EPA GREEN POWER PARTNERSHIP

Renewable Electricity Procurement for Use of Sold Products

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Table of Contents

Introduction

This paper discusses how renewable electricity procurement may help reporting organizations reduce scope 3 greenhouse gas (GHG) emissions from the use of their sold products that consume electricity. It summarizes GHG accounting principles from the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard and provides quantification approaches based on guidance from the GHG Protocol Technical Guidance for Calculating Scope 3 Emissions. These GHG Protocol documents define the 15 categories of scope 3 emissions associated with different aspects of an organization's value chain. Some scope 3 categories are defined as upstream, associated with an organization's purchases of goods and services (categories 1–8). Other categories are downstream, associated with its sold products (categories 9–15); the GHG Protocol standard designates the emissions from the use of sold products as category 11.

Organizations are increasingly interested in quantifying and reducing scope 3 emissions from their value chains because an organization's scope 3 emissions are often much larger than its scope 1 and 2 emissions combined. Scope 3 category 11, use of sold products emissions are significant for organizations in many industries and are typically the largest source of emissions for organizations that sell energy-consuming products due to the emissions associated with energy use.

This paper will focus on sold products that use electricity, including electronics, office and industrial equipment, household appliances, buildings, and electric vehicles. It also includes any digital products or services whose customers must consume electricity to use them, such as streaming, cloud computing, software, and a range of web-based services. This practice paper is intended for the providers of these products, including manufacturers, wholesalers, retailers, and service providers. It illustrates several examples of product categories, but it does not exhaustively list the breadth of potential products, and the unique situation of a company and its products may dictate some individualized interpretation.

For organizations that sell products that use electricity, addressing use of sold products emissions is essential to reducing their total GHG emissions. Renewable electricity can be an important part of an emissions reduction strategy. Purchasing renewable electricity on behalf of customers that consume electricity through the use of the organization's products can be an efficient and scalable approach to reducing emissions.

This paper is a supplement to EPA's Renewable Electricity Procurement on Behalf of Others: A Corporate Reporting Guide. Although the previous paper explicitly excluded scope 3 category 11, we recommend reading that first to get the largest benefit from this paper. As well as providing examples for organizations considering how renewable electricity purchasing can help them reduce their scope 3 GHG emissions as part of their engagement with their value chains, it presents four guiding principles:

1. Accounting should align with the GHG Protocol.
2. Scope 2 emissions should reflect purchasing choices.
3. Scope 3 emissions can reflect choices made by another party.
4. Renewable electricity can be allocated.

These principles apply to the renewable electricity purchasing approaches discussed in this paper as well. The previous paper explicitly excluded scope 3, category 11, mainly because the GHG Protocol's recommended quantification approach for this category reflects emissions (from use) for the full lifetime of each product sold during the reporting year, while the market-based scope 2 emissions of the customer only reflect a single year of emissions, as do many other scope 3 categories. This paper considers approaches for GHG accounting and renewable electricity purchasing to

address this discrepancy. It does not supersede the earlier paper, but instead focuses on supplemental considerations for organizations regarding renewable electricity procurement for use of sold products.

This paper also is not intended to supersede GHG Protocol standards and guidance, but rather serves ass a practice paper, intended to provide examples for several procurement scenarios in an effort to explain the potential application of the GHG Protocol for this type of renewable electricity procurement.

Definition: Use of Sold Products

A sold product is a commodity or item that an organization has sold to a customer. Sold products vary widely based on the type of industry or sector in which an organization operates. This paper focuses on products that use electricity. Product types include:

- Physical products: tangible products that can be seen, touched, and physically possessed.
- Digital products: intangible products that are delivered electronically and only exist in digital form.
- Services: intangible products where the "product" is a service that is sold to the customer.

In addition to selling different types of products, an organization can sell products in different stages of intended use:

- Intermediate products: inputs or components of other products, rather than final end products sold to customers. An intermediate product needs further processing before it can be used in the final product or by the customer.
- Final products: products that are sold to the customer in their final form and do not need further processing to be included in other products. The GHG Protocol further divides final products into:
    - Products consumed by end consumers.
    - Products sold to retailers for resale to end consumers.
    - Products consumed by businesses in their current form.

Table 1 shows examples of products in the various categories.

Table 1. Examples of Types of Products

Product Type	Example Products
Physical products—final	Mobile electronic devices, office and industrial equipment, household appliances, power tools, new buildings, electric vehicles
Physical products—intermediate	Electronic components (hard drives, laptop displays), radio in electric vehicle, lighting in refrigerator
Digital products	Digital media (streaming services, e-books, downloaded music), software
Services	Cloud computing, online services (e.g., purchasing, banking, account management)

The following section discusses approaches for quantifying GHG emissions from the use of sold products that consume electricity. These emissions are categorized as either direct use-phase emissions or indirect use-phase emissions. Direct use-phase emissions result from products that directly use electricity (e.g., electronic equipment), while indirect use-phase emissions occur when a product indirectly uses electricity (e.g., food needing electricity use for refrigeration). Direct use-phase emissions are required to be included in quantifying emissions from use-of-sold-products, while indirect use-phase emissions are optional. This paper focuses on direct use-phase emissions, but the principles can apply to indirect use-phase emissions as well.

Greenhouse Gas Accounting Approaches for Use of Sold Products

The GHG Protocol's recommended emissions quantification approach for category 11 reflects emissions during the full lifetime of each product sold during the reporting year. This lifetime approach is discussed below. Also discussed is an alternate annual emissions approach, which would better match the time boundary of emissions and renewable electricity purchases.

The methodologies described below focus on calculation methods for use-phase emissions from products that directly consume electricity, and are based on guidance from the GHG Protocol Technical Guidance for Calculating Scope 3 Emissions.

Lifetime Emissions Accounting Approach

In the approach to quantify emissions from the use of sold products as currently defined by the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard and the GHG Protocol Technical Guidance for Calculating Scope 3 Emissions, the time boundary includes emissions from the full lifetimes of the products sold during the reporting year (e.g., if a product operates for eight years, eight years of emissions will be reported). This time boundary differs from the one used for scope 1, 2, and many other scope 3 categories because it reflects future emissions rather than emissions only during the reporting year.

To calculate lifetime emissions, the reporting organization needs the following information to first calculate lifetime electricity consumption:

- Quantity and type of products sold in the reporting year
- Location where sold products are used
- Electricity consumption of products, per year or per use
- Total lifetime of product, most commonly measured in years or in number of uses of the product

The emissions from a single product or product category can be calculated using Equation 1a or 1b, based on whether electricity and lifetime are known per year or per use:

Equation 1a

$$\text{Emissions} = \text{Quantity of product sold in reporting year} \times \text{Product electricity consumption per year} \times \text{Product lifetime in years} \times \text{Current emission factor}$$

Equation 1b

$$\text{Emissions} = \text{Quantity of product sold in reporting year} \times \text{Product electricity consumption per use} \times \text{Product lifetime in uses} \times \text{Current emission factor}$$

This calculation would be performed for each location where products are used. The emissions for all products or product categories sold during the reporting year would be summed to determine total emissions.

See the "Accounting Considerations" section below for more guidance on the inputs to these calculations.

Example Lifetime Emissions for One Product Category

A technology company sells 2 million laptops in the United States in 2023. The annual expected electricity consumption of each laptop, based on assumed inputs on number of hours used per day and the wattage of each laptop, is 150

kilowatt-hours (kWh) per year.[1] Each laptop has an expected lifetime of five years. The company will report the anticipated use-phase emissions of the 2 million laptops sold in 2023 over their five-year expected lifetime. Using this information, the equation yields a lifetime electricity consumption (calculated in Equation 2) that is multiplied by the U.S. national average emission factor for 2023. This in turn yields a result of 583,500 metric tons (583,500,000 kilograms) of carbon dioxide equivalent (CO_2e) in use-of-sold-products emissions for 2023 (calculated in Equation 3).

Equation 2

$$\text{2,000,000 laptops} \times \text{150 kWh per year electricity use} \times \text{5 years expected lifetime} = \text{1,500,000,000 kWh lifetime electricity consumption}$$

Equation 3

$$\text{1,500,000,000 kWh lifetime electricity consumption} \times \frac{0.389 \text{ kg } CO_2e}{\text{kWh}} \text{ U.S. national average emission factor for 2023} \times \frac{1 \text{ metric ton}}{1{,}000 \text{ kg}} = \text{583,500 metric tons } CO_2e \text{ lifetime emissions}$$

One criticism of the lifetime emissions accounting approach is that it requires the reporting entity to use a current emission factor or estimate future grid emission factors when accounting for lifetime product emissions. Estimating future emissions rates is imprecise and can lead to an over or under reporting of emissions. Organizations should be conservative when selecting future emissions rates and when estimating emissions beyond five years.

Annual Emissions Accounting Approach

The GHG Protocol is now updating its reporting standards and guidance. Organizations have advocated for the addition of a second option for quantifying use of sold products emissions, in addition to the current approach based on lifetime product emissions. The second option would be to quantify the emissions from the use of sold products for the reporting year based on the organization's sold products that were in use during the reporting year. This would require the organization to gather data on the quantity and type of products that were operating during the reporting year, where they are operating, and what the annual electricity use is. Most of those products will have been sold in the past, which can make data collection more challenging.

This proposed annual approach delivers a number of potential benefits. It would provide better alignment of the time boundary with scope 2 and other scope 3 emissions, offering more renewable electricity procurement options, as discussed below. An annual approach could reflect changes in the performance (improvement or degradation) of a product throughout its life, if data were available, which could better incentivize a manufacturer to focus on long-term performance. While this approach would not provide as much incentive for rapid improvements in the performance of new products, it could provide more accuracy than the lifetime approach if data on the quantity and type of products currently operating are more accurate than the estimation of product lifetime. These data are likely to be more challenging to obtain, however, compared to the data needed for the lifetime approach.

To calculate the annual emissions, the reporting organization needs the following information to first calculate annual electricity consumption:

- Quantity and type of sold products that are operating in the reporting year
- Location where sold products are used
- Annual electricity consumption of products

The emissions from a single product or product category can be calculated using Equation 4:

[1] Note that this example is based on expected electricity consumption per year. If an organization instead has data on electricity consumption for each use of a product, it could use the second equation above, which is based on number of product uses.

Equation 4

$$\text{Emissions} = \text{Quantity of product operating in reporting year} \times \text{Product electricity consumption per year} \times \text{Current emission factor}$$

This calculation would be performed for each location where products are used. The emissions for all products or product categories operating during the reporting year would be summed to determine total emissions.

See the "Accounting Considerations" section below for more guidance on the inputs to these calculations.

Example Annual Emissions for One Product Category

A technology company has used customer feedback to determine that 8 million of its sold laptops are in use in the United States in 2023. Most of these were sold in previous years. The annual expected electricity consumption of each laptop, based on assumed inputs on number of hours used per data and the wattage of each laptop, is 150 kWh per year. Total annual electricity consumption is calculated using Equation 5. The company will report the use-phase emissions of the 8 million laptops sold and in use in 2023. Emissions from the use of sold products in this case will be 466,800 metric tons CO_2e in 2023 (calculated in Equation 6).

Equation 5

$$\text{8,000,000 laptops} \times \text{150 kWh per year electricity use} = \text{1,200,000,000 kWh electricity consumption in 2023 for all products in use}$$

Equation 6

$$\text{1,200,000,000 kWh annual electricity consumption} \times \frac{\text{0.389 kg } CO_2e}{\text{kWh}} \times \text{U.S. national average emission factor for 2023} \times \frac{\text{1 metric ton}}{\text{1,000 kg}} = \text{466,800 metric tons } CO_2e \text{ annual emissions}$$

Accounting Considerations

The considerations in this section apply to both accounting approaches outlined above. They provide examples of practice on the various inputs to the emissions calculations.

Location Where Sold Products Are Used

Because this information will define what emission factors are used to quantify emissions, location is discussed in the "Emission Factors" section below.

Electricity Consumption

Emissions from use of a sold product depend on the electricity consumption of the product. For a physical product, this is the amount of electricity that it directly consumes. For a final physical product, such as a laptop, it is the electricity use of the entire laptop. For an intermediate product, such as a hard drive, it is the electricity use only of the hard drive, not the entire computer. Many digital products or services require use of an electricity-consuming device. For example, streaming media play on a mobile device or television. Cloud computing, software, and web-based services require a

computer or mobile device for access or operation. In these cases, electricity use is based on the electricity use of the associated device while it is running the digital product or service.[2]

Product Lifetime

Lifetime is another consideration in quantifying emissions, and the means of calculating vary by product type. Physical products have an operational lifetime that is most commonly represented in terms of number of years or number of uses of the product, though other metrics are also possible. Digital product lifetimes may best be characterized by the duration of the licensing period when the product is sold. For a service, the definition of "sold" will be important in determining lifetime, as often the services sold in a year are considered to be the services in use during that year only.

Emission Factors

The emission factor provides the average emissions per unit of electricity consumption. The appropriate emission factor depends on whether the reporting organization is quantifying its scope 3 emissions using the location-based or market-based scope 2 emissions of its suppliers or customers. The location-based method considers average emission factors for the electricity grids that provide the electricity used by the product. The market-based method considers contractual arrangements under which an organization procures power from specific sources, such as renewable electricity. Each of these two methods has a defined hierarchy for use in selecting appropriate emission factors. See the guidance in Indirect Emissions from Purchased Electricity for more information on choosing the appropriate emission factor.

For the location-based method, emission factors will vary according to the location of the electricity consumption where the product is used and the carbon intensity of the electricity used in that area . The accuracy of information on where products are used will vary for each organization based on the amount of information it has on its customers and the use of its products. If data are not available specifically on where products are used, the location where products are sold can be applied as a proxy. For example, it could be assumed that all products sold in a country are used in that country. Different product types will have different profiles in this respect. Some products, such as home appliances, are primarily stationary; the location of their use can be characterized based on the home or business location of the customer. Other products, such as cell phones, are mobile. Defining the location of their use is therefore more challenging and may require information on both the primary locations and the travel patterns of customers. Even stationary products may be used in different locations over the course of their lives. For customers that are broadly spread geographically or for mobile products, it is likely that national emission factors will be used instead of regional factors, as companies may not be able to determine the specifics of where their products are used. However, if more granular data on the location of product use are available, a local or regional emission factor should be used.

For the market-based method, emission factors depend on customers' electricity purchasing choices. If a reporting organization would like to reflect renewable electricity purchase either by its customers or on behalf of its customers, the market-based method should be used, allowing the emission factor associated with the renewable electricity choice to be applied.

If renewable electricity or other contractual instruments are not purchased by customers, supplier-specific emission factors are another option in the market-based hierarchy. They could be used if it is known that a product was used within the service territory of a certain electricity supplier. If information is not available on the electricity purchasing choices or the suppliers used by customers, the subnational or national grid average emission factors should be used, and the same approach suggested above would apply.

[2] Digital products and streaming media are sometimes hosted on a server. Emissions from these servers typically would not be characterized as scope 3 use of sold products. There are two typical scenarios:

- Servers are owned by the digital product manufacturer or streaming content provider. These emissions are scope 2 for the manufacturer or content provider.
- Servers are owned by a cloud service provider hired by the digital product manufacturer or streaming content provider. These emissions are scope 3 purchased goods and services for the manufacturer or content provider.

For both the location-based and market-based methods, using a current emission factor for calculations is important even if lifetime emissions are calculated. This is because future emissions are assigned to the current reporting year and future emission factors are unknown.

Considerations for New Sources of Electricity Demand Added to an Existing Grid

Levels of electricity consumption are expected to change over time, both within a company's own operations and throughout its value chain. Electricity demand can change due to a range of circumstances, including business acquisitions and divestitures, normal business growth, and expansion and retirements of products in the market. Certain economic and business activities, such as AI data computing, electrification of the buildings and transportation sectors,[3] and the production of hydrogen through electrolysis, have all been highlighted as likely to add significant new load growth to an existing grid. This load growth requires that organizations involved in these industries pay particular attention to their procurement strategies to meet new electricity demand growth.

When new sources of electricity demand are added to an existing grid system, the risk for increased emissions is an important consideration. When an organization contractually purchases power to meet new incremental electricity demand from a pool of existing generating sources, there is an increased likelihood that other existing dispatchable generation sources will increase their output to meet the total new electricity demand on the grid system. Adding new incremental electricity demand to an existing grid may result in an increase of total grid system emissions even when the organization has secured RECs from zero emitting existing grid sources.

If an organization desires to minimize the emissions impact on the grid, it should assess and meet new incremental electricity demand through an equivalent amount of renewable power from new incremental generation sources, put into service around the same time as the new electricity demand was first realized on the grid. The challenge lies in how each organization assesses or measures what is new or existing electricity demand across its emissions footprint. As a best practice, organizations should consider articulating (as part of setting emissions or renewable energy targets) how their procurement strategies to purchase emissions-free power will align with changes in expected electricity demand overtime.

From the perspective of use of sold products in scope 3, category 11, if an organization launches a new product that consumes electricity and adds demand to an existing electric grid, the organization may need to consider whether the new demand created by that product needs to be met with new incremental sources of zero-emitting generation to avoid inducing grid emissions on the broader grid system. To the extent possible, organizations should also consider other related dynamics of power procurement beyond the buying power from new incremental capacity—specifically geographic and temporal alignment considerations. In 2023, the U.S. Department of Energy issued a white paper that described these dynamics within the context of hydrogen production, explaining a concept called "three pillars." In some cases, new electricity demand from new products may replace the electricity demand of older products that are reaching the end of their operational and electricity-consuming lifespans. In these cases, organizations may consider that the new products do not represent a net increase in electricity demand on the existing grid system.

Data for Determining Emissions and Purchasing Renewable Electricity for Scope 3, Category 11

To determine emissions from the use of sold products, reporting organizations need to know or estimate product electricity consumption (based on either a lifetime accounting or an annual accounting approach) and choose an emission factor that provides the average emissions per unit of electricity consumption.

[3] EPA recommends efficient electrification as part of a broader strategy to decarbonize the grid along with renewable energy.

To determine emissions using the lifetime accounting approach, the reporting organization needs to collect the following information:

- Quantity and type of products sold in the reporting year
- Location where sold products are used
- Electricity consumption of products, per year or per use
- Total lifetime of product in years or in uses

To determine emissions using the annual accounting approach, the reporting organization needs to collect the following information:

- Quantity and type of sold products that are operating in the reporting year
- Location where sold products are used
- Annual electricity consumption of products

Reporting organizations will know the quantity and location of a given product sold based on sales records. Options for selecting emission factors are provided in the "Accounting Considerations" section above. This section focuses on data sources that reporting organizations can use to determine product electricity use and expected product lifetime.

Note that, for physical products, the focus is on electricity use for the product itself. For digital products and services, the focus is on electricity use of the device with which the customer will use the product (e.g., customer's computer, TV, or mobile device).

Data Hierarchy for Product Electricity Consumption

Determining product electricity consumption relies on measuring or modeling how consumers use the product. It is important to maintain consistency in those assumptions and ensure that any year-to-year changes are appropriate and data-supported. This section describes a hierarchy for data sources.

1: Primary Sources

If available, the best data come from actual product operation or the product design process.

Actual operating data can be gathered if the product sold is a connected/smart device that reports operating data over the lifetime of its use. To be usable in the calculation of product use emissions, however, these data would need to be directly transmitted to the reporting organization or made available to it in some other way. Products may have telemetry that would allow direct reporting back to the reporting organization, or utilities may be able to share product electricity use with reporting organizations.

In the absence of actual measured data from the product's use, the next best primary data are data the reporting organization collects during product design and testing. These data would be the basis for determining expected average electricity use based on testing (as opposed to per-use data from connected/smart devices).

- For physical products, three key pieces of data are needed: product wattage, operating hours per year, and expected product lifetime. These could be determined as annual averages incorporating various operating modes (e.g. On, Standby, Sleep) or determined separately for different modes. The reporting organization could determine wattage through a product life cycle assessment (i.e., a cradle-to-grave analysis of the environmental impact of the product over its lifetime), product testing during the design process, or collection of other design data/information by the manufacturer. The reporting organization could determine operating hours and expected product lifetime from a life cycle assessment, design team knowledge of product use, or feedback from customers on how often and how long they use the product.
- For digital products and services, the reporting organization needs to know wattage and operating hours for the device with which the customer will use the product (e.g., laptop or mobile device). That wattage will likely need

to come from secondary sources (see "2. Secondary Sources" below), because the reporting organization does not make the device. For operating hours, the organization could use a similar approach to the one for physical products: design team knowledge of product use or feedback from customers on how often they use the product. The product lifetime for a digital product is the amount of time that the product is available.

2: Secondary Sources

In many cases, reporting organizations will need to rely on secondary sources of product use data since they are not directly manufacturing the product. For example, this is the case for retailers who sell products from many manufacturers. Several secondary sources are available to help estimate annual or lifetime electricity use.

- **ENERGY STAR Scope 3, Category 11: Use of Sold Products Analysis Tool**. This tool, maintained by EPA's ENERGY STAR program, allows retailers to benchmark and project corporate scope 3 GHG emissions associated with the use of sold products that are ENERGY STAR certified. The tool quantifies emissions associated with current sales of ENERGY STAR products and forecasts reductions in emissions based on increases in sales of ENERGY STAR products. With over 70 categories, it can help retailers of any size pinpoint the types and quantities of ENERGY STAR products that will bring them closer to meeting or beating their corporate carbon emission goals. The tool's analysis is based on average product lifetime and product energy use data for standard new products and ENERGY STAR certified products of the following types: residential appliances, residential lighting, consumer electronics, data centers, office equipment, computers and monitors, heating and cooling, commercial products, and other products. These data are available on the tool's "Product Data and EFs" worksheet. The tool is available for download here. Examples of product lifetime and electricity use data contained in the tool are presented in Table 2.

  All ENERGY STAR certified products are listed in EPA's ENERGY STAR database. ENERGY STAR certified product lifetime and energy use data can be found in the data packages that can be accessed from the latest product specification development pages.

Table 2. Average Lifetime and Annual Electricity Consumption for a Sample of Products in the ENERGY STAR Scope 3, Category 11: Use of Sold Products Analysis Tool, v2.0 (November 2023)

Product Category	Product	Product Lifetime (Years)	Electricity—Unit Energy Consumption (kWh/Year)	
			Standard New Product	ENERGY STAR Certified Product
Residential appliances	Room air conditioners	9	611.26	555.69
	Standard ceiling fans	14	120.12	41.09
	Refrigerators—side by side	12	691.56	630.91
Consumer electronics	TVs—LED/LCD TVs, 52.5"–59.5"	5	252	181
	Audio equipment—receivers	7	65	54
	Audio Equipment—soundbars	7	91	28
Office equipment	Workstations	4	1,254	915
	Printers (mono laser)	4	50	35
Computers and monitors	Home desktops	4	29.16	17.36
	Home laptops	4	10.13	7.32
Heating and cooling	Central air conditioners	25	2,062	1,765
Commercial products	Commercial dishwashers	12	19,202	16,814
	Commercial coffee brewers	7	956	701
Other products	Electric vehicle supply equipment	10	38	26
	Vending machines	14	1,337	1,222

- **Department of Energy Federal Efficiency Standards**. Federal efficiency standards cover a broad range of consumer and commercial products. These standards set maximum energy use and other performance requirements for products. The Technical Support Documents for each product contains information on maximum energy use that can be used to help estimate product electricity use as well as product lifetime estimates. Final and draft Technical Support Documents can be found in the "Recent and Ongoing Activities" section of a product's page.

- **Published energy use estimates from the Retail Industry Leaders Association (RILA) and Optera**. RILA and Optera developed and maintain the Direct-Use Product Emissions Database (DPED), a tool intended to facilitate retailer reporting of scope 3, category 11 use of sold products emissions. The DPED includes product use emissions data for more than 180 direct-use product types, such as appliances, electronics, and outdoor power equipment.

Renewable Electricity Procurement Options for Category 11 Use of Sold Products

This section discusses how a reporting organization could purchase renewable electricity on behalf of customers to address a product's emissions associated with its energy consumption, based on whether it is using the lifetime or annual approach. This section discusses GHG accounting and renewable electricity purchasing methods that could more clearly align the time boundary.

In considering these procurement options, a reporting organization should consider applying the principles and methods founded in existing accounting guidance described in Renewable Electricity Procurement on Behalf of Others: A Corporate Reporting Guide. These principles noted below help ensure credible renewable electricity claims and GHG emission benefits from corporate GHG accounting. Note that the term "reporting organization" refers to organizations

applying the four principles below. It does not imply that the organizations in the value chain are not also reporting. In fact, it is preferred if all associated parties are publicly reporting emissions and actively engaged with each other.

1	Accounting should align with the GHG Protocol.	Reporting organizations should report location-based and market-based scope 2 emissions following the quality criteria and emission factor hierarchy defined in the Greenhouse Gas Protocol Scope 2 Guidance.
2	Scope 2 emissions should reflect purchasing choices.	Market-based scope 2 emissions should reflect the purchasing choices of the reporting organization and should not reflect the purchasing choices of another party, unless a purchasing choice that benefits another party is made explicitly to benefit the reporting organization's scope 2 emissions. For this reason, a purchase of renewable electricity should be applied to only one organization's scope 2 emissions.
3	Scope 3 emissions can reflect choices made by another party.	A reporting organization can quantify its scope 3 emissions based on the market-based scope 2 emissions of its suppliers or customers, even if the purchasing choices of those value chain partners are not made explicitly to benefit the reporting organization. The reporting organization should indicate in its public reporting if it is using location-based or market-based scope 2 emissions. A reporting organization should not purchase renewable electricity and simply apply it to scope 3 emissions without involvement from its supplier or customer.
4	Renewable electricity can be allocated.	If renewable electricity is purchased for a portion of an activity, the purchaser can choose to which value chain partners the renewable electricity is allocated. The amount allocated should not exceed the amount purchased.

In addition, clear, transparent, auditable documentation should be used to track REC retirement and allocation to value chain partners or consumers of sold products. This documentation should give a third-party verifier enough information to confidently verify an organization's emissions and target progress.

Renewable Electricity Purchasing in the Lifetime Approach

The time boundary of the lifetime approach differs from the market-based scope 2 emissions of the customer, which includes emissions from the reporting year only. Due to this difference in the timing of emissions, the methods outlined in Renewable Electricity Procurement on Behalf of Others are not directly applicable to emissions from the use of sold products.

To align more clearly with the lifetime approach's time boundary, a reporting organization can consider an alternate purchasing approach, in which it secures a verified contract for a multi-year stream of RECs from a new renewable electricity project,[4] retires those RECs, and allocates them to its customers. Applying generated RECs from a new renewable energy project to the emissions from newly sold products in the current reporting year will best align the time boundary of the renewable electricity with the lifetime emissions approach (as compared to verifying procurement and use through RECs from existing generators).

To maximize this alignment, a reporting organization can apply the following criteria:

- The renewable electricity project start date (also known as the commissioning date or commercial operation date) is before, and as close as possible to, the beginning of the reporting year when a new product's electricity consumption is first realized in the first year of sales. This makes it a new project that is also operational for the entire reporting year.
- The project is in the same electricity market where the products will consume electricity.
- The future stream of the project's RECs is allocated to the future electricity use of the sold product(s) for the duration of each product's expected life, such that each future year of products' electricity use has allocated a quantity of project RECs of the same vintage.
- The project's expected lifetime extends to or beyond the expected lifetime of the products to which RECs will be allocated.
- The REC retirement, allocation, and documentation guidelines from Renewable Electricity Procurement on Behalf of Others are followed.
- The customer involvement guidelines below are followed.
- If the above criteria are met, it would not be necessary to prove that the renewable electricity project was built solely or primarily to serve the reporting organization's product electricity use.

If these criteria are met, the reporting organization can sum the future stream of RECs purchased from a project and use those RECs as the basis for calculating its scope 3 use-of-sold-products emissions for the reporting year under the lifetime accounting approach. This can be done for specific product types or for an entire product portfolio, with one renewable project or with multiple projects that each generate enough renewable electricity to cover the products to which its RECs are allocated. The RECs may cover all or part of the products' annual electricity use. (Full coverage may not be possible if some products are used in markets where a multi-year stream of RECs cannot be purchased. This may be the case in certain markets that present difficulties in siting renewable electricity projects.) The customer to whom the RECs are allocated can apply the quantity of RECs allocated to the product's electricity use for the current reporting year to its current reporting year scope 2 market-based emissions; it can apply the RECs allocated to the next reporting year in the next reporting year's emissions; and so forth until the end of the product's lifetime.

[4] The newness of the renewable project should be in relation to when a product(s) increases new incremental demand on an existing grid.

Example of Renewable Electricity Purchasing for the Use of Sold Products in the Lifetime Approach

In the following example, a reporting organization manufactures three products, each of which has a different product lifetime and annual electricity use. The lifetime electricity use of these products is reflected in emissions reporting. The organization purchases a future stream of RECs from three new solar projects. The total quantity of RECs from the three projects is allocated to the three products in total; it exceeds the total annual electricity use for the products. This example meets the criteria listed above.

Table 3 presents the electricity use of the three sold products over their lifetimes. Table 4 presents the electricity use of each of the sold products as reflected in the organization's emissions reporting. Table 5 presents the RECs generated from the renewable electricity project to cover the electricity use of the organization's sold products. This reflects some degradation of solar panel output over time.

Table 3. Electricity Use of Products

Product	Product Lifetime (Years)	Electricity Use (MWh)										
		Reporting Year (RY)*	RY+1	RY+2	RY+3	RY+4	RY+5	RY+6	RY+7	RY+8	RY+9	RY+10
Product A sold in RY	10		2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Product B sold in RY	5		2,000	2,000	2,000	2,000	2,000					
Product C sold in RY	8		3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000		
Total			**7,500**	**7,500**	**7,500**	**7,500**	**7,500**	**5,500**	**5,500**	**5,500**	**2,500**	**2,500**

*Electricity use in the reporting year is 0 MWh because the example assumes the products' lifetime begins the year after the reporting year. If more detail is available on when products begin operating, that could be reflected in this type of table.

Table 4. Electricity Use of Products Reflected in Emissions Reporting

Product	Product Lifetime (Years)	Electricity Use Reflected in Emissions Reporting (MWh)
Product A sold in RY	10	25,000
Product B sold in RY	5	10,000
Product C sold in RY	8	24,000
	Total	**59,000**

Table 5. RECs Generated from Renewable Electricity Project to Cover Product Electricity Use

Renewable Electricity Project	Project Lifetime (Years)	RECs Generated (MWh)										
		RY	RY+1	RY+2	RY+3	RY+4	RY+5	RY+6	RY+7	RY+8	RY+9	RY+10
Solar 1 (1,200 kW)	20	2,600	2,600	2,500	2,500	2,400	2,400	2,300	2,300	2,200	2,200	2,100
Solar 2 (1,200 kW)	20	2,600	2,600	2,500	2,500	2,400	2,400	2,300	2,300	2,200	2,200	2,100
Solar 3 (1,200 kW)	20	2,600	2,600	2,500	2,500	2,400	2,400	2,300	2,300	2,200	2,200	2,100
Total		**7,800**	**7,800**	**7,500**	**7,500**	**7,200**	**7,200**	**6,900**	**6,900**	**6,600**	**6,600**	**6,300**

Renewable Electricity Purchasing in the Annual Approach

Using an annual emissions approach allows for time-coincident matching of renewable electricity purchases to emissions. The renewable electricity should be sourced from the same electricity market where the products consume electricity. Organizations can then apply the methods outlined in Renewable Electricity Procurement on Behalf of Others for purchasing renewable electricity on behalf of customers. This can be done for specific product types or for the entire product portfolio. (Purchasing renewable electricity for the full portfolio may not be possible if some products are used in markets where renewable electricity cannot be purchased.) Renewable electricity purchasing provides a significant additional opportunity for organizations to reduce their scope 3 emissions by helping their customers reduce scope 2 market-based emissions.

Example of Renewable Electricity Purchasing for the Use of Sold Products in the Annual Approach

In the following example, a reporting organization manufactures three products, whose annual electricity use is summed. The organization purchases RECs from several different sources so that the total quantity of RECs exceeds the electricity use of the products in the reporting year. Table 6 presents the electricity use of the three products sold in the reporting year. Table 7 presents the RECs generated from the renewable electricity project in the reporting year or the RECs purchased in the reporting year.

Table 6. Electricity Use of Products Operating in Reporting Year

Product	Electricity Use (MWh)
Product A	20,000
Product B	8,000
Product C	15,000
Total	**43,000**

Table 7. RECs Generated from Renewable Electricity Project or Purchased in Reporting Year

REC Source	RECs (MWh)
Solar project 1 (3,000 kW)	5,800
Solar project 2 (4,500 kW)	9,900
Solar project 3 (2,500 kW)	6,100
Unbundled RECs	15,000
Total	**36,800**

In this case, the quantity of RECs is less than the total product electricity consumption. A portion of the product electricity use equal to the quantify of RECs will have a zero emission factor applied. The remaining electricity use will be multiplied by an appropriate emission factor in accordance with the market-based emission factor hierarchy.

Multiple Reporters

As explained in the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard, the emissions for a single product may appropriately be included in the use-of-sold-products emissions for multiple organizations. For example, the manufacturer of an electronic device and the retailer would both report emissions from the product's use. Also, the manufacturer of an energy-consuming intermediate product and the manufacturer of the final product would both report use-of-sold-products emissions associated with the intermediate product.

Consider a case where the customer (the end-user of the product) has been conveyed the right to claim the environmental attributes of renewable electricity, either because they have purchased renewable electricity or because

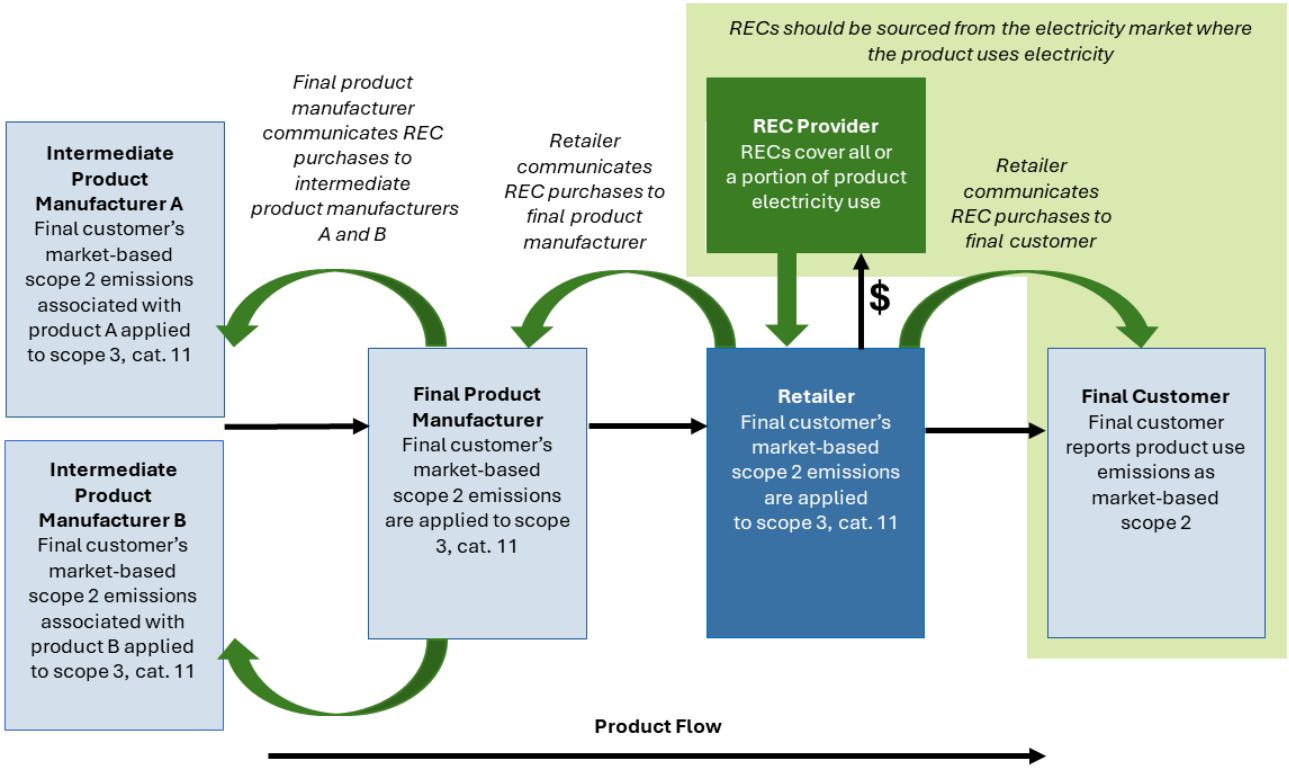
the manufacturer of the sold product has purchased it on their behalf. The customer would then apply the renewable electricity to its scope 2 market-based electricity emissions for the use of certain products. Multiple reporting organizations that supplied those products, such as the manufacturer and the retailer, could reflect those market-based electricity emissions in their scope 3 use-of-sold-products emissions.

This would be more challenging for individual consumers than for business customers. It might require communication between the reporting organizations. For example, if a retailer buys renewable electricity on behalf of the consumers of a product, it could report this to the product manufacturer.

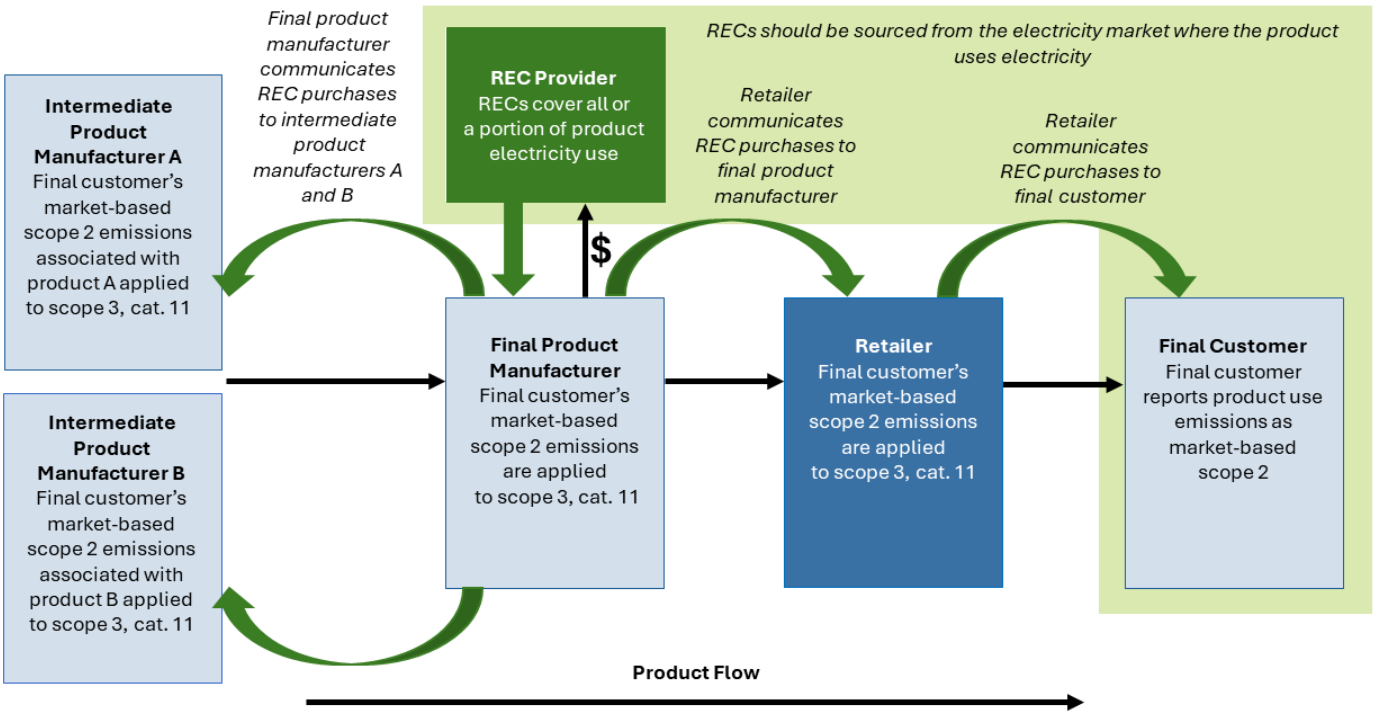
Examples of Emissions Reporting Under Several REC Purchasing Scenarios

The following graphics illustrate emissions reporting through the product value chain under several REC purchasing scenarios. These examples assume that each final product is composed of two intermediate products. In all three scenarios, RECs are purchased on behalf of the final customer. These RECs must be purchased in the electricity market where the products will be used. The final customer reports product use emissions as market-based scope 2 emissions and the intermediate product manufacturers, final product manufacturer, and retailer report product use emissions in scope 3, category 11. In any purchasing scenario, sufficient communication is critical to appropriately engaging value chain partners. This is discussed further in the next section.

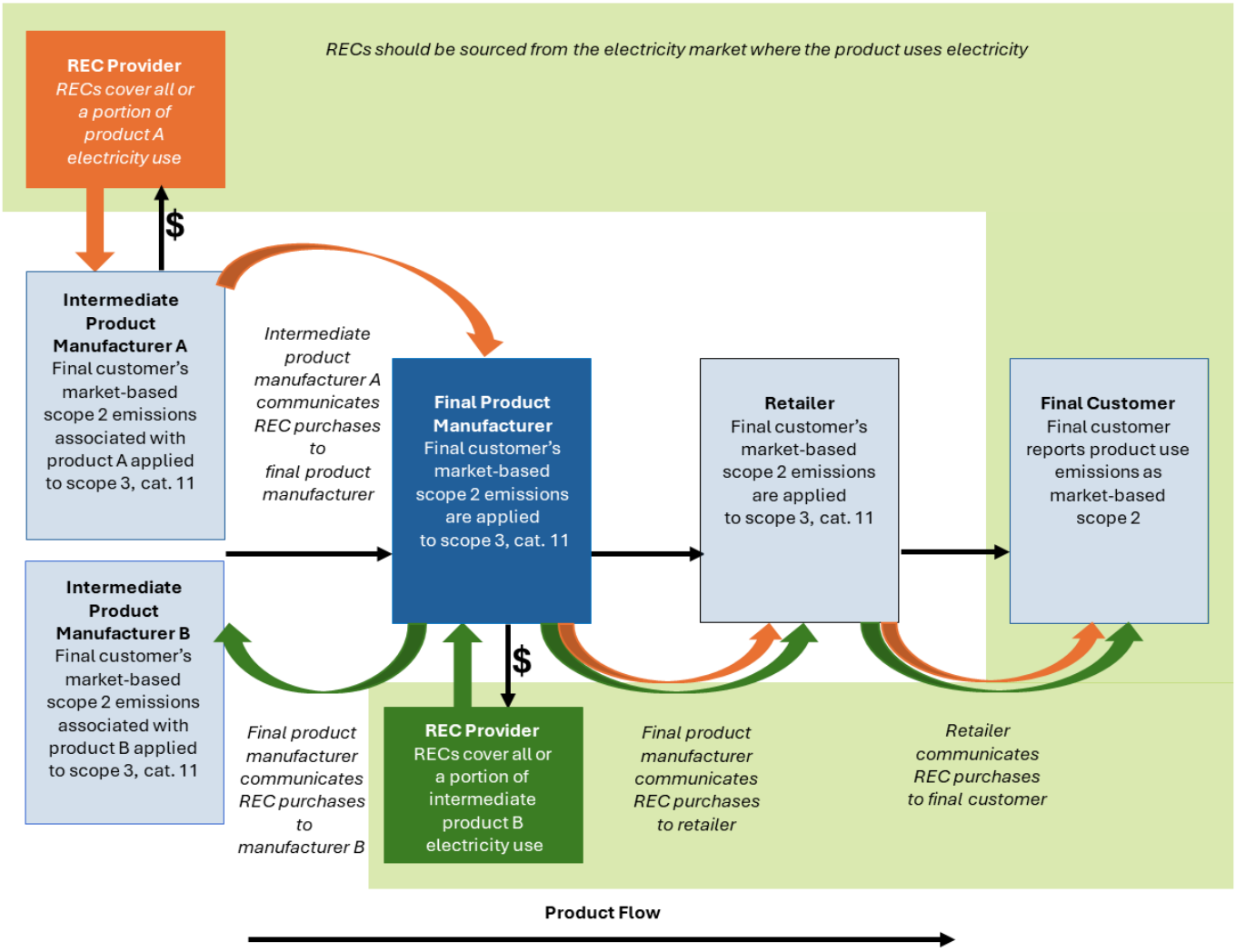
*Scenario 1: Emissions reporting when the **retailer** purchases and retires RECs that cover all or part of a product's electricity use on behalf of the final customer.*



*Scenario 2: Emissions reporting when the **final product manufacturer** purchases and retires RECs that cover all or part of a product's electricity use on behalf of the final customer.*



Scenario 3: Emissions reporting when intermediate product manufacturer A purchases and retires RECs on behalf of the final customer to cover all or part of the electricity use associated with its product, and the final product manufacturer purchases and retires RECs on behalf of the final customer to cover all or part of the electricity use of intermediate product B



REC Purchasing Communication

The guiding principles from Renewable Electricity Procurement on Behalf of Others indicate that in any approach to purchasing renewable electricity on behalf of a customer, there should be transparent communication of the transaction between the reporting organization and the customer to ensure proper GHG accounting and documentation. This is also important for renewable electricity purchases for use of sold products, because it ensures that the customer is aware of any renewable electricity purchases and can reflect this in their scope 2 emissions reporting. The complexity of implementing this principle will vary depending on whether the reporting organization is selling to another business or selling to a consumer. With a business customer, it is more practical to directly involve the customer in the renewable electricity purchase and apply one of the REC allocation options outlined in Renewable Electricity Procurement on Behalf of Others. This approach is recommended wherever possible.

For individual consumers, there may be much less communication with the reporting organization, so a range of levels of involvement could be acceptable. These are listed below in order of preference based on alignment with the guiding principles. Significant process changes might be necessary to accomplish them.

- **Opt-in:** The consumer is involved by consenting to the purchase of RECs on their behalf. This consent could be acquired at the point of sale, through a customer response survey or website form, or by way of product interactivity with the customer. The opt-in approach is most aligned with the accounting principles discussed earlier in this paper and the engagement approaches outlined in Renewable Electricity Procurement on Behalf of Others.
- **Opt-out:** The consumer is included unless they opted out of the purchase of RECs on their behalf. They could opt out at the point of sale, through a customer response survey or website form, or by way of product interactivity with the customer.
- **Inform:** The consumer is included in the purchase of RECs without their consent. The reporting organization informs them that it is buying renewable electricity to meet all (or a certain percentage) of the expected electricity use of the product. This disclosure could be made in a variety of ways, such as at the point of sale, through product packaging or documentation, through outreach to the customer, or by way of product interactivity with the customer.

Other Considerations

This section discussions some other considerations involved in purchasing renewable electricity to cover emissions from the use of sold products.

Category 11 Emissions Responsibilities

- As previously noted, all product manufacturers, including intermediate product manufacturers and retailers that sell products that use electricity, have a responsibility under the current GHG Protocol to report emissions associated with the use of the products sold under category 11. Final product manufacturers and retailers report emissions associated with the electricity used by the full product, but intermediate product manufacturers only report the emissions associated with the electricity the intermediate product uses.
- Buying renewable electricity to meet a product's electricity use also requires a key strategic approach:
    - Double or triple buying of renewable electricity only serves to increase the cost of goods sold. The approach outlined in this paper attempts to avoid this.
    - Strategic procurement requires good communications up and down the value chain.
    - Product labeling or product disclosure support effective implementation.

Market Boundary Considerations

- Depending on the product, electricity use may be in a different market than the one where the product was sold (e.g., a cell phone user might travel with their phone). Renewable electricity that is purchased to cover category 11 emissions should be generated in the market where the product consumes electricity (scope 2 alignment practices). For example, a REC generated in the United States should not be applied to electricity consumption in Europe. Reporting entities may have varying degrees of information/data on where products are consuming electricity. Unless there is clear information or data showing that a product is being used in a different market than the one where it was purchased, reporting entities may choose not to adjust for the alignment of renewable electricity generation to product consumption across market boundaries.
- Following the core GHG accounting principles of relevance, completeness, consistency, transparency, and accuracy, a reporting organization should focus on clear, transparent documentation of its approach to addressing category 11 emissions.

More Granular Alignment of Renewable Electricity Generation to Product Electricity Consumption

- Several strategies have emerged to better match renewable electricity generation with consumption (e.g., hourly instruments). These strategies could be applied to the annual emissions accounting approach.
- Organizations have to determine whether market infrastructure exists to support these strategies.
- Siting renewable projects in "dirtier" grids (known as "emissionality") may not result in additional reductions in a GHG inventory, but can achieve a greater emissions reduction impact when considered outside the boundaries of the inventory.
- Reporting entities may have different perspectives on market boundary determinations, (e.g., within the United States, within a particular state/province, within a particular balancing authority).

Data Availability and Precision

- Data on where a product is used, how much electricity a product uses, and the renewable electricity procured to meet a product's electricity use will influence the approach a reporting entity takes to address category 11 emissions.
- Greater data precision will allow for better identification of emission reduction opportunities and more accurate tracking of those reductions. Organizations should understand that high data precision may come at a higher cost. Organizations should clearly assess the necessary level of precision that meets their circumstances, but also achieves the objective of core GHG accounting principles to deliver complete and accurate emissions accounting.

Over- vs. Underproduction of Lower-Emissions Power

- Reporting entities procuring renewable electricity to address category 11 emissions may have to address over and underestimates of both electricity generation and product electricity consumption.
- Organizations may want to address a minimum percentage of their product's electricity use in a market through direct project engagement, while also engaging through more flexible and adaptable renewable electricity procurement options to help scale an accurate match to the reporting entity's products.
- Organizations should be clear on how purchases of renewable electricity are allocated between their own electricity use (scope 2) and their customers (scope 3) electricity use, with a focus on transparent documentation for this allocation.

Note: This practice paper is part of a series of papers developed by EPA to identify best practices based on existing efforts to incorporate purchases of renewable electricity into current corporate greenhouse gas accounting for category 11 sold products in a way that is consistent with the principles already identified under existing guidance for reporting electricity under scope 2.