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Corporate decarbonization strategies and carbon accounting standards: implementation learnings to inform standard revisions

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The corporate commitment to reducing greenhouse gas (GHG) emissions has gained significant traction, with over 11,000 companies committing to reduce their corporate emissions. This paper critically examines two prevalent corporate climate strategies: renewable energy power purchase agreements (PPAs) and supplier engagement initiatives, highlighting their alignment with existing GHG Protocol accounting standards and company implementation considerations around internal approval processes, business operation impacts, and transaction costs. The analysis reveals that PPAs are successful due to their clear recognition in accounting standards and minimal impact on core business operations. Conversely, supplier engagement programs, despite their endorsement by initiatives like the Science Based Targets Initiative, struggle to deliver scope 3 inventory reductions emissions due to mismatched data and high transaction costs. The paper underscores the necessity for corporate climate standard setters to consider the realities of company accounting and decarbonization strategy practices as standards undergo major revisions. By integrating these implementation considerations, the effectiveness of voluntary GHG emissions accounting and target-setting systems can be improved, ultimately contributing to more significant emission reductions.

KEYWORDS

carbon accounting, decarbonization strategies, corporate decision making, supplier engagement, scope 3, scope 2

Introduction

Over 11,000 companies have commitments to reduce their scope 1, 2, and 3 greenhouse gas (GHG) emissions ([Science Based Targets Initiative, 2025a](#)). Most of these companies use GHG accounting standards and guidance developed by the GHG Protocol, a joint initiative of the World Resources Institute and World Business Council for Sustainable Development that “establishes comprehensive global standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains and mitigation actions” ([GHG Protocol, 2025](#)). Two of the most widely used GHG Protocol publications are the Scope 2 Guidance (2015) and the Scope 3 Standard (2011). These publications, which provide requirements and guidance for companies to quantify emissions from their market-based electricity purchases and their upstream

and downstream value chain activities respectively, were published before there was significant corporate practitioner accounting and decarbonization solution implementation experience. When the scope 2 Guidance was published in 2015, less than 15 gigawatts (GW) of renewable energy capacity had been contracted through corporate power purchase agreements (PPAs) globally (Bloomberg New Energy Finance, 2016). Today, companies have contracted for over 200 GWs of renewable energy PPAs (Bloomberg New Energy Finance, 2024; Clean Energy Buyers Association, 2025), along with other renewable energy certificate (REC) procurement methods. Before the scope 3 Standard was published in 2011, most companies did not report their scope 3 emissions; the few that did typically disclosed results for only a handful of reporting categories, such as business travel emissions (World Resources Institute, 2022). As of 2025, thousands of companies now report scope 3 emissions and over 270 companies participate in CDP's supply chain program, which supports member companies in collecting supplier scope 1, 2, and 3 GHG emissions data (along with other environmental data). In 2024, the CDP supply chain program requested data from more than 60,000 supplier companies (CDP, 2025).

Despite these achievements, there is widespread understanding that reducing scope 3 emissions, and also realizing those reduction within a company's attributional scope 3 inventory, is difficult to achieve with current inventory and target-setting standards (Ballentine, 2024). Addressing this challenge is one reason the GHG Protocol is undertaking a revision process for the Corporate Standard, scope 2 Guidance, and Scope 3 Standard, and the planned development of a new market-based intervention standard (GHG Protocol, 2024a).

The revision process has spurred researchers and practitioners alike to evaluate the effectiveness of different voluntary decarbonization strategies, and the appropriateness of different GHG accounting methods in company disclosures and targets. For example, researchers have examined REC prices, the various contract structures used by companies, and whether the use of RECs in corporate GHG accounting has contributed to additional renewable energy capacity deployment (Tawney et al., 2018). Existing scope 3 research has evaluated the drivers for companies to establish supplier engagement initiatives (Lintukangas et al., 2023). Many studies, particularly those focused on electric system modeling impacts of renewable energy procurement, assume different characteristics of participating companies. These assumptions include that the companies are not cost sensitive to climate strategy cost increases, that GHG reporting and climate targets are business priorities and will remain so if different revision proposals are adopted (i.e., no attrition), that there are few transaction costs of aggregating demand across companies to coordinate combined action, that the companies are rational actors planning over long time periods, and that with enough company investment sufficient data to implement the accounting proposals will exist (Riepin et al., 2024; Bjørn et al., 2025; Xu et al., 2024).

A few researchers have identified the limitations of these assumptions, calling for research on corporate behavior impacts of GHG accounting revisions (Bjørn et al., 2025). In researching for this article the author could not identify peer-reviewed articles covering the carbon accounting and corporate decision-making implementation reasons companies pursue certain decarbonization strategies. This article attempts to fill this gap by examining two

commonly-deployed corporate climate strategies: (1) transacting utility-scale renewable energy power purchase agreements (PPAs), and (2) supplier "engagement strategies." This article evaluates how these strategies produce results within existing carbon accounting standards and available data, along with how well the strategies align with company operating and approval processes. It also examines the transaction cost effectiveness of the strategies. Findings are sourced from the author's experience implementing these strategies within Fortune 500 companies, informal interviews with corporate practitioners, and from available publications.

The strategy evaluation results are likely unremarkable to corporate decarbonization practitioners, yet the literature on these critical implementation considerations is scant. This gap threatens the effectiveness of corporate decarbonization literature reviews and the emphasis on "scientific integrity" within the standard revision processes being run by the Science Based Targets Initiative and GHG Protocol (Science Based Targets Initiative, 2024; GHG Protocol, 2024b). Ultimately, the effectiveness of the entire voluntary corporate GHG emissions accounting, reporting, and target-setting system, as measured by GHG emissions reduced or avoided as a result of voluntary decarbonization investments, is threatened if the corporate implementation experience is neglected in peer-reviewed literature.

Strategy 1: corporate renewable energy power purchase agreements (PPAs)

Strategy overview

PPAs are long-term (typically 10–15 years) contract-for-difference agreements, where the buyer and seller agree on a strike price, and the contract "settles" the differences between the actual electricity market price at the time of generation and the strike price. To illustrate how PPA settlements work, consider a solar PPA price of \$50 per MWh. At a given hour the solar facility generates 1 MWh, and the wholesale electricity market price at the PPA's contractual electricity market hub is \$45. In this scenario, the corporate buyer will owe the seller \$5 [1 MWh of generation * (\$50–\$45)]. If the electricity price was instead \$55, then the seller would owe the buyer \$5 [1 MWh of generation * (\$50–\$55)].

PPAs usually include the transfer of RECs from the contracted renewable energy project from the Seller to the Buyer; however, the transfer of RECs is not a required feature of the agreement's structure. RECs obtained by the corporate buyer can be accounted for in the company's market-based scope 2 emissions inventory by directly replacing a MWh of the company's electricity consumption. Companies follow the GHG Protocol's Scope 2 Guidance (2015) to account for retired RECs in their market-based scope 2 inventories.

For sellers, PPAs reduce revenue volatility risk, which can enable project developers to obtain financing and construct renewable energy projects. PPAs require parties to be sufficiently creditworthy, which can be a barrier for smaller companies to transact PPAs (Norton Rose Fulbright, 2020). Despite significant declines in the levelized cost of renewable energy, PPA prices have risen in recent years, and in multiple markets today new

PPAs are forecasted to be a net cost to the buyer over the term of the agreement (e.g., net cost of \$30 per expected REC). So why do companies sign PPAs? Evaluating the strategy through carbon accounting, corporate decision making, and transaction cost criteria help explain why PPAs are a common strategy across companies with climate targets.

Carbon accounting considerations

Standards clearly recognize PPAs are eligible GHG inventory reduction strategies.

While there are disagreements about the proper carbon accounting treatment for RECs, the fact remains procuring and retiring RECs reduces a company's scope 2 market-based inventory under current guidance. PPAs are also explicitly allowed in RE100, the U.S. EPA Green Power Partnership, and other reporting programs. Furthermore, with the GHG Protocol scope 2 Guidance's adoption by reference into emerging mandatory disclosure systems, companies are confident that this action will reduce their publicly-reported scope 2 market-based inventory. This level of accounting treatment certainty is in contrast to the state of clear accounting treatment for supplier engagement strategies (strategy 2 in this article).

Data from PPAs match GHG inventory activity data units

PPAs typically require the transfer of a project's RECs from the project owner to the corporate offtaker. RECs are denominated in megawatt hours (MWh), which are the same unit of activity data companies use to calculate their scope 2 emissions. This 'unit matching' allows for the current Scope 2 attributional market-based inventory to mathematically work for companies. This is a critical reason why corporate renewable energy procurement has high adoption rates among companies with GHG inventories and goals.

For emerging scope 3 environmental attribute certificates (EACs), which are being designed to mirror RECs (e.g., low carbon concrete, maritime EACs), it is likely that there will be many instances of EACs not matching the corresponding scope 3 emission activity's data (e.g., ton of low carbon concrete when the purchasing company can only estimate emissions attributed to masonry emissions in its upstream value chain). This potential mismatch may affect corporate buyer adoption rates if carbon accounting standard setters continue to recommend accounting methods like those employed for RECs in scope 2 market-based inventories.

Business impact considerations

PPAs do not impact the company's core business profit centers or critical supplier relationships; PPAs are aligned with internal approval processes.

Since PPAs are financial agreements between a renewable energy project developer and the buyer company, they do not require modifications to the company's existing contracts or supplier relationships. This feature can reduce the number of internal teams required to review and approve the agreements as compared to other decarbonization strategies. PPAs are often transacted and managed by the company's teams working outside the company's core profit centers. This means that pursuing PPAs does not need to compete with other core business priorities.

Furthermore, companies transacting PPAs can often use existing finance and legal internal review processes that are designed for comparable types of financial agreements. The company's accounting team may have existing experience evaluating similar financial agreements for any derivative accounting obligations under U.S. Generally Accepted Accounting Principles (GAAP) or the International Financial Reporting Standards accounting systems. Overall, PPAs are well aligned with internal company review and approval processes.

PPAs do not affect core company operations, nor do they require internal technical expertise.

Certain energy decarbonization projects, such as installing an electric vehicle charging station, require a partial or complete power shutdown of a company's facility. These projects can require complex internal coordination of multiple teams, and if the shutdown runs on longer than planned, the project may negatively impact the company's operations. As financial agreements, PPAs do not impact a company's physical operations.

In addition, unlike decarbonization strategies that focus on capital-intensive projects in HVAC, refrigeration, or manufacturing systems, companies transacting PPAs do not need to industry-specific knowledge about renewable energy generating technologies. Instead, these agreements are fundamentally about purchasing a commodity (RECs), something companies are very familiar with.

Transaction cost considerations

A single PPA can reduce a substantial portion of company scope 2 market-based inventory results.

Unlike behind-the-meter solar projects installations, a single PPA can provide large volumes of RECs, (e.g., 400,000 RECs for a 100 MW wind facility with a 46 percent capacity factor). This large volume of RECs per agreement reduces the overall number of transactions the company must execute to meet its climate goals. This scale is valuable when senior leadership approval is required for contract execution, since project teams may only have a few opportunities per year to present sizable contracts to this level of leadership. While contracts with smaller total financial commitments may be signed at lower levels within the company, energy teams may experience less overall transaction costs with fewer contracts that each produce large results.

Strategy 2: scope 3 supplier engagement

Strategy overview

For the purposes of this article, scope 3 “supplier engagement” programs are company-sponsored programs where the companies request that their direct (tier 1) suppliers calculate the supplier’s GHG inventory, report the supplier inventory data annually to the company, and set supplier-specific decarbonization targets. Some companies also engage their tier 2 suppliers. Programs such as the Science Based Target Initiative and CDP recommend versions of this strategy (Science Based Targets Initiative, 2025b; CDP, 2023).

Supplier engagement has been a recommended strategy since the 2011 publication of the GHG Protocol Scope 3 Standard. While many companies have versions of these programs, and reporting programs like CDP report emission savings from these strategies (CDP, 2024),¹ there is little evidence that these programs have helped companies reduce their reported scope 3 inventories. Why is supplier engagement not producing company scope 3 inventory reduction results? In practice, this strategy encounters the following implementation challenges that limit its success.

Carbon accounting considerations

Strategy’s data outputs do not match inventory data.

Supplier engagement programs often ask suppliers to report their annual scope 1 and 2 emissions data allocated to the requesting company. Sometimes they request data on the amount of electricity consumed and renewable energy purchased (MWhs and RECs), and on the level of energy efficiency investments made (monies spent or first-year MWh savings) by the supplier. Meanwhile, company scope 3 emissions are mostly calculated using company spend data (e.g., cost of goods purchased from supplier) or product activity data (e.g., number of products purchased), and consolidated emission factors (e.g., kilograms of CO₂e per unit product). Integrating the supplier data into inventories calculated with common emission factors is complex and requires significant knowledge of the supplier’s production processes to complete.

Standards recommend supplier engagement, but their accounting guidance is impractical.

Even if companies develop systems to incorporate supplier data into their scope 3 inventory, few appear to use the data

to publish results. This may be because there are limited public examples of how to do this. The GHG Protocol’s Scope 3 Calculation Guidance (2013) directs companies to collect data on the quantities of different inputs used in the purchased product’s manufacturing processes, and identify emission factors applicable to the production of those inputs upstream of that supplier. In reality this level of detail is either not available from suppliers, or contains competitive business information.

To overcome this barrier, some firms have developed intricate solutions that disaggregate emission factors and replace part of the emission factor with allocated supplier emissions (Tasa Analytics, 2025; Salesforce, 2025). These systems are often complex, expensive, and require many modeling assumptions that lack transparency.

Given these data challenges, today few companies directly attribute any reported reductions in their scope 3 inventories to their supplier engagement programs. Companies that incorporate supplier emissions data in their scope 3 calculations do not provide details on their methodology.² Instead, companies more often report the percentage of suppliers involved in their scope 3 engagement programs as a percent of total spend, or the number of suppliers who have set science-aligned emissions reduction targets. These figures are treated as related to but not directly affecting the companies’ quantitative scope 3 inventory results reporting.³

There are exceptions to the disconnected reporting of supplier engagement results, corporate inventories, and target progress. In 2024, Apple reported that its suppliers procured renewable energy that avoided 18.5 million metric tons of carbon emissions (Apple, 2024). Walmart’s Project Gigaton, with over 5,900 suppliers participating, reported reaching its goal of 1 gigaton of reduced, avoided, or sequestered emissions 6 years early (Walmart, 2024a). It’s worth noting that both companies employ forms of avoided emissions accounting in order to measure the impact of their programs (Apple, 2024; Walmart, 2024b). This is likely due, in part, to the challenges described with integrating supplier emissions data into scope 3 progress reporting.

Business impact considerations

Successful supplier engagement programs often require supplier industry-specific knowledge.

1 From CDP report: “Supplier engagement is a critical tool and is proven to be impactful in encouraging disclosure and climate action across supply chains: suppliers disclosing through CDP reported that engagement from buyers led to 43 MtCO₂e savings being made, equivalent to the total annual emissions of Cameroon.” In the author’s experience preparing corporate climate disclosure reports, project reductions reported to CDP are often calculated using forms of avoided emissions accounting, which may not impact the corporate GHG inventory results unless the right data conditions exist. In addition, the reported reductions are not necessarily a result from supplier engagement programs.

2 A representative example of such accounting methodology disclosure detail is from Mars, Inc.’s 2024 CDP Corporate Questionnaire (Mars, 2025), specifically the company’s response to question 7.8.5 (explaining the percentage of the company’s scope 3 emissions calculated using supplier or value chain partner data): “We calculated emissions by multiplying activity data (what we bought, from whom, from where, etc.) and emissions factors. This figure [scope 3 category 1 base year emissions] pertains to purchased raw materials who’s [sic] emissions were calculated using supply-specific factors - a combination of primary data and geographically-specific public lifecycle analysis datasets. While activity data is supplemented by supplier-provided origin information, this was not taken into account to calculate this %.”

3 An example of reporting supplier engagement program results next to and separate from scope 3 inventory results is Target Corporation (2024).

When companies source products from supplier they use product specifications to define the product's performance requirements, rather than specifying exactly how the products should be produced. This allows the company and suppliers to specialize in what they are best at, and does not require each other to have knowledge of technologies and production processes outside of their core domains. In contrast to this specialization, supplier engagement programs require knowledge of the supplier's production processes in order to assess reported emissions data and to recommend emission reduction projects applicable to the supplier's operations. Successful programs are often found with companies that have a high degree of supply chain vertical integration, make up a large of an upstream supplier's book of business, or have a very strong hand in the product's design specifications and production processes with its suppliers.

Transaction cost considerations

Engagement strategies require many touchpoints per emission reduction opportunity.

The large number of tier 1 suppliers and the multiple contact points in supplier engagement programs can lead to high transaction costs. This is especially true when the effort is compared to the mitigation potential of individual supplier decarbonization projects. The amount of staff time required to administer supplier engagement programs, including developing inventory and target setting training materials, establishing data management systems, managing translation services, and eventually running annual supplier data reporting processes, is significant. It is not uncommon for a company's sustainability supplier engagement team to have more employees than the teams directly working on either decarbonization project development or GHG inventory reporting.

Discussion and conclusion

The analysis of the two strategies demonstrates that accounting and business implementation considerations have material impact on the success of GHG inventory reduction strategies within companies and value chains. Yet these considerations are often overlooked within the carbon accounting and voluntary climate targets literature. Failure to understand these implementation topics and design the next set of corporate climate standards with them in mind will diminish the effectiveness of the standards toward their stated goals.

Researchers should evaluate more implementation considerations, such as research on the data collection costs of different carbon accounting systems, how data encouraged by carbon accounting systems aligns (or not) with data produced by available decarbonization

projects in value chains, and how changes to carbon accounting, reporting, and target setting programs impact a company's decision making criteria for longer-term decarbonization projects, such as carbon removal offtake agreements.

It's worthwhile to question whether carbon accounting systems should be designed around these implementation considerations, or if markets and companies should change their procurement and approval systems around the carbon accounting standards. The former seems more likely to effectively happen within the decarbonization timeline corporate climate systems claim to be working under. Furthermore, solving for these implementation considerations can still be compatible with high-integrity carbon accounting and target setting systems. If the standards are to reach their stated goals of incentivizing companies to invest in decarbonization solutions that reduce overall emissions, it is imperative that these core implementation considerations be put at the center of new and revised corporate carbon standard development processes.

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