KWH)



SOURCE: CRREM WITH DATA FROM BEIS

The resulting decrease in the average EF of the electricity generation over time implies that GHG emissions will decrease in the future due to the efforts of the energy sector to decarbonize. Regarding the real estate industry, the decarbonization of electricity generation will ‘automatically’ result in a reduction of the GHG emissions of buildings, i.e., the same amount of consumed electricity will result in lower electricity-associated emissions. Nevertheless, grid decarbonization will not impact the energy intensity of buildings, which is an important consideration in the assessment of transition risk.

Additionally, residual EFs, used in market-based reporting, resemble the location-based EFs described above, but they reflect the remaining energy mix after the energy – with claimed and retired renewable and low-carbon attributes – has been removed.

Finally, while annual variable EFs (like those described above) are useful for a wide range of exercises including forward-looking analyses, time-of-use EFs, which account for local variability in the actual electricity generation on a daily or hourly basis (or even more frequently in some cases), provide a more accurate assessment of real-world location-based emissions than annual variable EFs and are recommended for those able to acquire and handle them.

Emissions intensities can be used to contextualize emissions in a particular sector, providing a relative performance measure that is decoupled from absolute emissions. GHG intensity values are constructed by dividing absolute GHG emissions by a financial indicator (e.g., revenue, market capitalization) or sector-dependent unit of output. In the case of real estate, the United Nations Environment Programme (UNEP), GHG Protocol, TCFD, and others recommend calculating the GHG intensity as GHG emissions per square meter, using the unit [kgCO₂e/m²/year] (kilograms of carbon dioxide equivalents per square meter per year).³⁸ For real estate, it is important to note that other factors such as the occupancy of the property, extended operating hours, or special consumers (e.g. data centers) might make it necessary to normalize performance metrics for specific purposes (see section *Normalization for Operational Considerations*).

38 GHG Protocol, 2013, p. 173.

Summary points of section GHG Emissions in the *Real Estate Sector*:

- GHG emissions released by the built environment can be differentiated into operational GHG (caused by the energy consumed by building-integrated technical systems during the operation of the building) and embodied carbon (caused by the construction, maintenance and disposal of the building). The guidance and recommendations in this document are focused on operational GHG emissions.
- Buildings' operational GHG emissions are most commonly calculated by converting the amount of energy consumed in the asset (kWh) and other GHGs emitted on site into carbon equivalent emission (kgCO₂e) with the help of EFs (kgCO₂e/kWh).
- In the case of real estate, the most common unit of GHG intensity is kgCO₂e/m²/year (kilograms of carbon dioxide equivalents per square meter per year).
- Direct emissions occur within the site boundaries (fossil fuels and refrigerant leakages) whereas indirect emissions are released by other actors in a value chain (electricity and district heating/cooling; other indirect emissions).
- The delineation of GHG emissions from Real Estate assets over scope 1, 2 and 3 depend on the reporting entity, the chosen consolidation approach (equity share, financial control, operational control approach), and the type of (and even specificities within the) lease agreement.
- GHG intensity will vary between different building types, different building use profiles, different climates and also according to the GHG intensity of local energy markets.

Guidance and Recommendations

Our recommendations can be differentiated as follows:

- **Shall** – The term “shall” is used to indicate what is required for GHG accounting in line with the GHG Protocol and the PCAF Standard.
- **Should** – The term “should” is used to indicate a recommendation, often times best practice, but not a strict requirement. The recommendations in this document are typically specifically developed to ensure consistent accounting for emissions from real estate operations across users of this technical guidance document.
- **Must** – The term “must” is used to indicate a conditional ‘shall’. That is, if a specific condition is met (generally a “should” practice), an additional practice ‘must’ be completed.
- **May** – The term “may” is used to indicate an optional or permissible action.

Boxes such as this are used to delineate when a piece of guidance is not appropriate for accounting and reporting purposes, but may be used for various additional purposes such as transition risk analysis and measurement, forecasting, etc., as long as the methods employed are made clear and transparent. Boxes are also used to delineate guidance that is not strictly related to accounting, such as target-setting. There are no “shall” requirements in these boxes.

The GHG Protocol Corporate Standard and the PCAF Standard

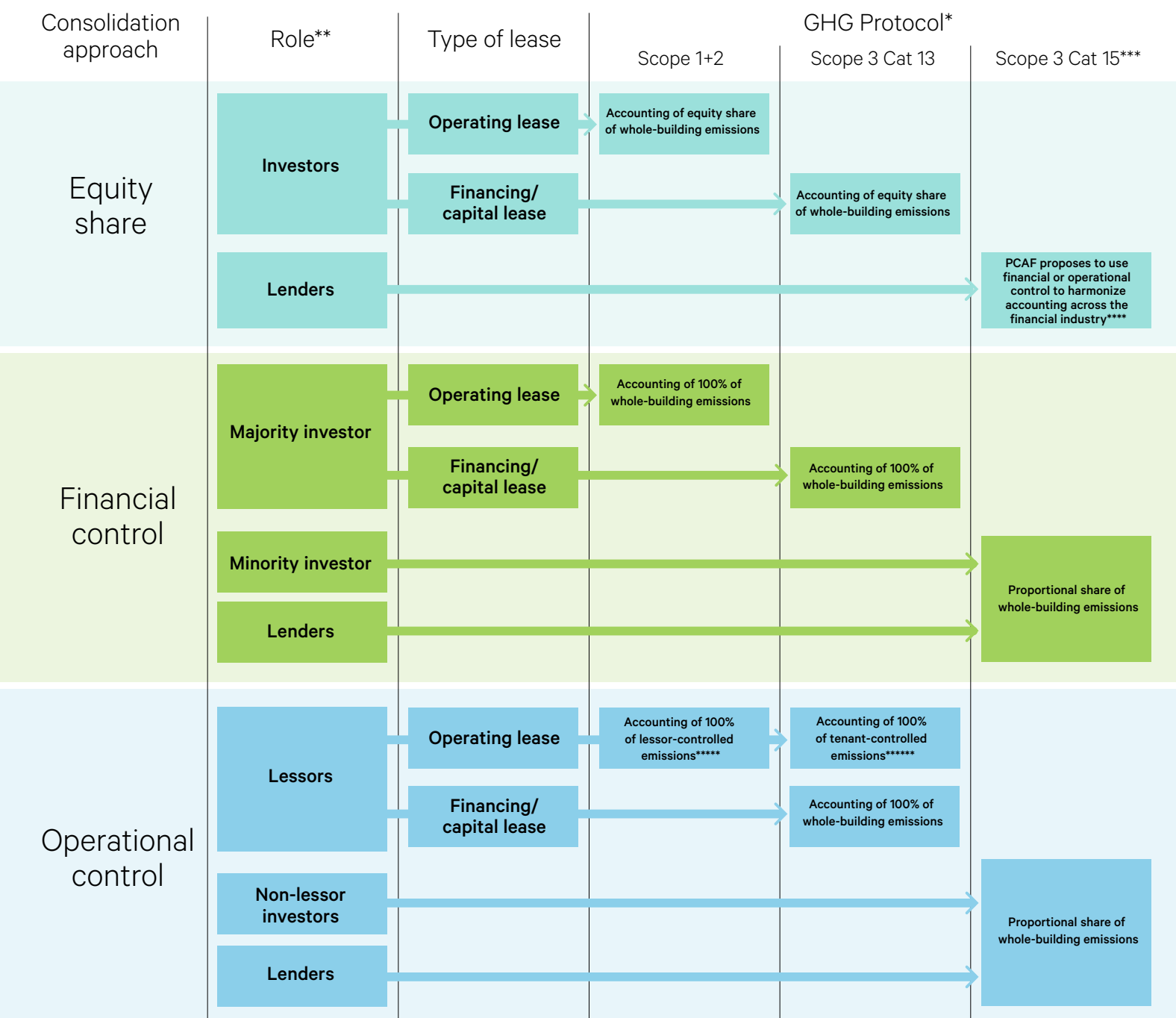
As outlined in the introduction, the GHG Protocol Corporate Standard was originally built for use by corporations, while the PCAF Standard was initially established to account for financed emissions of loans and investments. While the PCAF Standard focuses on reporting of emissions related to loans and investments to commercial real estate in scope 3 (category 15), some investments can also occur in scope 1 and 2, including direct investments and joint ventures. Emissions from real estate can also be reported under scope 3 (category 13), emissions from leased assets, in specific situations.

There are different ways in which various types of financial institutions can finance and invest in real estate, and this has implications for how emissions are allocated to reporting scopes and categories within the reporting of each stakeholder. Main drivers between how and where emissions are reported are:

1. The chosen consolidation approach by the reporting company described in section *Consolidation approach and GHG accounting of Real Estate*.
2. Whether the reporting company (lessor) is also leasing the real estate to others or only an investor/lender.

Figure 3-1 provides a comprehensive overview of where to account the GHG emissions from real estate, depending on the consolidation approach, role and type of lease.

**FIGURE 3-1: OPTIONS FOR FINANCIAL INSTITUTIONS TO FINANCE REAL ESTATE
AND RESULTING SCOPE ATTRIBUTION**



* GHG Protocol, 2006.

** Assets are owned when a financial institution (i.e., lessor) has majority equity share in the assets or is the controlling partner in a joint venture. Non-lessor generally refers to minority equity share, or a loan provided by a bank to leverage the investment. In case of equity share, loan exposure is not applicable.

*** PCAF has published the Global GHG Accounting and Reporting Standard for the Financial Industry that details the GHG accounting methods for scope 3 category 15.

**** As the equity share consolidation approach doesn't apply to other forms of finance (e.g., loans), this consolidation approach is not applicable across the full financial industry.

***** In case the lessor has operational control over an asset leased to another company under an operating lease, especially when operational control is not perceived by the lessee.

***** When the lessee has full operational control.

As illustrated in Figure 3-1, GHG accounting for the lessor (majority equity share or controlling partner) of real estate will follow the Corporate Standard, whereby the consolidation approach will match the objectives of the reporting of the financial institution. Non-controlling actors (minority equity investments or lenders) in real estate will follow the PCAF Standard, whereby the relevant emissions are attributed to the appropriate level of aggregation using the appropriate financial share metric.

This delineation allows for a few key characteristics:

1. It allows for the compatibility of the two standards (by not having the standards overlap in particular areas).
2. It keeps the emissions of the financial institution “closer” to the party with the most influence over the stated emissions (100% of emissions from majority investments are often captured within scope 1 and 2 as opposed to being categorized as scope 3 for the sake of over-simplicity).

This does mean that the emissions from a single asset can sometimes be distributed across scope 1, 2 and 3 (category 13 or 15) classifications. It is expected that various net-zero and target-setting protocols for the real estate sector will likewise span across the necessary scopes to include the required emissions from the built environment in their frameworks.

“The GHG Protocol Corporate Standard makes no recommendation as to whether voluntary public GHG emissions reporting should be based on the equity share or any of the two control approaches but encourages companies to account for their emissions applying the equity share and a control appropriate separately.”³⁹ Thus, in corporate reporting, organizations are encouraged to consistently apply one consolidation approach (equity share, financial control, operational control) throughout their corporate reporting.

LEASED ASSETS (SCOPE 3, CATEGORY 13)

In the Corporate Standard, emissions from fuel combustion and electricity use of tenants under leasing arrangements can be defined as scope 1, 2, or 3 depending on the consolidation approach used and type of leasing arrangement.⁴⁰ The Scope 3 Standard has a category for emissions from downstream leased assets:

Cat 13. Downstream leased assets: This category includes emissions from the operation of assets that are owned by the reporting company (acting as lessor) and leased to other entities in the reporting year. This category is applicable to lessors (i.e., companies that receive payments from lessees who have the right to use an asset through a contract with the owner of the asset).

If a company (i.e., lessor) is reporting scope 3 emissions from downstream leased assets, these include the scope 1 and scope 2 emissions of lessees (see table 3-1).

³⁹ GHG Protocol, 2004, p. 20.

⁴⁰ GHG Protocol, 2011, p. 124.

Table 3-1: Accounting for Emissions from Leased Assets

	Type of leasing arrangement	
	Finance/capital lease	Operating lease
Equity share or financial control approach used	Lessor does not have ownership or financial control, therefore emissions associated with fuel combustion and use of purchased electricity are scope 3 (Downstream leased assets).	Lessor has ownership and financial control, therefore emissions associated with fuel combustion are scope 1 and use of purchased electricity are scope 2.
Operational control approach used	Lessor does not have operational control, therefore emissions associated with fuel combustion and use of purchased electricity are scope 3 (Downstream leased assets).	Lessor does not have operational control, therefore emissions associated with fuel combustion and use of purchased electricity are scope 3 (Downstream leased assets). ⁴¹

SOURCE: GHG PROTOCOL, SCOPE 3 STANDARD, 2011, P. 124.

As illustrated in Figure 3-1 in reference to the operational control approach with an operating lease, it may be the case that some emissions-generating activities within the building are controlled by the tenant and others at the same time are controlled by the lessor. With regard to Table 3-1 above, this reflects the situation in which both the default text and the footnote text for the bottom right cell (operational control approach and operating lease) are true for different energy sources/services within a single building.

In specific instances, this could mean:

- Common spaces and shared services are controlled by the landlord (lessor's scope 1 and 2).
- Emissions related to the consumption of heating/cooling in tenant-occupied spaces could be scope 1 and 2 of the tenant (scope 3 of the landlord) if the tenant gets directly billed for the energy procurement by a third party or/and if the tenant has clear submetering and consumption control for heating/cooling in the leased space. So even if there is central heating / cooling, the tenant might contractually control of this consumption as agreed upon with the landlord.

Generally, stairwells and elevators in multi-tenant properties and related lighting is clearly scope 2 for the lessor. Similarly, other "Shared Services" like central heating/cooling, when unable to distinguish between services delivered to common spaces and those delivered to tenant-occupied spaces, will be treated as scope 1 and 2 of the landlord.⁴²

Except in the case of owner-occupied buildings, there will always be to some degree of shared responsibilities regarding necessary efforts to reduce carbon emissions, either on a behavioral

⁴¹ Some companies may be able to demonstrate that they do have operational control over an asset leased to another company under an operating lease, especially when operational control is not perceived by the lessee. In this case, the lessor may report emissions from fuel combustion as scope 1 and emissions from the use of purchased electricity as scope 2 as long as the decision is disclosed and justified in the public report.

⁴² This is to prevent situations in which both the landlord and the tenant claim that the corresponding emissions fall into their respective scope 3. This follows the "precautionary principle" used by PCAF for EVIC calculations, referencing the UN: "If in doubt, err on the side of the planet not the side of the company." (1992).

or technical level. Even if some emissions are classified as scope 3 from a landlord's perspective, the landlord should still take responsibility to propose major retrofit measures regarding lighting, technical equipment, etc.

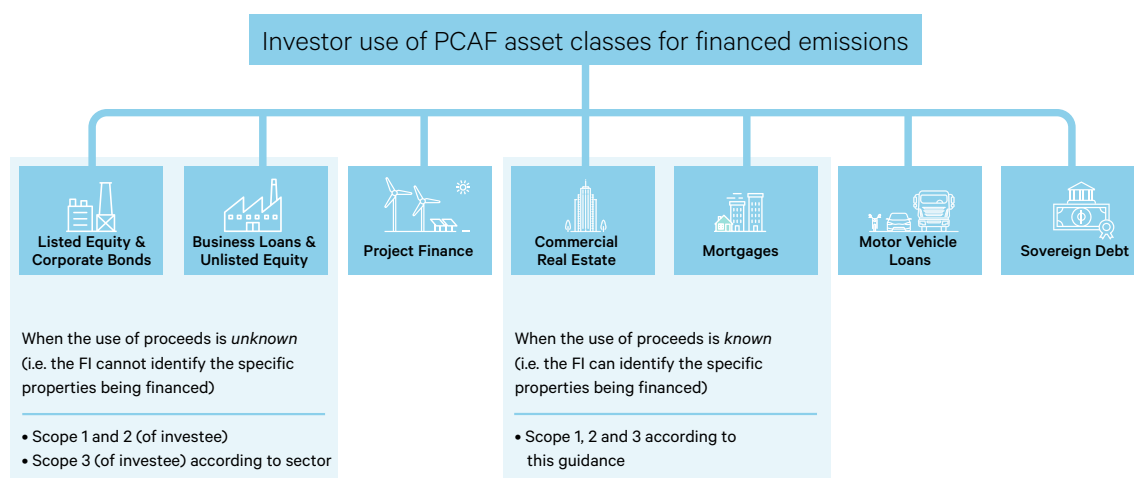
For owner-occupied properties, direct emissions are scope 1 and indirect emissions from energy procurement are scope 2. These emissions are not considered financed emissions, as the properties are for use as opposed to investment.

FINANCED EMISSIONS (SCOPE 3, CATEGORY 15)

The accounting of financed emissions requires that asset-level accounting be done in a more standardized manner than allowed for by the Corporate Standard due to the need to aggregate asset-level information from sometimes long and complicated value chains and ownership/management structures. The scope delineations as applied under the Corporate Standard (see section *Corporate GHG Accounting*) cannot be used 'as is' (e.g., from corporate reports) in accounting and reporting of financed emissions because the variety of organizational boundaries and consolidation approaches used for corporate reporting results in different scope attributions for the emissions associated with the same characteristics (e.g., tenant consumption). For example, if Real Estate Company A uses the operational control consolidation approach for its corporate reporting, and Real Estate Company B uses the financial control consolidation approach for its corporate reporting, a financial institution with stakes in both that simply sums up emissions by scope will have an inconsistent view of its emission scopes. The consequences of this include:

- Compromised comparability, between and within financial institutions
- Room for both double counting and completely missed emissions

Therefore, for the purposes of delineating emissions scopes for accounting of financed emissions (category 15) in the real estate sector, financial institutions **shall** impose the PCAF Standard. In practice, this amounts to using an operational boundary of the whole building (see *Whole-building approach*) and an attribution method based on a proportional share, see Figure 3-1.

Figure 3-2: PCAF Asset Class Guidance to be used by Investor

Importantly, Figure 3-2 above describes in what asset classes, and by which methods, the investor **shall** use when aggregating its GHG emissions of their investments. Below you find two specific examples on REITS and private real estate funds.

Note that much of this guidance is dependent on the ability to receive data at various levels of investment types and structures. Direct ownership investors have in general strong insight and good ability to retrieve the necessary data, whereas indirect investors (or lenders) would need (to a large extent) to rely on the direct investors to comply with this guidance. Thus, it is emphasized that while direct investors are to comply, indirect investors must ensure that direct investors comply, so that they may also comply.

REAL ESTATE INVESTMENT TRUSTS (REITS)

For REITS, if the use of proceeds is known, the fund itself should account emissions according to asset class Commercial Real Estate, and investors to the fund should account their emissions proportionally according to their share. When the use of proceeds is unknown, then money invested or loaned to a REIT would be classified under the Listed Equity & Corporate Bonds asset class if publicly traded, or under the Business Loans & Unlisted Equity asset class if they are not publicly traded.

PRIVATE REAL ESTATE FUNDS

As stated in the PCAF Standard, “Private equity that refers to investment funds is not included in this asset class [business loans and unlisted equity]; guidance on such private equity will follow in later editions of the Standard.” Until such time, it is recommended that financial institutions use the Commercial Real Estate chapter of the PCAF Standard for private real estate funds. This will require that the Private Real Estate Funds themselves account in the same manner.

Defining operational control at the building level

We only need to consider the definition of operational control at the building level for setting organizational boundaries (i.e., what fuel types to account for over what floor areas) under the operational control consolidation approach. Those using either the equity share or financial control approach will not require this distinction, but will instead rely on whole-building emissions and the type of lease (finance or operating).

Under the operational control approach, if the asset is leased under a finance or capital lease, all emissions (base-building, shared services, common areas, tenant spaces, etc.) are attributed to the tenant, and are to be classified as scope 3 by the lessor. If, however, an operating lease is used, the delineation of emissions scopes will depend on the allocation of “operational control”.

There is often confusion regarding the attribution of emissions from tenants. Generally, this stems from the ambiguity of who has “operational control”. The GHG Protocol defines “operational control” as:

A company has operational control over an operation if the former or one of its subsidiaries has the full authority to introduce and implement its operating policies at the operation.

This of course then depends on the definition of “operating policies” in real estate operations, as often the procurer of energy or the holder of the energy contract can be different from the party controlling the consumption of energy.

The notion of operational control **should** be determined based on the specifics listed in the operating lease, where the responsibilities for various services are defined, noting that different services may fall under the control of different parties within the same lease. It is acknowledged that this can make comparisons between assets (and the portfolios of which they constitute a part) very challenging. As noted above, when unable to distinguish between services delivered to common spaces and those delivered to tenant-occupied spaces, will be treated as scope 1 and 2 of the landlord. This default to the precautionary principle allows for the close reflection of responsibility for the “operating policies” as per the GHG Protocol, while appreciating the challenges of aggregating a wide variety of lease terms.

For example, if the whole-building is leased to a tenant with an operating lease, the general text in the operational control/operating lease cell of the table abides, placing all emissions in the scope 3 of the lessor because the tenant has operational control of the entire building (including base building). However, as is often the case when there are multiple tenants, there are cases in which, while the tenants procure their own electricity from a chosen provider, the base-building (common spaces and shared services) are operated by the landlord or property manager. In such cases, the emissions from electricity would be under operational control of the tenants and would be attributed to scope 3 of the lessor and scope 2 of the tenant, and the base-building operations would be under operational control of the lessor, resulting in scope 1 and 2 emissions for the lessor and upstream leased asset scope 3 emissions for the tenant.

Whole-building approach

GHG accounting and reporting initiatives often limit reporting to the boundaries defined from the reporting organizations' perspective, measuring their financial and non-financial performance within these boundaries. However, while "ownership" of emissions reported as scope 1 and 2 reflect much of the transition risk in the real estate sector, tenant-related emissions can still constitute a significant source of risk borne by the landlord/investor/lessor because transition risk can also depend on a building's GHG performance in relation to regulatory requirements and market expectations, regardless of how electricity is sub-metered or controlled within the building and the resulting implications for the allocation of emissions 'ownership'. Furthermore, while an investor who owns a share of a particular building does not necessarily bear the full transition risk, it will still be necessary to quantify the total emissions from the entire building, irrespective of who has the capacity to control these emissions, to assess their portion of the overall risk.

Financial institutions **shall** include all operational emissions from the entire building in GHG accounting as the necessary default. This requires the quantification and assessment of all GHG emissions of buildings in operation, irrespective of the organizational boundaries or control approaches used by various stakeholders in their corporate reporting. This is referred to as the "whole-building approach".

Additionally, and optionally, financial institutions **may** delineate (within their scope 3 emissions), the scope 1, 2, and 3 emissions of the real estate operations. This means that the emissions resulting from landlord/lessor or building manager-controlled spaces **may** be separated from tenant-related building emissions. This can be useful in disaggregating and understanding the various drivers of transition risk, where they come from, and how they can be addressed. If tenant data cannot be collected, please refer to the guidance on *Estimation of incomplete data*.

The whole-building approach is aligned with the GHG Protocol Scope 3 Standard pertaining to the investment-specific method of reporting investments, in which investors should collect:

- Scope 1 and scope 2 emissions of investee company
- The investor's proportional share in the investee
- If significant, companies should also collect scope 3 emissions of the investee company

Here, any emissions from the building that are categorized as scope 3 are deemed significant and are to be included in the accounting. This is also aligned with the update to the TCFD recommendations that organizations in all sectors "include disclosure of relevant, material categories of scope 3 emissions".⁴³ Again, in real estate, the whole building-related emissions are deemed to be relevant and material.

43 "TCFD has determined that data and methodologies have matured sufficiently such that scope 3 disclosure is appropriate for all financial and non-financial sectors. Disclosure is particularly important for organizations for which scope 3 emissions account for 40% or more of the total emissions of the organization or for which scope 3 emissions have been deemed a significant risk in their value chain." (TCFD, 2021).

This is also reflected in the PCAF Standard related to scope 3 category 15, stating “For property already built, financial institutions shall cover the absolute scope 1 and 2 emissions related to the energy use of financed buildings during their operation (energy use includes the energy consumed by the building’s occupant and shared facilities).”

Furthermore, for the purpose of aligning the (financed) emissions of real estate portfolios with net-zero frameworks and commitments, both the UN-convened Net-Zero Asset Owner Alliance (NZAOA) and the Institutional Investors Group on Climate Change (IIGCC), as well as the SBTi, recommend the inclusion of tenant-related emissions in the setting of and compliance with targets, regardless of their categorization as scope 3 emissions in most instances of corporate reporting and target setting.^{44,45,46}

Based on the foundation of guidance provided above, the example table below illustrate how an investor or bank would account for the operational GHG emissions of an example building under a variety of direct investment structures. Table 3-2 details an operational control consolidation approach with an operating lease in which electricity for tenant space is sub-metered and controlled by the tenant, but control of the heating/cooling is not perceived by the tenant and is provided as an un-sub-metered shared services to all tenants in the building by the landlord. See *Appendix V* for tables illustrating financial control and equity share methods.

The building in this example is an office building with 1,000 m² (20%) of common space and 4,000m² (80%) of tenant-occupied space. The building has a market value of 20 million EUR and is supplied by electricity and district heating. The annual emissions total of the building is 25,000kg CO₂e/year. The building’s electricity and district heating result in 15,000kg CO₂e/year and 10,000kg CO₂e/year, respectively. 10% of electricity GHG corresponds to control of the electricity contracts for the common spaces, and 90% of the electricity GHG corresponds to contracts for electricity procured by the tenants. Importantly, the electricity is sub-metered, so it is known how electricity is consumed across the building space. In this building, 100% of the district heating (DH in the table below) is controlled by the landlord, and is supplied to the entire building, including tenant-occupied spaces. For district heating, the energy is not sub-metered.

⁴⁴ NZAOA, 2021.

⁴⁵ IIGCC, 2021.

⁴⁶ SBTi, 2022, p. 127.

TABLE 3-2: FINANCIAL INSTITUTION ACCOUNTING USING GHG PROTOCOL OPERATIONAL CONTROL APPROACH UNDER OPERATING LEASE

Scenario	Operational Control	Attribution
Directly held (equity only) One investor owns 100% Equity only financing	Owner has operational control over: 100% of DH GHG 10% of elec. GHG	Investor is attributed: 10,000kg DH GHG as scope 2 1,500kg elec. GHG as scope 2 13,500kg elec. GHG as scope 3 (cat 13)
Directly held (leveraged) One investor owns 100% of equity 50% loan-to-value ratio	Owner has operational control over: 100% of DH GHG 10% of elec. GHG	Investor is attributed: 10,000kg DH GHG as scope 2 1,500kg elec. GHG as scope 2 13,500kg elec. GHG as scope 3 (cat 13) Bank is attributed: 12,500kg as scope 3 (cat 15) (EUR 10m / EUR 20m) * 25,000kg
Joint venture (equity only) 4 investors with 25% each Equity only financing	Controlling Partner has operational control over: 100% of DH GHG 10% of elec. GHG Non-controlling Partner has operational control over: 0%	Controlling Partner is attributed: 10,000kg DH GHG as Scope 2 1,500kg elec. GHG as Scope 2 13,500kg elec. GHG as Scope 3 (cat 13) Non-controlling Partner is attributed: 2,500kg DH GHG as Scope 3 (cat 15) 3,750kg elec. GHG as Scope 3 (cat 15)
Joint venture (leveraged) 4 investors with 25% each 50% loan-to-value ratio	Controlling Partner has operational control over: 100% of DH GHG 10% of elec. GHG Non-controlling Partner has operational control over: 0%	Controlling Partner is attributed: 10,000kg DH GHG as Scope 2 1,500kg elec. GHG as Scope 2 13,500kg elec. GHG as Scope 3 (cat 13) Non-controlling Partner is attributed: 2,500kg DH GHG as Scope 3 (cat 15) 3,750kg elec. GHG as Scope 3 (cat 15) Bank is attributed: 12,500kg as scope 3 (cat 15) (EUR 10m / EUR 20m) * 25,000kg

Operational and embodied carbon

For standing real estate assets, the operational emissions (those originating from operational energy use, life cycle module B6 according to EN 15978, see Figure 2-1) **shall** be reported.

In-use embodied carbon – including maintenance, repair, and retrofit measures – **should** be tracked and reported separately. In order to guarantee a net positive environmental benefit of a retrofit, it is imperative to ensure that the embodied carbon emitted as a consequence of the retrofit is taken into account in addition to the reduction in operational carbon emissions it enables. In practice, the maintenance, repair, and/or retrofit of a building often does not occur annually, but rather sporadically. If reported, the in-use embodied carbon for a given retrofit project **must** be reported for the year of retrofit completion. Given that maintenance, repair and retrofits are unlikely to happen in the same year for all assets in a portfolio, the reported in-use embodied carbon is unlikely to cause a spike in a given year.

Financial institutions **should** also report on upfront embodied carbon of their real estate portfolios. If it is, it **must** be reported separately from operational emissions and categorized using EN 15978. Note that the embodied carbon emitted in the past (upstream) for the construction of a building does not usually imply transition risk on the standing investment moving forward.

This document does not provide guidance on the transference of upfront or in-use embodied carbon into ‘annuities’ for the purposes of transition risk management or net-zero commitment alignment, but rather is limited to the annual reporting of GHG emissions. It is expected, with the development and growing availability of frameworks and tools for the calculation of the embodied carbon of buildings, that reporting on embodied carbon (alongside LCA and Whole-life-carbon assessments) will become more important in the future, particularly for new construction.

Location-based and market-based methods

ELECTRICITY

As described in section Operational GHG Emissions on ‘Scope 2 – Indirect emissions, the GHG Protocol defines two calculation methods for the measurement of scope 2 emissions: the location-based and or market-based method. There are benefits and drawbacks of both methods. Table 3-3 provides a corresponding summary for the real estate sector.⁴⁷

⁴⁷ For a more detailed account of the benefits and drawbacks of the location-based and market-based reporting methods, please refer to the GHG Protocol Scope 2 Guidance, 2015.

TABLE 3-3: MAJOR BENEFITS AND DRAWBACKS OF THE LOCATION-BASED AND MARKET-BASED METHODS FOR GHG EMISSIONS REPORTING IN REAL ESTATE

	Location-based	Market-based
Benefits	Benefits to financial institutions - Provides more comparability on energy performance, when isolated to a single region, without the need to translate GHG performance back into energy performance Benefits to low-carbon transition - Incentivizes energy reduction and energy efficiency measures - Incentivizes directly on-site renewable energy generation	Benefits to financial institutions Allows for accounting of off-site renewable energy to progress towards net-zero goals ⁴⁸ Benefits to low-carbon transition - Incentivizes use of/switch to low-carbon energy options (including both on-site and off-site renewable energy) by landlord and tenants, which theoretically incentivizes utilities and power generators to build/supply more renewable energy - May incentivize energy reduction and energy efficiency measures (and becomes more practical as renewable energy prices rise)
Drawbacks of relying on a single method	Drawbacks to financial institutions - Does not account for active renewable energy procurement via the grid, which is invariably a part of any net-zero initiative, framework, or commitment for real estate Drawbacks to low-carbon transition - Could remove accounting incentive for renewable energy purchasing and, consequently, reduce the demand signal in renewable energy markets and the amount of renewable energy on the grid - Could result in freeloading on grid decarbonization actioned by the energy sector, and decreased incentive for energy reduction measures	Drawbacks to financial institutions - In the absence of robust residual EFs (as in some less sophisticated energy markets), market-based methods could potentially lead to double-counting of renewable energy use Drawbacks to low-carbon transition - Could potentially lead actors to emphasize their use of low-carbon energy procurement options at the expense of pursuing energy reduction and energy efficiency measures⁴⁹

As outlined in section *GHG Protocol Corporate Standard and the PCAF Standard*, emissions from the electricity use of real estate may end up either in scope 2 or in scope 3 (category 13 or 15) of financial institutions. Reporting requirements differ:

For scope 2 emissions following the GHG Protocol Scope 2 Guidance⁵⁰, companies are required to report two scope 2 figures (following both methods) but select one for target setting. This is called “dual reporting”. The GHG Protocol states: *‘For companies with any operations in markets providing product or supplier-specific data in the form of contractual instruments, companies shall report scope 2 according to a location-based method and a market-based method. Each method’s results reflect different risks and opportunities associated with emissions from electricity use, and can inform different decisions and levers to reduce emissions. Companies shall choose which method’s results to use for goal setting and other benchmarks.’*

48 Credible and verifiable contractual instruments must be used to preclude double-counting of renewable energy use and to prohibit greenwashing from financial institutions.

49 Sophisticated markets overcome this drawback through effective energy benchmarking and disclosure.

50 GHG Protocol, 2015.

For scope 3 emissions associated to the use of electricity (in the supply chain) this requirement for “dual reporting”, however, does not exist. Therefore, companies have the flexibility to choose the approach that best fits their needs, or follow approach used of the emitters in their supplier chain (e.g., the carbon footprint reports of suppliers, customers, etc.). For individual company carbon footprints this can work well, but when comparing footprints of different companies within the same sector (like in real estate) this may lead to inconsistencies.

To ensure consistent accounting of operational emissions from real estate by financial institutions, this technical guidance recommends that financial institutions with real estate activities in markets providing product or supplier-specific data in the form of contractual instruments **shall** report emissions related to electricity use using both the location-based method *and* the market-based method. This holds for electricity emissions reported in scope 2 as well as scope 3 category 13 and 15. GHG emissions **shall** be reported separately for each method.

When either method is used improperly, when methods are mixed, or when information is aggregated between assets or portfolios that use different methods, the resulting information is compromised. Financial institutions therefore **must not** aggregate data collected via different methods. Furthermore, for the market-based method, the Scope 2 Quality Criteria **shall** be used (see *Appendix III*), as defined by the Scope 2 Guidance. These recommendations are in line with both the Scope 2 Guidance⁵¹ and the EPRA Sustainability Best Practice Recommendations (sBPR)⁵².

Dual reporting in this manner incentivizes both reductions in energy consumption (primarily via the location-based method) and, for the remaining energy consumption, procurement of renewable energy (primarily via the market-based method). It also provides financial institutions with a greater understanding of the decarbonization strategies of their real estate management. GHG emissions calculation using the location-based method is particularly useful in transition risk assessment because it allows for a more consistent basis for the comparison of buildings’ energy use mix and efficiency. GHG emissions calculation using the market-based method is particularly useful for determining manager decision-making regarding GHG emissions reduction decoupled from the impact of average jurisdictional grid decarbonization.

It is acknowledged that market-based method requires the collection of more data (regarding contractual instruments, residual emissions factors, etc.). However, the Scope 2 Guidance outlines how to deal with varying levels of access to particular data.⁵³ Notably, if no data is available, the market-based method output will be the same as that produced by the location-based method. Equal location-based and market-based GHG emissions values therefore signal that the reporting entity does not have the data collection processes or expertise in place to be able to handle market-based reporting. With the development and growing availability of residual EFs used in the market-based method, as well as the continued production and tracking of high-quality energy attribute characteristics for the purpose of credible alignment with various net-zero frameworks, it is expected that market-based GHG emissions reporting will become easier in the near future.

51 Since the Scope 2 Guidance amendment to the Corporate Standard was published in 2015, companies are recommended to report separately on both location-based and market-based scope 2 GHG emissions.

52 EPRA Sustainability Best Practice Recommendations (sBPR) define the location-based method as the minimum reporting requirement and allow for reporting using the market-based method as an “additional performance measure” (EPRA, 2017).

53 See Section 7.1 of the GHG Protocol Scope 2 Guidance, 2015 for more information.

DISTRICT HEATING AND COOLING

The differentiation between location- and market-based accounting of GHG emissions is most relevant for electricity. Nevertheless, as per the Scope 2 Guidance:

Companies **shall** report emissions from the purchase and use of these energy products the same as for electricity: according to a location-based and market-based method, if the contractual instruments used meet the Scope 2 Quality Criteria as appropriate for gas transactions. These may be the same total where direct line transfers of energy are used.

Companies **should** follow Table 4.4 (included in *Appendix VI*) accounting for scope 2 with and without certificates sales to determine the treatment of direct line energy transfers (e.g., receiving heat/steam/cooling directly from another facility) or energy used from local steam/heat/cooling distribution systems. A location-based emission factor for such systems should characterize the average GHG intensity of the fuels used to generate the heat/steam/cooling, as well as the efficiency of that generation.⁵⁴

Furthermore, to mitigate greenwashing of district heating and cooling systems:

Emissions from steam, heat, or cooling that is received via direct line as “waste” from an industrial process **should** still be reported based on the underlying emissions from the original generation process. Some companies may wish to account for these as zero emissions because the steam/heat/cooling would have been vented instantaneously if not used. However, accurate emissions accounting requires the actual emissions associated with the production of this waste to be reported.

Importantly, as with GHG accounting resulting from electricity use, financial institutions **must not** aggregate emissions data collected via different methods (location-based and market-based).

Location-based emission factors

In measuring building energy consumption, financial institutions **shall** refer to the emissions corresponding to so-called ‘final energy’ procured, which can be read off electricity meters and utility bills, in contrast to primary energy, which indicates how much energy was used in the generation of electricity at the source by burning fossil fuels like oil and gas. The difference between final energy and primary energy is a result of inefficiencies in the process of conversion⁵⁵, and transmission and distribution (T&D) losses. Therefore, when using the location-based method to calculate GHG emissions from purchased electricity in real estate, financial institutions **shall** use grid electricity EFs that exclude T&D losses as well as trade effects of electricity exports and imports between countries – i.e., they should not be solely based on

54 An emission factor per unit energy for purchased steam or heat is equal to the emission factor per unit energy of the fuel used divided by the thermal efficiency of the generation. An emission factor for purchased cooling that is generated by an electric chiller is equal to the emission factor for the electricity consumed in the chiller divided by the chiller’s coefficient of performance (COP).

55 Generally, the relationship between these two figures is expressed with so-called primary energy factors, which vary between different energy sources like electricity or gas.

the energy generation mix of the country.⁵⁶ Because T&D losses should be accounted for by the electricity distribution operator, these are not to be included in a real estate asset's scope 2 emissions. Rather, these would be captured in scope 3 category 3 (Fuel- and energy related activities not included in scope 1 or scope 2).⁵⁷

Experience in areas with decarbonizing grids shows that seasonal, daily, and hourly variation in location-based emissions factors become critical to understanding real-world scope 2 emissions. Where possible, emissions **should** be calculated using time-resolved emissions factors, although it is recognized that this is not often possible given the availability challenges of such detailed data.

Estimation of incomplete data

It is acknowledged that tenant energy data (and corresponding emissions data) can be difficult, if not impossible, to currently collect. This document provides guidance as per the methods and techniques by which such data may be estimated. However, it will be up to governments and local regulatory bodies to provide the legal structure by which such data can be shared between various parties along the built environment value chain while respecting various data privacy concerns.

For the purposes of reporting GHG emissions from real estate, financial institutions **should** account GHG emissions based on actual energy consumption. When energy consumption data is not available for the entire portfolio, the remainder **should** be estimated. If estimation of energy consumption is needed, financial institutions **must** track and disclose how much energy data, and subsequently how much GHG data, was estimated, as well as the estimation methods applied for the calculation. This **should** be presented in the form of the PCAF Data Quality Score. If estimates are not included in the calculation of GHG emissions and the energy consumption data is incomplete, the actual data coverage **must** be disclosed. Financial institutions that rely on estimated data **should** include a strategy to collect real data and replace estimated data with real data in the coming years.

For the purposes of transition risk assessment, whole building data covering a full year is required for a meaningful comparison against decarbonization pathways, especially if the decarbonization pathways are constructed using whole-building data. In this case, if data for the whole building covering a full year is not available, estimates **must** be used, and stakeholders **must** track and disclose the share of estimated GHG data as well as the estimation methods applied.

⁵⁶ GHG Protocol, 2015.

⁵⁷ GHG Protocol, 2011.

Estimation from incomplete floor area data coverage

If complete energy consumption data associated with the whole building is available, then the associated GHG emissions can be readily calculated and allocated to their respective scopes (see *Whole-building approach & Scope allocation*). However, if energy consumption data is not available, or only partially available, for any specified floor area, then financial institutions **should** estimate the energy consumption of the unavailable floor area in order to have a complete picture of GHG emissions of the whole building. These emissions **may** be allocated into their respective scopes if data on the operational control and energy sources of the estimated energy consumption is available.

When estimating data, it is important to consider that energy consumption patterns can vary significantly between common areas and tenant spaces. Thus, if the breakdown of energy consumption between common areas and tenant spaces (and shared services) is available and data is available for some spaces but not others, then remaining energy consumption values **should** be estimated separately per floor area to calculate the remaining emissions. However, if the area breakdown between different floor area types is not available, then estimations may be made at the whole-building level in accordance with the PCAF data quality hierarchy (see *Quality assurance and verification*).

Estimation from incomplete data within the period of ownership

If the period for which energy consumption data (and the corresponding emissions calculations) covered is shorter than one year (due to acquisition, sale, or other reasons), estimation might be beneficial for some purposes. If calculating absolute emissions for reporting purposes, only the emissions during the period of ownership need be calculated. If energy consumption data for the full period of ownership is not available, then the energy consumption during the period of ownership **should** be estimated. If energy consumption is estimated for uncovered time during the period of ownership, or extrapolated for the full year if ownership data is just available for a limited time, then the estimated energy consumption **should** be normalized for seasonal variation (see *Normalization of energy consumption based on climatic conditions*).

Likewise, should an intensity need to be calculated, but energy consumption data for the full year is not available, then the energy consumption during the year should be estimated (in order to get to kWh/m²/year). If energy consumption is estimated for uncovered time during the year, then the estimated energy consumption should be normalized for seasonal variation (see *Normalization of energy consumption based on climatic conditions*).

Modifying energy consumption based on climatic conditions

There is a wide range of climatic regions globally, each with very different demands on the thermal quality of buildings, thus resulting in a different energy consumption required to achieve identical indoor comfort levels. In the comparison of energy consumption data, as well as of the corresponding energy and GHG intensities, one might wish to understand that data in the context of the local climatic conditions during the reporting year or period for which the data was recorded.

For financed emissions reporting, weather normalization **shall not** be applied, as the reporting is meant to reflect what happened, not in an 'average' year.

However, weather normalization **may** be used to improve like-for-like comparisons. Furthermore, decisions regarding the energy efficiency efforts of individual buildings or evaluating transition risk **may** incorporate these methods since the weather conditions in a particular year might not accurately reflect a particular building's inherent qualities and since climate change will have a very different effect on heating- and cooling-related energy demands and consequent projections of carbon emissions.

A common method for normalizing heating and cooling demands of buildings makes use of Heating Degree Days (HDD) and Cooling Degree Days (CDD) indices⁵⁸ -- weather-based technical indices designed to describe the need for the heating energy and cooling (air-conditioning) requirements of buildings, respectively. Eurostat provides a technical definition and detailed requirements for their use.⁵⁹

Information on average heating- and cooling-related weather and climate conditions at specific locations **may** be used for the assessment of buildings' carbon performance in three ways: (1) estimating energy consumption during periods for which energy data is not available, (2) normalizing weather conditions in the year of assessment and (3) estimating the effect of climate change on future heating and cooling demand.

(1) Estimating energy consumption during periods for which energy data is not available

If energy data is not available for a particular time period, normalization of estimated remaining energy data **may** be based on the ratio between the HDD (or CDD) for the period of estimated energy data and the HDD (or CDD) of measured energy data.

(2) Normalizing weather conditions in the year of assessment

Another application of HDD and CDD is the normalization of energy demand and consequent GHG emissions based on the actual consumption data for a year. If the measured values originate from a year with rather mild winter months, low actual heating demand will not reflect the real thermal quality of the building.

Normalization in this manner **may** be used for various time-series analysis benchmarking and risk management exercises. However, as stated above, normalization of actual measured energy **shall not** be done for reporting purposes.

This method is more reliable for normalizing actual energy demand to an estimation of general performance than other approaches that are for example based on the mean outdoor temperature only. Since heating demand usually has good correlation to the indoor-to-outdoor temperature difference and a building's heat loss coefficient (dependent on building fabric and air infiltration), there is also a good correlation between heating demand

⁵⁸ Petri; Caldeira, 2015, p. 10.

⁵⁹ Eurostat Metadata, 2020.

and HDD, as the latter reflects these temperature differences. Local 30-year average HDD and CDD values can be derived from reanalysis data and used in the construction of a relevant HDD or CDD ratio.

(3) Estimating the effect of climate change on future heating and cooling demand

Climate change will have a significant impact on future heating and cooling energy demand. HDD and CDD values can also be used to consider this impact when estimating a building's future GHG emissions. This can be done by comparing projected HDD or CDD values against historical benchmarks – e.g., projecting energy consumption against a modified HDD/CDD. This is particularly relevant for district heating and cooling if this is how the building regulates its temperature. Thus, this kind of normalization is especially relevant for risk assessment.

Projected heating and cooling energy demand using HDD/CDD modifications **may** be used for science-based target setting. If it is used for such a purpose, then the construction of the HDD and CDD ratio projections **must** be disclosed in detail, including information on the datasets and projections use, as well as how and to what building performance variables the ratios were connected.

Normalization for operational considerations

Properties often have vacant space — i.e., are not fully occupied.

Reporting of financed emissions **shall** reflect the actual performance, irrespective of occupancy (normalization for vacant space or other occupancy-based considerations **shall not** be used in reporting of financed emissions).

However, for applications in which like-for-like comparisons are important, such as benchmarking as well as any kind of transition risk assessment, it is useful to normalize GHG intensity metrics to account for vacant space. Intensities derived from consumption data of partially vacant buildings using the entire building floor areas as the basis for the intensity calculations could be misleading since they imply better efficiency than actual performance.

Therefore, normalization **may** be applied in the following situations: benchmarking, target setting and risk management. If normalization is applied, 'average annual vacancy' **should** be used. Furthermore, if this normalization is applied to target-setting, then the normalization **must** be applied upwards. That is, vacancy may be assumed to decrease in projections (increasing future energy demand), but vacancy may not be assumed to increase in projections (decreasing future energy demand).

There might be cases in which further normalization is useful for contextualizing and benchmarking use-intensity or running hours (e.g., 24/7 operations) in comparison with the average property of this use-type. Companies **may** apply appropriate normalization techniques for these situations and **must** clearly state the reason and applied methods.

Fugitive emissions

As per the Corporate Standard, GHG emission calculations and tracking **shall** include fugitive emissions. These include the F-gases described in the *GHG Emissions in the Real Estate Sector* section of this report, and reporting includes tracking the type of gas leakage in kilograms (kg), the corresponding time period over which the emissions occurred, and converting the kilograms of the GHGs into CO₂-equivalents using official EFs such as those provided in the IPCC and GHG Protocol.⁶⁰ They are to be treated as other direct emissions (i.e., onsite fuel burning) following the attribution dichotomy in Figure 3-1.

Where fugitive emissions are relevant and material (i.e., above 5% of the portfolio), financial institutions **should** track and disclose these emissions. Additionally, they **should** disclose the methodology used to calculate fugitive emissions, included any assumptions or estimations as appropriate.

If financial institutions do not track and disclose fugitive emissions, they **shall** disclose why they did not do so, their plans assess the materiality of fugitive emissions in their real estate portfolios, and their plans to collect and disclose this information in the future.

In practice, the refilling of gases often does not occur annually, but rather every few years. Therefore, the reality of losses occurs throughout that period. For reporting of these emissions, the data **must** be reported for the respective year. Given that gas refilling, and the corresponding logging of reported losses, is unlikely to happen in the same year for all assets in a portfolio, the reported losses are not likely to cause a spike in a given year.

For other purposes, it may be more informative to annualize the overall amount and allocate the figure to the entire period covered – e.g., the refill equals 7.0 kg and a refill takes place for the first time in 2.5 years, then the annual figure would be 2.80 kg. This normalization **may** be applied for benchmarking and transition risk purposes to provide less variable and more informative asset-level insights.

It is likely that reporting fugitive emissions will become more important for GHG accounting in the real estate sector in the future since F-Gases (HFCs and PFCs) play an important role in the building sector.⁶¹

Gross electricity and net-energy demand

In cases where renewable energy (e.g., with solar panels) is generated on site, this energy can either be consumed on-site or excess energy might be sold back to the grid. “Determining the underlying activity data (in MWh or kWh) in these systems may be challenging given the flux of electricity coming in or flowing out.”⁶²

60 GHG Protocol, 2021.

61 EEA, 2021; Olivier and Peters, 2020; United States Environmental Protection Agency, 2022.

62 GHG Protocol, 2015.

TABLE 3-4: COMPARING GROSS AND NET ENERGY CONSUMPTION

Total energy production from on-site system	On-site energy consumption from on-site system	Energy exported from the on-site system to the grid	Energy imported from the grid
100 kWh	50 kWh	50 kWh	70 kWh
Total energy consumption (to be reported separately) = 120 kWh 50 kWh consumed from on-site system + 70 kWh imported from grid			
“Net” grid consumption= 20 kWh (70 kWh imported from grid - 50 kWh exported)			

Source: GHG Protocol, 2015.

The guidance herein follows that of the *Scope 2 Guidance*, “For accurate scope 2 GHG accounting, companies **shall** use the total—or gross—electricity purchases from the grid rather than grid purchases “net” of generation for the scope 2 calculation. A company’s total energy consumption would therefore include self-generated energy (any emissions reflected in scope 1) and total electricity purchased from the grid (electricity). It would exclude generation sold back to the grid.”⁶³ Additionally, “If a company cannot distinguish between its gross and net grid purchases, it **should** state and justify this in the inventory.”⁶⁴

This “gross” perspective would result in a number for proper GHG reporting which is derived based on the 70 kWh imported from the grid as illustrated in figure 3-3 above. Since the renewable energy produced and consumed on-site has an EF of nearly zero, this energy contributes to the energy intensity of the building, but will not affect the building’s GHG intensity.

For the purposes of measuring transition risk or claiming the operational “climate neutrality” of building, there are frameworks that distinguish further between “net energy demand” and “energy consumption” and the resulting effects related to energy and carbon intensities. Net energy demand refers to the difference between energy imported from the electricity grid and energy exported back onto the grid from on-site renewable energy generation that is not immediately consumed. The possibility to sell renewable energy to the grid could be a factor – in other words the property with surplus PV capacity could be better positioned (e.g. has the option to store the energy possibly in the future via batteries or sell credits etc.). Here, energy consumption and intensity figures are still the same, but, in contrast to scope 2 calculation, the electricity generated on site and pushed to the electric grid are deducted from a building’s GHG emissions. This figure therefore reflects the balance of energy imports and exports, and is not identical with a building’s energy consumption or the procured energy. For carbon risk management where the actual imports and exports are not measured individually and cannot be disaggregated, this approach may be applied, although it must be stated clearly that the net energy demand is used instead of gross electricity.

63 GHG Protocol, 2015.

64 GHG Protocol, 2015.

Quality assurance and verification

To ensure the reliability and validity of the resulting account of financed emissions from real estate operations, the entire carbon accounting process, methodology, and underlying input data **should** be audited and verified. In alignment with industry standards, an audit **must** provide at least a limited level of assurance, but financial institutions are encouraged to provide a reasonable level of assurance. Certified data is more reliable compared to self-declared statements.

Following auditing requirements, current financial and ESG reporting standards base most of their disclosure requirements on verifiable current and past data and request calculations to be based on specific accounting methodologies and protocols. Reporting actions require data from the last few years as well as the baseline year to monitor compliance with commitments and targets.

There is often a lag between financial reporting and required data, such as emissions data for the borrower or investee becoming available. In these instances, financial institutions **should** use the most recent data available even if it is representative of different years, with the intention of aligning as much as possible. Based on the data available, the following hierarchy for data used is proposed in order of preference (1 being the best score and 5 being the worst score):

TABLE 3-5: DATA QUALITY SCORE TABLE FOR COMMERCIAL REAL ESTATE

Data Quality	Options to estimate the financed emissions		When to use each option
Score 1	Option 1: Actual building emissions	1a	Primary data on actual building energy consumption (i.e. metered data) is available. Emissions are calculated using actual building energy consumption and supplier-specific emission factors (market-based) specific to the respective energy source.
Score 2		1b	Primary data on actual building energy consumption (i.e. metered data) is available. Emissions are calculated using actual building energy consumption and average emission factors specific to the respective energy source (location-based).
Score 3	Option 2: Estimated building emissions based on floor area	2a	Estimated building energy consumption per floor area based on official building energy labels AND the floor area are available. Emissions are calculated using estimated building energy consumption and average emission factors specific to the respective energy source (location-based).
Score 4		2b	Estimated building energy consumption per floor area based on building type and location specific statistical data AND the floor area are available. Emissions are calculated using estimated building energy consumption and average emission factors specific to the respective energy source.
Score 5	Option 3: Estimated building emissions based on number of buildings	3	Estimated building energy consumption per building based on building type and location-specific statistical data AND the number of buildings are available. Emissions are calculated using estimated building energy consumption and average emission factors specific to the respective energy source.

Source: PCAF, 2022

Note that each portion of a building's emissions may have a different score according to the table above. For instance, if the energy consumption for a building's common area is known and is multiplied by its set of appropriate average EFs to achieve a Score 2, and the energy consumption for that same building's tenant space is estimated based on the building type and location specific statistical data and floor space resulting in emissions data with a Score of 4, then the aggregate emissions of the entire building would be the weighted average (by emissions mass) of the scores 2 and 4.

It is understood that verified data is often even better than the underlying data included in Option 1 in the table above. Work to include quality assurance and verification in the scope of the data quality score table remains ongoing.

Floor space measurement

MEASUREMENT SCHEMES

As floor area is used in the estimation of intensity-based indicators, parameters on appropriate floor area measurement must be specified. There are numerous floor area schemes, including Gross Floor Area (GFA), Gross Internal Area (GIA), Gross External Area (GEA), Net Internal/Lettable Area (NIA/NLA), and Gross Lettable Area (GLA). These descriptions are commonly used globally, although they differ from each other. Most countries, the SBTi, and GRESB use GFA. However, some countries (including Australia, New Zealand, United Kingdom and Hong Kong) use Net Lettable Area (NLA) as standard practice for measuring assets.

The International Property Measurement Standard (IPMS) aims to establish a globally consistent methodology for property measurement.

- IPMS 2: Office states: "The sum of the areas of each floor level of an office Building measured to the Internal Dominant Face and reported on a Component-by-Component basis for each floor of a Building. In many markets, but not universally, this is known as Gross Internal Area (GIA)."⁶⁵
- IPMS 2: Residential states: "The sum of the areas of each floor level of a Building measured to the Internal Dominant Face, which may be reported on a Component-by-Component basis for each floor of a Building. This is known in many markets as Gross Internal Area"⁶⁶.

According to the Royal Institution of Chartered Surveyors (RICS), IPMS 2 "compares closely, but not exactly, to the GIA measurement under the Code of measuring practice." Details on conversion of GIA to IPMS 2 can be found in the RICS global guidance on property measurement.⁶⁷ CRREM refers to IPMS 2 schemes.

Financial institutions **shall** disclose the method by which they aggregate emissions based on various data reported to them. For absolute emissions, it is simply a matter of addition and

⁶⁵ IPMS, 2014.

⁶⁶ IPMS, 2014.

⁶⁷ RICS, 2018, section 3.2.3.

attribution. For the calculation of intensities, which require a consistent floor area definition as a denominator, the floor area definition used **should** be used as consistently as possible throughout their GHG accounting. Financial institutions **should** use the IPMS, specifically IPMS 2: Office or Residential to determine the asset floor area. For any reporting and accounting using floor area descriptions, their use and divergence from IPMS 2 **must** be explained.

GRESB uses the term GFA, which, while closely aligned to IPMS 2 specifications, is less prescriptive. GRESB guidance states that GFA “can exclude outdoor/exterior areas as well as indoor parking,” with specific rules pertaining to the inclusion or exclusion of indoor parking that depend on the particular asset.⁶⁸ In line with the guidance above, if unable to use a stricter definition, such deviations **must** be disclosed.

It should be noted that the difference between GFA and NLA refers to a building’s Common Areas, which is often unknown by building owners tracking NLA only. While this difference does not impact the adherence to the PCAF Standard for buildings with actual building energy consumption for the entire building, it does affect the calculation of building emissions for those methods that estimate energy consumption using floor area (Table 3-4: Data quality score table for Commercial Real Estate, options 2a and 2b). In such cases, conversion factors **must** be applied to arrive at IPMS floor areas. Property type-specific floor area ratios may be used together with the relevant data to estimate IPMS floor area. GRESB has provided a range of commonly used ratios per property type.⁶⁹

Furthermore, if the reporting entity can justify that the building type and location-specific statistical data used is based upon NLA (that is, if the building type and location-specific energy intensities used are derived from whole-building energy consumption and NLA as opposed to GFA), then the reporting entity **may** use that building type and location-specific statistical data in combination with the NLA floor area to estimate its whole-building energy consumption in accordance with the PCAF data quality hierarchy. This corresponds to options 2a and 2b of Table 3-4: Data quality score table for Commercial Real Estate, option 3.

PARKING

Emissions associated with parking areas **shall** be included in the absolute calculations of financed emissions. When calculating the GHG emissions intensity of a building or portfolio, parking **should** be reported separately. If the energy consumption of a building’s parking cannot be disaggregated from the energy consumption of the building, then the emissions **must** be included in the latter. This means that when calculating emissions intensity, the cumulative energy consumption from both the building and its parking will be divided by the floor area metric used, without the parking area. While potentially inflating the energy intensity of the building, this precludes the artificial lowering of a building’s GHG intensity solely due to inflation of the floor area denominator with parking space.

68 “Indoor parking can also be excluded only if the participant intends to represent parking as a separate property type and report the asset as such. However, if indoor parking is metered together with the central part of the asset, it should be included.” (GRESB, 2019).

69 GRESB, 2022.

Aggregating GHG intensities

The calculation of GHG intensity is described in the GHG Emissions in the Real Estate Sector section above. Asset-level GHG intensities **shall** be aggregated to portfolio-level (or multi-asset) GHG intensities by taking the floor area-weighted average of the asset-level intensities. Furthermore, financial institutions **shall** weight the contributions of each of their underlying property intensities by their financial share in each property when calculating a portfolio-level intensity.

The portfolio-level GHG intensity **shall** be calculated based on the formula below:

$$GHG_{intensity_portfolio} = \frac{\sum_{i=1}^i (\% ownership_i \times GHG emissions_i)}{\sum_{i=1}^i (\% ownership_i \times Floor area_i)}$$

Where **i** is an asset in the portfolio

Example: A fund consists of two assets as outlined in the table below

Asset	% Ownership	GHG emissions	Floor area	GHG intensity
Office	100%	5,000 kg CO ₂ e	100 m ²	50 kgCO ₂ e/m ²
Warehouse	10%	6,000 kg CO ₂ e	300 m ²	20 kgCO ₂ e/m ²

These assets' GHG intensities would be aggregated to portfolio-level GHG intensity following the formula above:

$$GHG_{intensity_portfolio} = \frac{(100\% \times 5000 \text{ kgCO}_2\text{e}) + (10\% \times 6000 \text{ kgCO}_2\text{e})}{(100\% \times 100\text{m}^2) + (10\% \times 300\text{m}^2)} = 43.077 \frac{\text{kgCO}_2\text{e}}{\text{m}^2}$$

Target setting

When setting GHG reduction targets, financial institutions **should** account for all real estate in their investible portfolios, that is, across their direct and indirect real estate portfolios.

Given the above guidance, which includes operational GHG emissions in scope 1, scope 2, scope 3 (category 13), and scope 3 (category 15), it is important to ensure consistency between the types of emissions being included and the benchmark used for target setting. For example, the CRREM decarbonization pathways are derived using whole-building operational emissions. Thus, appropriate use of the pathways for target setting (or any other purpose) requires the inclusion of scope 1, 2, and 3 emissions (both category 13 and 15 as appropriate) of the relevant real estate, including tenant-related emissions – i.e., using the whole-building approach.

In the projection of future building performance to comply with science-based targets, financial institutions may also incorporate foreseeable trends in grid decarbonization. These scenarios imply decreasing scope 2 emissions per unit of consumed electricity, contributing to the achievement of sectoral decarbonization targets. Projected EF's **should** attempt to incorporate robust and plausible forecast of predicted development, which may of course consider publicly communicated policy statements in their construction, but **should not** rely solely on policy statements or normative scenarios of future development. The reason for this is that some policy statements, and even some econometric models, amount to wishful thinking without concrete plans attached to them.

Summary points of section *Guidance and Recommendations*:

- The GHG Protocol Corporate Standard and the PCAF Standard:** The GHG Protocol Corporate Standard was originally built for use by corporations, while the PCAF Standard was initially established to account for financed emissions of loans and investments in scope 3 (category 15). Some investments can also occur in scope 1 and 2, including direct investments and joint ventures, and emissions from real estate can also be reported under scope 3 (category 13). Main drivers between how and where emissions are reported are the chosen consolidation approach by the reporting company and the role of the reporting entity (whether the reporting company (lessor) is also leasing the real estate to others or only an investor/lender). GHG accounting for the lessor (majority equity share or controlling partner) of real estate will follow the Corporate Standard, whereby the consolidation approach will match the objectives of the reporting of the financial institution. Non-controlling actors (minority equity investments or lenders) in real estate will follow the PCAF Standard, whereby the relevant emissions are attributed to the appropriate level of aggregation using the appropriate financial share metric.

- Whole-building approach:** Financial institutions **shall** include the appropriate share of emissions from the entire building in GHG accounting (whole building approach). This requires the quantification and assessment of all GHG emissions of buildings in operation, irrespective of the organizational boundaries or control approaches used by various stakeholders in their corporate reporting. This is referred to as the “whole building approach”.
- Operational and embodied carbon:** For standing real estate assets, the operational emissions **shall** be reported. Additionally, in-use embodied carbon including maintenance, repair, and retrofit measures **should** be tracked and reported for the respective year. In-use embodied carbon **should** be clearly delineated from operational emissions. Financial institutions **should** also report on upfront embodied carbon. If it is, it **must** be reported separately from operational emissions and categorized using EN 15978.
- Location-based vs. market-based method:** To ensure consistent accounting of operational emissions from real estate by financial institutions, this technical guidance recommends that financial institutions with real estate activities in markets providing product or supplier-specific data in the form of contractual instruments **shall** report emissions related to electricity use using both the location-based method and the market-based method. This holds for electricity emissions reported in scope 2 as well as scope 3 category 13 and 15. GHG emissions **shall** be reported separately for each method. Where possible, the location-based EF used for district heating (or water cooling) **should** be provided by the local provider. In the absence of such a locally specific EF, a higher-level (national) location-based EF **may** be used. In either case, the choice of EF **shall** be disclosed. Importantly, as with GHG accounting resulting from electricity use, financial institutions **must not** aggregate emissions data collected via different methods (location-based and market-based).
- Location-based emission factors:** They **shall** exclude upstream and downstream losses as well as trade effects of energy exports and imports between countries. Financial institutions **shall** refer to the final energy consumed.
- Market-based emission factors:** Where possible, emissions **should** be calculated using time-resolved emissions factors.
- Estimation of incomplete data:** For the purposes of accounting for GHG emissions from real estate operations, financial institutions **shall** aim to report GHG emissions based on actual energy consumption. When energy consumption data is not available for the entire portfolio, the remainder **should** be estimated. If estimation of energy consumption is needed, financial institutions **must** track and disclose how much energy data, and subsequently how much GHG data, was estimated, as well as the estimation methods applied for the calculation. This **should** be presented in the form of the PCAF Data Quality Score. If estimates are not included in the calculation of GHG emissions and the energy consumption data is incomplete, the actual data coverage **must** be disclosed. FIs that rely on estimated data **should** include a strategy to collect real data and replace estimated data with real data in the coming years.
- Normalization of energy consumption based on climatic conditions:** Weather normalization **may** be used to improve like-for-like comparisons and decisions regarding the necessary decarbonization efforts of individual buildings. However, for financed emissions reporting, weather normalization **shall not** be applied.

- Normalization for vacant space:** In order to enhance comparability for target setting, risk management, normalization for the vacant space based on “average annual vacancies” **may** be applied. Nevertheless, normalization **shall not** be done for reporting purposes, which **must** reflect the actual performance, irrespective of vacant space.
- Fugitive emissions:** Financial institutions **shall** include fugitive emissions in their GHG emissions calculation and tracking. Official emission factors **must** be applied to convert the gathered amounts of refrigerant losses to GHG emissions. Additionally, if FIs track and disclose fugitive emissions, they **must** disclose the methodology used to calculate fugitive emissions, included any assumptions or estimations as appropriate. If FIs do not track and disclose fugitive emissions, they **must** disclose why they did not do so, their plans assess the materiality of fugitive emissions in their real estate portfolios, and their plans to collect and disclose this information in the future.
- Gross electricity and net-energy demand:** For accurate scope 2 GHG reporting, companies **shall** use the gross electricity purchases from the grid, including self-generated energy and total electricity purchased. If companies cannot distinguish between gross and net grid purchases, this **should** be stated and justified in the inventory. For carbon-risk-management where the actual imports and exports are not measured individually and cannot be disaggregated, the net-energy demand approach **may** be applied, although it **must** be stated clearly that the net energy demand is used in lieu of gross electricity.
- Quality assurance and verification:** To ensure a high reliability and validity of the carbon intensity of properties, the entire carbon accounting process, methodology, and underlying input data **should** be audited and verified. In case of a lack in data availability, financial institutions should use the most recent data available, with the intention of aligning as much as possible.
- Floor space measurement:** Financial institutions **shall** disclose the method by which they aggregate emissions based on various data reported to them. For absolute emissions, it is simply a matter of addition and attribution. For the calculation of intensities, which require a consistent floor area definition as a denominator, the floor area definition used **should** be used as consistently as possible throughout their GHG accounting. Financial institutions **should** use the IPMS, specifically IPMS 2: Office or Residential to determine the asset floor area. For any reporting and accounting using floor area descriptions, their use and divergence from IPMS 2 **must** be explained.
- Target setting:** Financial institutions **should** set decarbonization targets to compare their resulting carbon intensities against science-based pathways. In the projection of future building performance to comply with science-based targets, financial institutions **may** also incorporate foreseeable trends in grid decarbonization.

Acronyms

BEIS	Department for Business, Energy & Industrial Strategy
BRE	Building Research Establishment
BSI	British Standards Institution
CDD	Cooling Degree Days
CDP	Carbon Disclosure Project
CDSB	Climate Disclosure Standards Board
CHP	Combined heat and power
CO₂	Carbon dioxide
CO₂e	Carbon dioxide equivalent. The unit is used to reflect the Global Warming Potential (GWP) of Greenhouse Gases (GHG) in a manner comparable to the GWP of CO ₂ .
COP	Conference of the Parties of the UNFCCC
CH₄	Methane
CRREM	Carbon Risk Real Estate Monitor
EC	European Commission
EEA	European Environment Agency
EF	Emission factor
EPBD	Energy Performance of Buildings Directive
EMAS	Eco-Management and Audit Scheme
EN	European Norm
EPRA	European Public Real Estate Association
ESG	Environmental, Social and Governance
EU	European Union
FSB	Financial Stability Board
GAAP	Generally accepted accounting principles
GBC	Green Building Council
GEA	Gross External Area
GFA	Gross Floor Area
GHG	Greenhouse gas
GIA	Gross Internal Area
GRI	Global Reporting Initiative
GWP	Global Warming Potential. GWP is used to measure the extent to which a certain GHG contributes to the heating of Earth's atmosphere in comparison with CO ₂ .
HDD	Heating Degree Days
HFCs	Hydrofluorocarbons
HQE	Haute Qualité Environnementale / High Quality Environment
HVAC	Heating, Ventilation and Air Conditioning
ICMS	International Cost Management Standard
IFRS	International Financial Reporting Standards
IIGCC	Institutional Investors Group on Climate Change
IIÖ/IIO	Institut für Immobilienökonomie / Institute for Real Estate Economics
IIRC	International Integrated Reporting Council
INREV	Investors in Non-Listed Real Estate Vehicles
IPMS	International Property Measurement Standards
IPCC	Intergovernmental Panel on Climate Change

IR	Integrated Reporting
ISO	International Organization for Standardization
JVs	Joint Ventures
kWh	Kilowatt hour
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LPs	Limited Partners
MSCI	Morgan Stanley Capital International
NDCs	Nationally Determined Contributions
NF₃	Nitrogen trifluoride
NGO	Non-governmental organization
NIA	Net Internal Area
NLA	Net Lettable Area
N₂O	Nitrous oxide
NZAOA	Net-Zero Asset Owner Alliance
NZCBC	Net-Zero Carbon Buildings Commitment
OECD	Organisation for Economic Co-operation and Development
PCAF	Partnership for Carbon Accounting Financials
PFCs	Perfluorocarbons
REITs	Real estate investment funds
RICS	Royal Institute of Chartered Surveyors
SASB	Sustainability Accounting Standards Board
SBPR	Sustainability Best Practice Recommendations
SBTi	Science Based Targets initiative
SF₆	Sulphur hexafluoride
TCFD	Task Force on Climate-related Financial Disclosures
T&D	Transmission and distribution
TEG	Technical expert group
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
UNPRI	United Nations Principles for Responsible Investment
USD	United States Dollar
WGBC	World Green Building Council
WRI	World Resources Institute

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Appendices

Appendix I: Task Force on Climate-related Financial Disclosures (TCFD)

Launched in 2015 by the Financial Stability Board (FSB)⁷⁰, the TCFD is an international initiative promoted by the G20 with the mandate to develop a framework for the clear, consistent, and relevant disclosure of climate-related information by companies. It encourages organizations to report the climate-related indicators and metrics that are likely to have a material impact on the organization. Therefore, TCFD recommendations can be considered as the bridge that links corporate financial reporting with climate-related reporting. These recommendations have become the de facto standard to which most ESG reporting initiatives are aligning their climate-related requirements.

The Final Report of the TCFD is structured around four Core Elements:

- **Governance:** The company's governance around climate-related risks and opportunities
- **Strategy:** The actual and potential impacts of climate-related risks and opportunities on the company's businesses, strategy, and financial planning
- **Risk Management:** The processes used to identify, assess, and manage climate-related risks
- **Metrics and Targets:** The metrics and targets used to assess and manage relevant climate-related risks and opportunities

Appendix II: GHG Protocol

The GHG Protocol is governed by the principles of relevance, completeness, consistency, transparency and accuracy, and all the reporting and accounting developed under these standards need to be based on these principles. Reporting organizations firstly need to set up their business goals (participating in voluntary or mandatory GHG reduction programs, or GHG markets) and set up their organizational and operational boundaries according to these goals.

The next step is to select a base year and calculate that year's carbon emissions (inventory). These emissions need to be tracked and reduced after the baseline year, and the organization also needs to define the conditions that will require recalculation of the inventory if substantial changes happen in the organization structure, methodology and emission boundaries. To calculate the emissions, the organization needs to identify the sources of carbon emissions, select a calculation approach, collect the data and report the inventory at corporate level. This calculation process needs to define and implement an inventory quality management system that controls calculations as well as data, documentation and evidence gathering.

The GHG Protocol's Corporate Standard defines three different categories (so-called 'scopes') of carbon emissions depending on the level of control an organization has in respect of each scope (direct or indirect emissions) and their capacity to reduce them. Companies need to account for and report emissions from each scope separately.

⁷⁰ FSB, 2015.

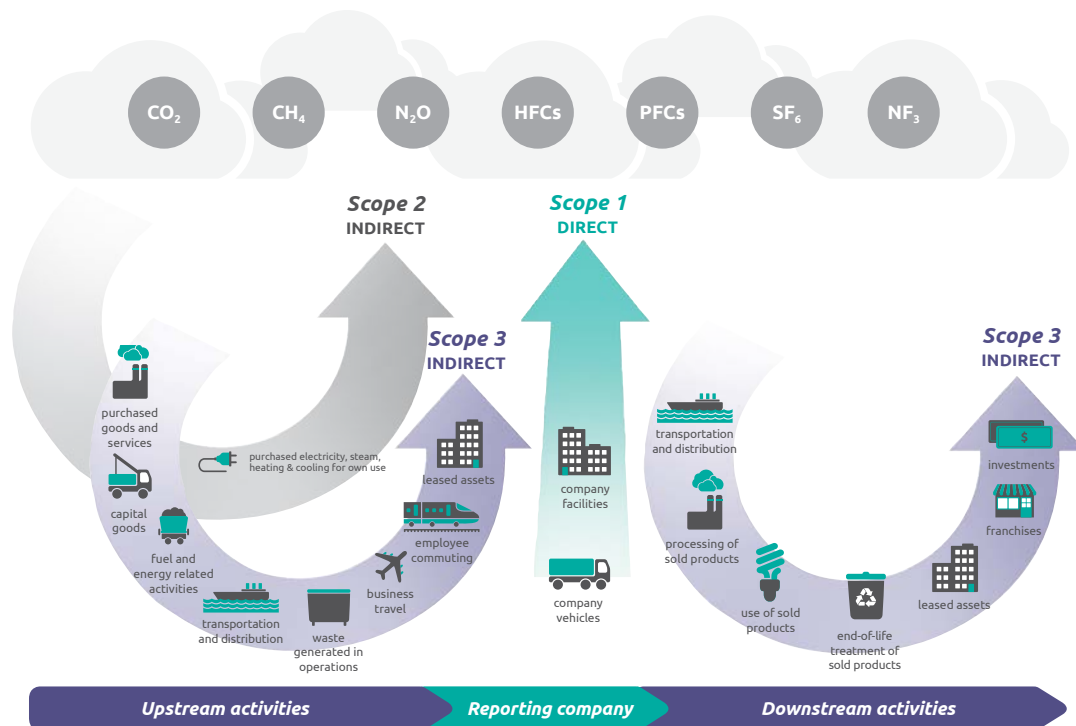
According to the GHG Protocol, the boundary of each scope is:

SCOPE 1 EMISSIONS: Emissions from sources the organization owns or controls. These are direct GHG emissions and they are released by (1) generation of electricity, heat or steam on site, (2) chemical processing, (3) transportation of materials, products, waste and employees in company owned vehicles, and (4) fugitive emissions from intentional or unintentional releases.

SCOPE 2 EMISSIONS: Indirect emissions from the generation of purchased electricity, steam, heat or cooling generated by others, which is consumed in the organization's owned or controlled equipment or operations. The amount of electricity consumed can be controlled by the company, but the carbon emitted in the generation of the electricity as well as the losses through transmission and distribution are outside the control of the organization. Note: These emissions (scope 2 for the company consuming electricity) are accounted as direct scope 1 emissions in the carbon reporting of electricity providers.

SCOPE 3 EMISSIONS: Indirect emissions from any other downstream or upstream activity. Accounting and reporting scope 3 emissions is optional according to the Corporate Standard.

FIGURE 4-1: OVERVIEW OF SCOPES AND EMISSIONS ACROSS A VALUE CHAIN



SOURCE: GHG PROTOCOL, 2013, P. 6.

Appendix III: Scope 2 Quality Criteria of GHG Protocol Scope 2 Guidance

All contractual instruments must meet the following eight Scope 2 Quality Criteria⁷¹ in order to be a reliable data source for the scope 2 market-based method.

All contractual instruments used in the market-based method for scope 2 accounting shall:

1. Convey the direct GHG emission rate attribute associated with the unit of electricity produced.
2. Be the only instruments that carry the GHG emission rate attribute claim associated with that quantity of electricity generation.
3. Be tracked and redeemed, retired, or canceled by or on behalf of the reporting entity.
4. Be issued and redeemed as close as possible to the period of energy consumption to which the instrument is applied.
5. Be sourced from the same market in which the reporting entity's electricity-consuming operations are located and to which the instrument is applied.

In addition, utility-specific emission factors shall:

6. Be calculated based on delivered electricity, incorporating certificates sourced and retired on behalf of its customers. Electricity from renewable facilities for which the attributes have been sold off (via contracts or certificates) shall be characterized as having the GHG attributes of the residual mix in the utility or supplier-specific emission factor.

In addition, companies purchasing electricity directly from generators or consuming on-site generation shall:

7. Ensure all contractual instruments conveying emissions claims be transferred to the reporting entity only. No other instruments that convey this claim to another end user shall be issued for the contracted electricity. The electricity from the facility shall not carry the GHG emission rate claim for use by a utility, for example, for the purpose of delivery and use claims.

Finally, to use any contractual instrument in the market-based method requires that:

8. An adjusted, residual mix characterizing the GHG intensity of unclaimed or publicly shared electricity shall be made available for consumer scope 2 calculations, or its absence shall be disclosed by the reporting entity.

⁷¹ GHG Protocol, 2015.

Appendix IV: Regulated and unregulated emissions (EU focus)

Depending on their level of control by building regulations, operational carbon emissions are normally divided into:

- Regulated carbon emissions are the emissions accounted and controlled by EU member states' building regulations, compliant with the minimum scopes set by the EPBD in its Annex I. Building regulations control the thermal characteristics of the fabric; HVAC and hot water installations, built-in lighting, the impact of building design and orientation, and the production of renewable energy. Therefore, all energy consumption that is affected by these components is regulated by EPBD and national building regulations. These are the only carbon emissions included in the Energy Performance Certificates (EPC), whose calculation methodology framework is also outlined by the EPBD.
- Unregulated carbon emissions are all other operational carbon emissions released by energy consumption within a building, which are not controlled by the EPBD and subsequent building regulations. These emissions are not accounted in EPCs. They usually encompass equipment and lighting and emissions from cooking/catering. The amount and source of unregulated carbon emissions can greatly vary depending on the building use, occupant behavior, and culture. In office buildings, these usually include IT equipment, small appliances and lighting, in hospitals they entail large medical equipment, and in the industrial sector they may include the energy consumption of various manufacturing processes.

EN 15978's definition of operational carbon is 'emissions from energy used by building-integrated technical systems during the operation of the building'. This definition was developed to 'comply with the EPBD (2002/91/EC, 2010/31/EC) and its national implementations'. However, EN 15978 also acknowledges unregulated carbon emissions, which can be accounted within B6 stage (see figure 2-1), but need to be reported and communicated separately.

Following the EPBD, all EU member states have developed methodologies to calculate regulated carbon emissions from buildings and report them in official EPCs. However, the carbon budgets and targets set for the real estate sector aim to reduce emissions released by all energy consumption within commercial buildings, regulated or not.

Unregulated energy consumption largely depends on the fit-out and use of the building rather than on the building characteristics or location. Benchmarks based on actual energy consumption of buildings for each typology can be used to complement regulated carbon emissions data. These unregulated energy consumption profiles are considered comparable in all EU countries for the same sector and subsector.

Appendix V: Financial Control and Equity Share Tables for Direct Investments

Based on the foundation of guidance provided above, the example tables below illustrate how an investor or bank would account for the operational GHG emissions of an example building under a variety of direct investment structures.

The building in this example is an office building with 1,000 m² (20%) of common space and 4,000m² (80%) of tenant-occupied space. The building has a market value of 20 million EUR and is supplied by electricity and district heating. The annual emissions total of the building is 25,000kg CO₂e/year. The building's electricity and district heating result in 15,000kg CO₂e/year and 10,000kg CO₂e/year respectively. 10% of electricity GHG corresponds to control of the electricity contracts for the common spaces, and 90% of the electricity GHG corresponds to contracts for electricity procured by the tenants. Importantly, the electricity is sub-metered, so it is known how electricity is consumed across the building space. In this building, 100% of the district heating is controlled by the landlord, and is supplied to the entire building, including tenant-occupied spaces. For district heating, the energy is not sub-metered.

**TABLE 4-1: FINANCIAL INSTITUTION ACCOUNTING USING
GHG PROTOCOL FINANCIAL CONTROL APPROACH**

Scenario	Operational Control	Attribution
Directly held (equity only) One investor owns 100% Equity only financing	<u>Owner has financial control over:</u> (finance/capital lease) 0% (operating lease) 100% DH GHG 100% elec. GHG	<u>Investor is attributed:</u> (finance/capital lease) 10,000kg DH GHG as Scope 3 (cat 13) 15,000kg elec. GHG as Scope 3 (cat 13) (operating lease) 10,000kg DH GHG as Scope 2 15,000kg elec. GHG as Scope 2
Directly held (leveraged) One investor owns 100% of equity 50% loan-to-value ratio	<u>Owner has financial control over:</u> (finance/capital lease) 0% (operating lease) 100% DH GHG 100% elec. GHG	<u>Investor is attributed:</u> (finance/capital lease) 10,000kg DH GHG as Scope 3 (cat 13) 15,000kg elec. GHG as Scope 3 (cat 13) (operating lease) 10,000kg DH GHG as Scope 2 15,000kg elec. GHG as Scope 2 <u>Bank is attributed:</u> 12,500kg as Scope 3 (cat 15) [(EUR 10m/EUR 20m) * 25,000kg]
Joint venture with joint financial control (equity only) 4 investors with 25% each Equity only financing	<u>JV partners have financial control over:</u> (finance/capital lease) 0% (operating lease) 25% DH GHG each 25% elec. GHG each	<u>JV partner is attributed:</u> (finance/capital lease) 2,500kg DH GHG as Scope 3 (cat 13) 3,750kg elec. GHG as Scope 3 (cat 13) (operating lease) 2,500kg DH GHG as Scope 2 3,750kg elec. GHG as Scope 2
Joint venture with non-joint financial control (equity only) 4 investors with 25% each Equity only financing	<u>Controlling JV partner has financial control over:</u> (finance/capital lease) 0% (operating lease) 100% DH GHG 100% elec. GHG <u>Non-controlling JV partner has financial control over:</u> (finance/capital lease) 0% (operating lease) 0%	<u>Controlling JV partner is attributed:</u> (finance/capital lease) 2,500kg DH GHG as Scope 3 (cat 13) 3,750kg elec. GHG as Scope 3 (cat 13) (operating lease) 2,500kg DH GHG as Scope 2 3,750kg elec. GHG as Scope 2 <u>Non-controlling JV partner is attributed:</u> (finance/capital lease) 0 (operating lease) 0

**TABLE 4-2: FINANCIAL INSTITUTION ACCOUNTING USING
GHG PROTOCOL EQUITY SHARE APPROACH**

Scenario	Operational Control	Attribution
Directly held (equity only) One investor owns 100% Equity only financing	<u>Investor has ownership over:</u> (finance/capital lease) 0% (operating lease) 100% DH GHG 100% elec. GHG	<u>Investor is attributed:</u> (finance/capital lease) 10,000kg DH GHG as Scope 3 (cat 13) 15,000kg elec. GHG as Scope 3 (cat 13) (operating lease) 10,000kg DH GHG as Scope 2 15,000kg elec. GHG as Scope 2
Directly held (leveraged) One investor owns 100% 50% loan-to-value ratio	<u>Investor has ownership over:</u> (finance/capital lease) 0% (operating lease) 100% DH GHG 100% elec. GHG	<u>Investor is attributed:</u> (finance/capital lease) 10,000kg DH GHG as Scope 3 (cat 13) 15,000kg elec. GHG as Scope 3 (cat 13) (operating lease) 10,000kg DH GHG as Scope 2 15,000kg elec. GHG as Scope 2 <u>Bank is attributed:</u> 12,500kg as Scope 3 (cat 15) [(EUR 10m/EUR 20m) * 25,000kg]
Joint venture (equity only) 4 investors with 25% each Equity only financing	<u>JV partners have ownership over:</u> (finance/capital lease) 0% (operating lease) 25% DH GHG each 25% elec. GHG each	<u>JV partner is attributed:</u> (finance/capital lease) 2,500kg DH GHG as Scope 3 (cat 13) 3,750kg elec. GHG as Scope 3 (cat 13) (operating lease) 2,500kg DH GHG as Scope 2 3,750kg elec. GHG as Scope 2
Joint venture (leveraged) 4 investors with 25% each 50% loan-to-value ratio	<u>JV partners have ownership over:</u> (finance/capital lease) 0% (operating lease) 25% DH GHG each 25% elec. GHG each	<u>JV partner is attributed:</u> (finance/capital lease) 2,500kg DH GHG as Scope 3 (cat 13) 3,750kg elec. GHG as Scope 3 (cat 13) (operating lease) 2,500kg DH GHG as Scope 2 3,750kg elec. GHG as Scope 2 <u>Bank is attributed:</u> 12,500kg as scope 3 (cat 15) [(EUR 10m/EUR 20m) * 25,000kg]

Appendix VI: Accounting for scope 2 with and without certificates sales

TABLE 4-3: ACCOUNTING FOR SCOPE 2 WITH AND WITHOUT CERTIFICATES SALES

	Scope 2 with location-based method	Scope 2 with market-based method
Energy consumed from owned/operated generation (e.g. a company owns a solar panel and consumes the energy)		
No certificates generated or sold	No scope 2 reported for consumption from owned generation	
Certificates from generation facility retired/retained by the generation facility's owner who consumes the energy	Should report certificate retention separately, but no scope 2 reported for consumption of on-site generation	
Certificates sold to 3rd party	Use location-based emission factor hierarchy	Use market-based emission factor hierarchy
Direct line (e.g. a company receives power directly from a generator, with no grid transfers)		
No certificates generated or sold	Use source-specific emission factor from direct line	
Certificates from generation facility purchased and retired/retained by the energy consumer	Use source-specific emission factor from direct line (same as certificate emission factor)	Use certificate emission factor (same as source-specific emission factor)
Certificates sold to 3rd party	Use location-based emission factor hierarchy	Use market-based emission factor hierarchy
Grid-distributed		
No certificates generated or sold from any generation facilities on the grid	Use location-based emission factor hierarchy	Use market-based emission factor hierarchy
Certificates purchased from grid generation facilities, or included in a supplier-specific emission factor	Use location-based emission factor hierarchy	Use market-based emission factor hierarchy
Certificates from grid generation facilities sold to 3rd parties	Use location-based emission factor hierarchy	Use market-based emission factor hierarchy

SOURCE: THE GHG PROTOCOL SCOPE 2 GUIDANCE, 2015



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