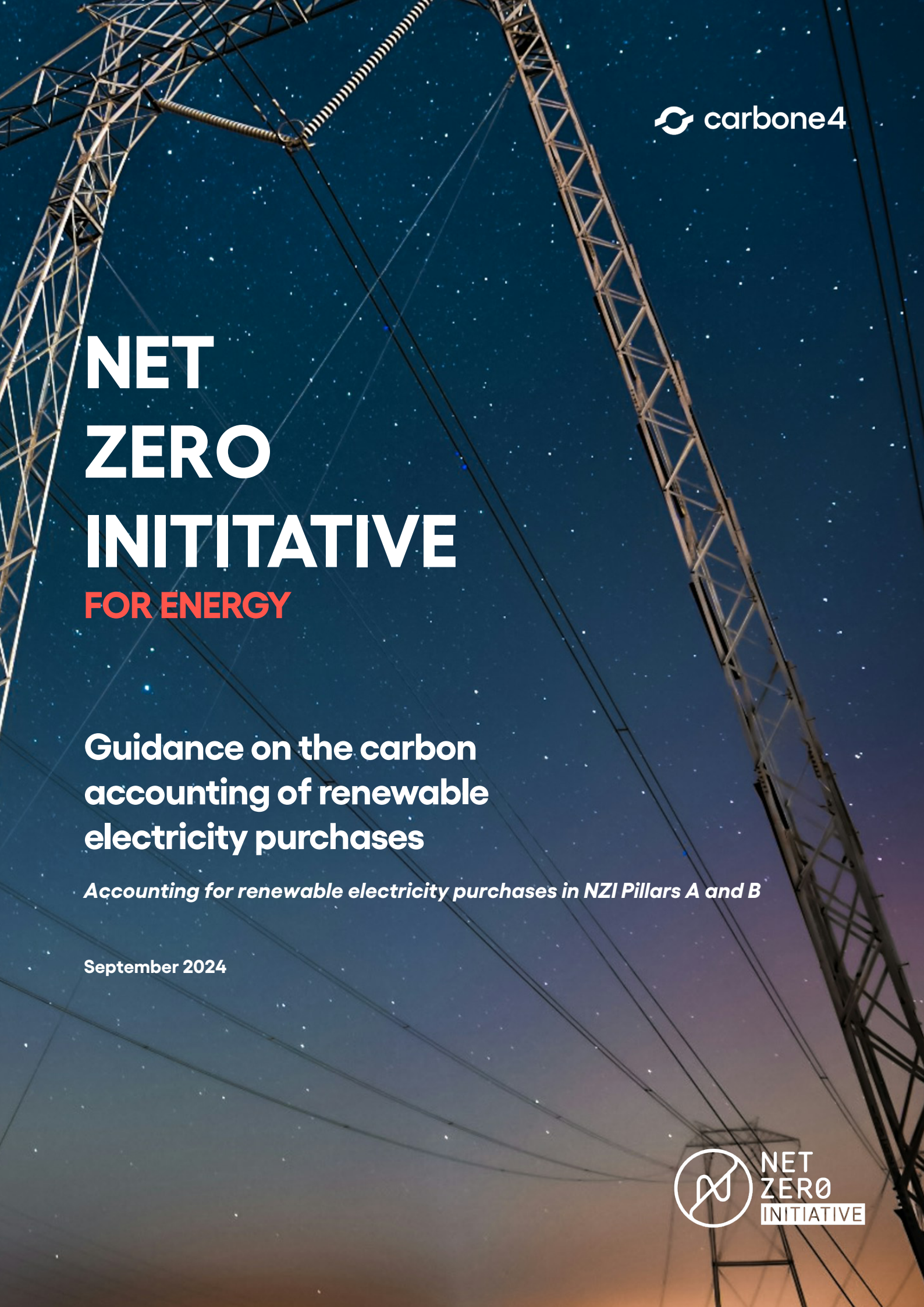

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NET ZERO INITITATIVE
FOR ENERGY

Guidance on the carbon accounting of renewable electricity purchases

Accounting for renewable electricity purchases in NZI Pillars A and B

September 2024

NET ZERO INITIATIVE

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Table of contents

Tables and figures

Executive summary

Since its creation, the Net Zero Initiative has aimed to support companies in their contribution to collective carbon neutrality in an ambitious way that is compatible with climate science. To achieve this, the initiative aims to structure the framework for climate measurement, targeting and action around three distinct pillars: induced emissions (pillar A), avoided emissions (pillar B), and sequestered emissions (pillar C). The electricity sector plays a key role in the overall decarbonization of energy, and of many sectors that depend on it, such as industry and transportation. Furthermore, companies are expected to demonstrate their ability to reduce the electricity emissions on which they depend, which are usually accounted in the scope 2 of their carbon footprint.

PART 1 - LOW CARBON ELECTRICITY MARKET AND CARBON ACCOUNTABILITY SYSTEMS

Electricity markets and procurement contracts

Many electricity procurement contract systems have been developed around the world in recent years so that companies can 'choose' the type of electricity they buy. Given that electricity networks are connected at regional or national level, it is rare for these procurement contracts to reflect a physical link between producer and consumer.

In particular, studies on the impact of Guarantees of Origin (GO) on electricity markets indicate that without hourly matching[1], their impact is very low, if not negligible[2], and monitoring data to follow temporal coherence is generally insufficient. What's more, GOs make little contribution to financing new renewable energy infrastructure. In 2022, the average price of a GO in France was €4.1/MWh[3], compared to €63/MWh[4] for the cost of producing additional renewable electricity (mainly ground-mounted solar PV and onshore wind).

Limits of existing accounting for renewable electricity purchases

Market-based accounting makes it possible to use the emission factors of the renewable electricity purchased with a certificate, without systematic effect on the decarbonization of the electricity consumed. For example, under the current European system, a German organization that consumes electricity on a winter's night can claim for 'renewable electricity' and emission reductions in market-based, thanks to Guarantees of Origin issued from photovoltaic production on a summer's day in Spain.

This spatial and temporal inconsistency is not only likely to slow down the real decarbonization of electricity (in Germany in the former example), it is also misleading information for buyers about the nature of the electricity consumed. What's more, this mechanism masks the necessary efforts

[1] Duration between the time of consumption of the electricity and the time of issuance of the renewable certificate of less than one hour.
[2] Langer, Lissy and Brander, Matthew and Lloyd, Shannon M. and Keles, Dogan and Matthews, H. Damon and Bjørn, Anders, *Does the purchase of voluntary renewable energy certificates lead to emission reductions? A review of studies quantifying the impact* (November 17, 2023).
[3] 2022 GO global results - EEX
[4] World Energy Outlook 2023 – International Energy Agency

to make the electricity network more flexible (storage capacity, adaptation of demand) linked to the development of intermittent renewable energies[5]. Figure 1 below illustrates that difference between the physical connection of an organization connected to a grid powered with renewable and non-renewable electricity, and the financial connection to the wholesale market with renewable certificates from all over Europe.

At European level, the market is flooded with **low-cost Guarantees of Origin** where renewable electricity production is easy and substantial (solar energy in Spain or hydroelectric power in Norway, for example). However, the players present in these countries are also likely to claim low-carbon electricity for this same production because of the physical connection that links them to these capacities, making preferential use of location-based accounting, leading to the risk of double-counting.

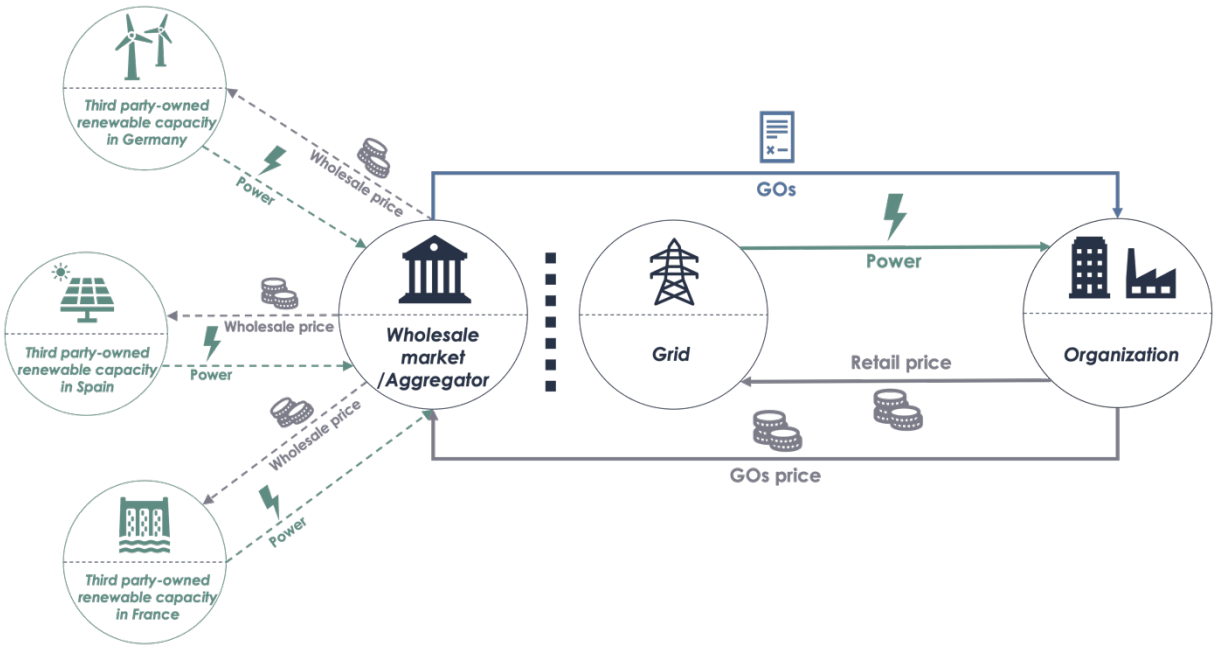


Figure 1 – Example of purchase of Guarantees of Origin on the European wholesale market.

Needs for new methods and criteria in accounting rules

In this context, this guide focuses on the following questions: *under which conditions does an electricity procurement contract really help to decarbonize the electricity on which an organization depends? Can current carbon accounting reflect this? If not, how could it evolve to do so?*

This guide focuses on the main types of renewable electricity contract that exist but does not cover Guarantees of Origin or any other certificates for non-renewable electricity. These are however an interesting evolution of certificate markets, and their impact on emissions accounting could be developed at a later stage. **This document presents methodological proposals for the accounting associated with these contracts within the NZI framework.** These proposals aim to reflect the real impact of these different energy procurement contracts in terms of induced

[5] Maxence Cordiez - Institut Montaigne, *Décarbonation : corriger le système des garanties d'origine électriques :* https://www.institutmontaigne.org/expressions/decarbonation-corriger-le-systeme-des-garanties-dorigine-electriques

emissions (pillar A) and avoided emissions (pillar B). In fact, these types of electricity procurement contracts encompass different realities with a highly variable impact on the decarbonization of electricity, which current carbon accounting does not capture.

PART 2 - RECOMMENDATIONS FOR CHANGES IN ACCOUNTING RULES

New carbon accounting criteria are therefore being introduced to encourage economic players to favor the most virtuous contracts in terms of electricity decarbonization. Through this document and these recommendations, the NZI framework aims to contribute to the ongoing work of the GHG Protocol for its Corporate Standard, with a rigorous and ambitious accounting of renewable energy purchases, likely to accelerate the electricity sector's decarbonization.

Criteria for spatio-temporal consistency

This guide therefore proposes ambitious criteria for spatio-temporal consistency between electricity production and consumption, to stimulate the electricity market towards greater transparency and better spatio-temporal consistency of electricity purchases. **This guide's key proposals are related to market-based accounting of GOs and Purchased Power Agreements for Pillar A:**

1. **Spatial coherence**: **the buyer's facilities and the renewable installation must be on a connected network and limited to bordering countries/states or province.** This condition reflects the fact that, despite interconnections between grids of various countries, states, or provinces, the amount of electricity transferring from one grid to another is often limited, particularly when the grids are not adjacent to each other. The development of electricity interconnections is one of the European Union's energy priorities, but requires major infrastructure. The interconnection capacity target for each country (with its bordering countries) has been set at 10% of its installed capacity in 2020 and 15% in 2030[6], a long way from an electricity network where electrons would cross the continent as easily as on the market.

2. **Temporal coherence: the consumption must take place within 30 days of GO production time (monthly matching) and emissions reduction accounting depends on the level of temporal coherence**:
    - 100% of emission reductions can be accounted for with hourly matching.
    - 50% of emission reductions can be accounted for with daily matching.
    - 25% of emission reductions can be accounted for with monthly matching.
    - No reductions can be accounted for if coherence greater than one month

Temporal coherence	Hour	Day	Month	> 1 month
Emission reductions acceptance rate α	1	0.5	0.25	0

Table 1 - Emission reductions acceptance rate depending on the temporal coherence of Guarantees of Origin.

[6] RTE, *SDDR 2019 Chapitre 05 - Les interconnexions : https://assets.rte-france.com/prod/public/2020-07/SDDR%202019%20Chapitre%2005%20-%20Les%20interconnexions.pdf*

Transparency and precise tracking of electricity markets

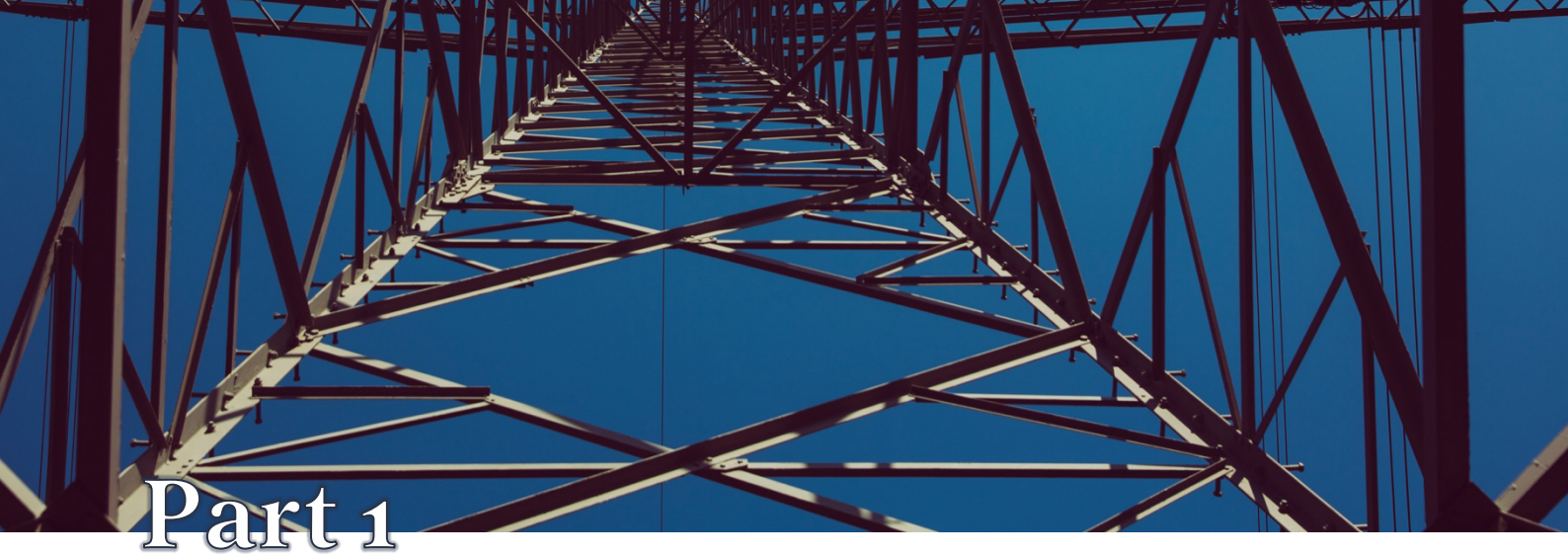
Some of these conditions, particularly hourly temporal alignment between electricity consumption and the issuance of renewable certificates (referred to as temporal coherence in this guide), pose technical challenges to Pillar A emissions reduction, given that energy markets may not currently facilitate precise tracking.

Ultimately, strict hourly matching conditions should be established for accounting GOs in a few years' time. However, daily and monthly matching may temporally account for a partial reduction in emissions related to electricity consumption. These lenient conditions remain purposely ambitious, as stringent guidelines should drive rapid evolution within markets and organizations.

This transitional phase has been designed to encourage players to improve their temporal consistency, until conditions allow for more feasible hourly matching. In addition, the proposed accounting rules are intended to support ongoing initiatives to develop information systems at the required level of granularity. Moreover, **the development of an accurate and harmonized tracking system of the residual mix emission factor is also crucial to make market-based accounting reliable and an incentive for decarbonization.**

Regardless of the methodology adopted by an organization for energy-related emissions accounting, **it is necessary to transparently report the spatial and temporal coherence of the renewable certificates cancelled by organizations against their consumption.**

In terms of avoided emissions for Pillar B, **energy certificates that have not been used to reduce Pillar A** (induced emissions) **can be used to claim avoided emissions** (Pillar B - category B3). In line with NZI guidelines, this guide suggests that avoided emissions should be calculated in relation to the country's average EF, and in proportion to the financial contribution. As with all avoided emissions, if a more specific counterfactual scenario can be proposed, the purchaser is encouraged to do so.



Part 1

Low carbon electricity market and carbon accountability systems

I. Introduction

Companies can purchase, consume, or finance renewable energy through various market mechanisms and contractual tools. Given that electricity networks are connected at regional or national level, it is rare for these procurement contracts to reflect a physical link between producer and consumer. Questions that arise are: *under which conditions does an electricity procurement contract really help to decarbonize the electricity on which an organization depends? And can current carbon accounting reflect this?*

This guide proposes to clarify the position of NZI concerning climate accounting rules for these situations, both in Pillar A (induced emissions) and in Pillar B (avoided emissions) of the NZI framework. In view of the ongoing work by the GHG Protocol concerning the GHG Protocol Corporate Standard, NZI wishes to provide its recommendations for renewable energy purchases through this guide. The disparities between this guide and the current GHG Protocol Corporate Standard mainly concern the market-based accounting approach and pillar B avoided emissions for renewable energy contracts.

In this guide, the goal is to establish a more precise methodology for evaluating the actual climate impact of various procurement contracts. It aims to commend organizations whose initiatives contribute to a reduction in overall energy-related emissions. This guide therefore proposes long-term accounting objectives based on spatial and temporal consistency; and less stringent transitional criteria given the current lack of technical resources for properly monitoring the matching between production and consumption.

II. Energy sources

This guide focuses on renewable electricity sources, renewable gas purchases have been addressed in a separate document. Here are some illustrations of renewable energy sources:

Electricity	PV and Concentrated Solar Power
	Onshore and offshore wind power
	Hydroelectricity, water turbines
	Geothermal energy

Table 2 - Examples of renewable electricity sources.

III. Types of electricity supply or contracts

This guide attempts to cover the different types of renewable electricity supply, whether physical supply (self-consumption, on-site PPAs, grid purchase), contracts, or other legal or market arrangements (off-site PPAs, purchase of guarantees of origin (GO), direct investments, etc.).

The sources covered are the following and are more thoroughly described in the next sections:

- ***Simple purchase of energy from the grid:*** The organization buys its energy directly from the electricity grid.
- ***Self-consumption of renewable electricity and/or on-site Power Purchase Agreement (PPA):***
  - Self-consumption of renewable electricity: the organization produces and consumes its own renewable electricity.
  - On-site Power Purchase Agreement (PPA): The organization finances the installation of renewable capacity near its sites, and directly consumes all or part of the output of that capacity.

Energy Attribute Certificates (EAC), Renewable Energy Certificates (REC), Guarantees of Origin (GO):

Energy Attribute Certificates (EACs) exist in many countries under different names but operate in a similar way. They include Renewable Energy Certificates (RECs) in the United States and Guarantees of Origin (GOs) in Europe. EACs, GOs and RECs are used interchangeably in this guide, generally under the term GO, which is generic in Europe. An Energy Attribute Certificate enables to track the origin of a MWh injected into the grid. It is a contractual instrument designed to transmit information about the electricity produced (type of plant, name of plant, location, actual quantity of electricity produced).

EAC are generally based on a standard (e.g. The International REC Standard), an accounting system and an exchange market. EACs work as follows:

- The electricity producer indicates the quantity of electricity produced and fed into the grid.
- The electricity producer receives certificates.
- These certificates can then be traded and cancelled by market players to claim the use of the energy produced.

An EAC can also be used to transmit an emission factor (EF) to the purchaser for carbon accounting purposes (Scope 2).

Off-site PPA

Physical ("as-generated") off-site PPA: The organization commits to buying a given amount of energy at a given price from the contracted renewable installation (on the same network as its facilities) and matches its consumption to the production of the off-site installation. In practice the organization will often pay a utility for balancing services. Excess electricity will be resold on the wholesale market and low production will be compensated by buying on the market. The contracts often last 10-20 years. The renewable certificates associated with the renewable production should be transferred to the buyer. "Physical" does not mean the electricity consumed is that physically produced by the installation.

Financial off-site PPA: The organization commits to buying a given amount of energy at a given price from the contracted renewable installation. The installation is not necessarily on the same network as the organization's facilities and its consumption does not necessarily match the production of the off-site installation. The renewable certificates associated with the renewable production should be transferred to the buyer.

Purchase of electricity from a renewable aggregator: The organization purchases electricity from a renewable aggregator. The aggregator can source the renewable energy through different types of contracts and aims to balance production and consumption. The renewable certificates associated with the renewable production should be transferred to the buyer.

Premiums: The organization pays a premium on its energy bill, which goes into a fund to install new renewable electricity generation capacity.

Direct investment in renewable capacity: The organization takes an equity stake in a renewable capacity.

It should be noted that for PPAs and energy purchased from a renewable aggregator to be accounted for in market-based accounting, **the Energy Attribute Certificates must be transferred**. If the renewable certificates are not transferred to the buyer, the emissions accounting should follow the "simple purchase of energy from the grid" method.

IV. Types of accounting for renewable electricity purchases

1. Location-based, market-based

Two broad approaches to accounting for renewable power purchases can be distinguished:

- The ***location-based*** approach, which is based on the energy physically consumed by a given entity, regardless of the contract. This approach reflects the real average impact of the energy supply in the country. This method uses the average emission factors (EF) of the national electricity mix and is mandatory for emissions accounting. This average method does not distinguish between consumption profiles over the course of the year and the day, whereas electricity generation sources are likely to vary greatly over time. For example, electricity consumed during peak hours is more likely to come from controllable generation capacity, which may be fossil-fired.

- The ***market-based*** approach, which is based on the energy produced by the entity with which a given entity has a contract, regardless of the actual origin of the energy physically consumed. This method uses the emission factors (EF) of the electricity purchase contracts, and the EF of the residual mix for the part not covered by contracts.

For example, *when an organization gets an off-site financial PPA contract (with photovoltaic production, for example), it nevertheless continues to consume 'conventional' electricity from the grid.* ***In location-based emissions accounting****, the average annual electricity production in the country is considered, with a weighted emissions factor for the different sources of production of the country*

In market-based accounting*, it is the electricity produced by the renewable energy capacity (photovoltaic in this example) that generated the GOs that is considered. If the electricity consumed is greater than the electricity purchased through this contract, then the remaining electricity is accounted for using the residual grid emission factor, which corresponds to the electricity consumed from the grid that has not been cancelled and withdrawn through contracts.*

In the market-based approach, a multitude of energy contracts are considered, each with varying impacts on the grid. The aim of market-based accounting is to comprehensively grasp and accurately measure the climate impact of organizations based on their energy consumption. Given this, it becomes crucial to distinguish between different energy contracts and prioritize those that yield the most positive climate impact, that contribute to reduce the power grid's emissions.

Market-based accounting uses the residual mix emission factor for some electricity consumption. The residual mix typically includes a combination of various energy sources, including fossil fuels, nuclear power, and renewable sources that are not explicitly accounted for through RECs (Renewable Energy Certificates) or GOs.

Today, **the residual mix is not calculated sufficiently precisely and uniformly over different regions** leading to renewable generation being sometimes double counted, sometimes forgotten. For the residual mix to accurately depict the "residual" electricity not claimed for through RECs, a common methodology must be established over different regions and markets, and **an accurate tracking system managed by a specific institution should be developed to make market-based accounting reliable and an incentive for decarbonization.**

2. Pillar A, Pillar B

In the NZI framework[7] , two very different types of corporate climate impact are considered:

- **Pillar A** focuses on counting emissions induced by the organization, including emissions related to energy purchases. Pillar A is commonly referred to as the "carbon footprint" and is divided into several categories. For energy, these are:
    - Scope 1, related to direct emissions (combustion and fugitive emissions) from the use of energy.
    - Scope 2, related to indirect emissions from the production of purchased electricity, steam, heat and cooling.
    - Scope 3 - Category 3 "Energy and fuel related activities not included in scope 1 and 2", related to indirect emissions from purchased energy, i.e. capacity construction, transport and distribution, losses, or upstream fuels.

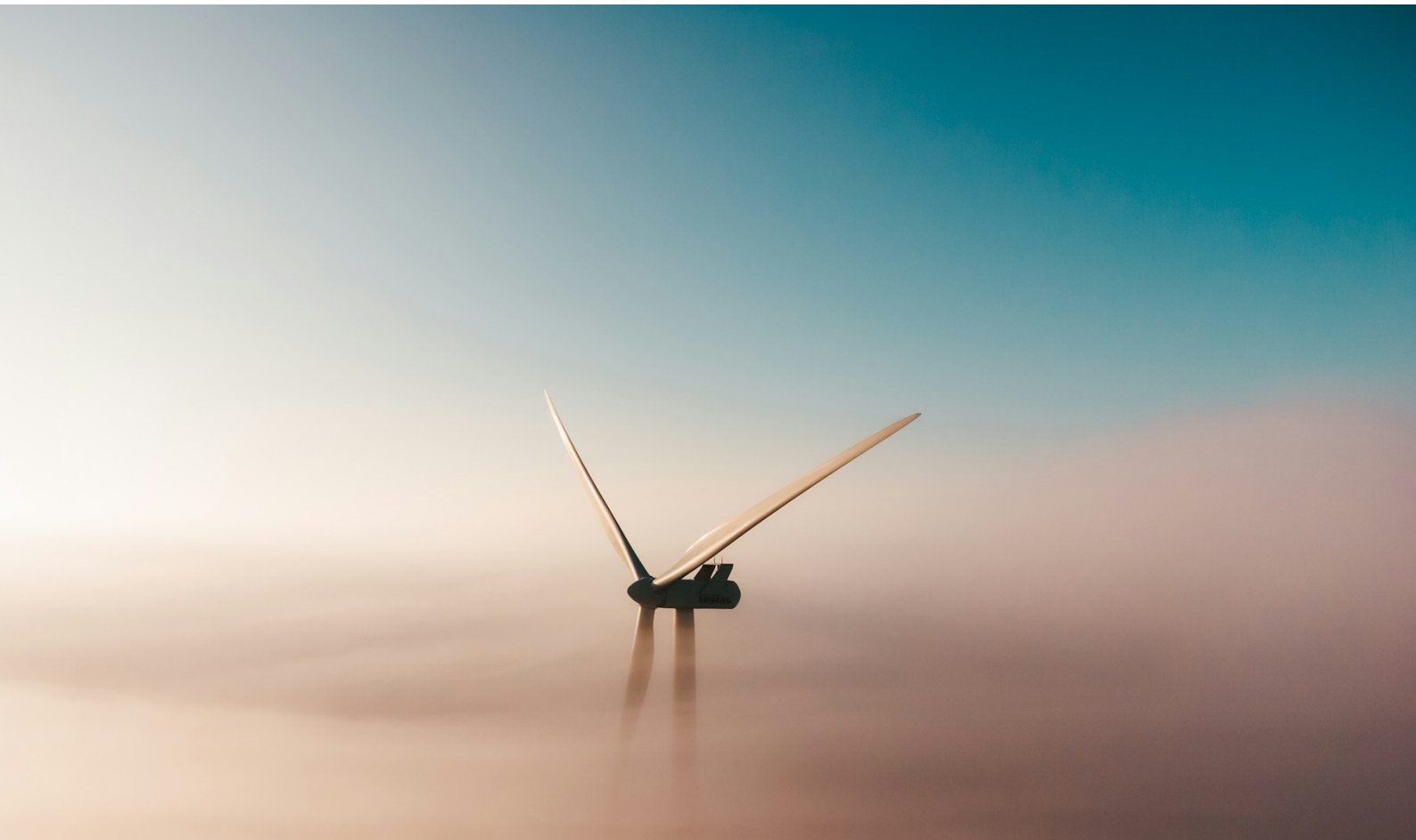
- **Pillar B** aims to quantify the decarbonizing effect of the organization's actions on society, whether it is:
    - B_2: From the sale of its products and services.
    - B_3: Financing of additional projects outside of its value chain.

It should be noted that the different NZI framework pillars estimate different attributes of the corporate climate impact. They can therefore not be subtracted from each other. For example, pillar B's avoided emissions cannot be subtracted from pillar A's induced emissions.

[7] Carbon 4, *Net Zero Initiative. A benchmark for collective carbon neutrality,* 2020.

Three pillars of NZI		REDUCE EMISSIONS		GENERATE REMOVALS
		A/ Reduce the company's emissions	B/ Reduce emissions from others	C/ Remove CO_2 from the atmosphere
		Emission reductions	*Avoided emissions*	*Removals*
In the value chain	Operations	Direct emissions *(scope 1+2)*	-	Direct removals
In the value chain	Upstream & downstream	Indirect emissions *(scope 3)*	Avoided emissions through products and services	Indirect removals
Outside the value chain		-	Financing certified avoided emissions	Financing carbon removal projects

Figure 2 – The Net Zero Initiative matrix. This document focuses on the first two pillars.



Part 2

Accounting rules

I. Introduction

In this section we cover the main electricity contracts and detail NZI's proposed methodology for emissions accounting. As mentioned in introduction, the disparities between this guide and the current GHG Protocol Corporate Standard mainly concern the market-based accounting approach and pillar B avoided emissions.

In this methodology, the use of certain contracts to reduce an organization's Pillar A is subject to the fulfillment of certain conditions. Some of these conditions, particularly hourly temporal alignment between electricity consumption and the issuance of renewable certificates (referred to as temporal coherence in this guide), pose technical challenges to Pillar A emissions reduction, given that energy markets may not currently facilitate precise tracking.

Ultimately, strict hourly matching conditions should be established for accounting GOs in a few years' time. **Daily and monthly matching may temporally account for a partial reduction in emissions related to electricity consumption.** Nevertheless, these lenient conditions remain purposely ambitious, as stringent guidelines should drive rapid evolution within markets and organizations.

Regardless of the methodology adopted by an organization for energy-related emissions accounting, **it is necessary to transparently report the spatial and temporal coherence of the renewable certificates cancelled by organizations against their consumption.**

I. Simple purchase of electricity from the grid

The organization buys its energy directly from the electricity network, at the retail price, as illustrated in the figure below.

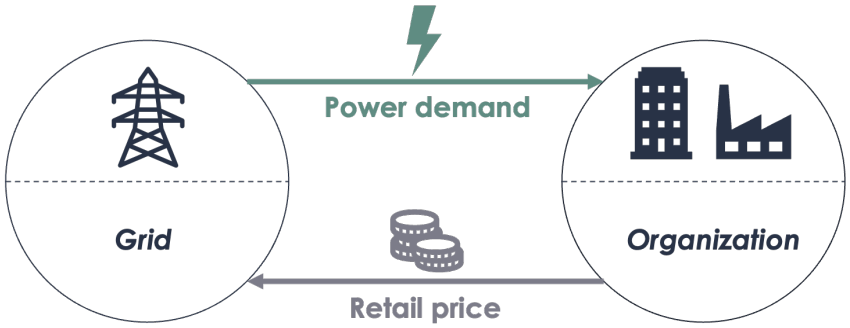


Figure 3 - Simple purchase of electricity from the grid.

When the organization consumes a share of electricity that comes from the grid, without being linked to a renewable contract, **it cannot claim any avoided emissions in pillar B on this consumption**. The associated **induced emissions** must be reported with the **EF of the country's average mix** in **location-based**, and with the **EF of the residual mix** in **market-based**. The residual mix corresponds to the electricity mix not covered by electricity certificates that have been cancelled and withdrawn from the market.

Pillar A *Location-based accounting*	**Pillar A** *Market-based accounting*	**Pillar B** *Avoided emissions*
Scope 2: count the emissions induced with the combustion EF and fugitive emissions of the country's **average electricity mix**. **Scope 3 – Category 3**: count the emissions induced with the upstream EF of fuels, losses, and infrastructures of the country's **average electricity mix**.	**Scope 2**: count the emissions induced with the combustion EF and fugitive emissions of the **residual mix** (i.e. the mix of electricity production means not covered by cancelled renewable certificates). **Scope 3 – Category 3**: count the emissions induced with the upstream EF of the **residual** fuel, losses, and infrastructure **mix**.	N.A.

Table 3 - Accounting rules for the simple purchase of electricity from the grid.

II. Self-consumption of renewable electricity and/or on-site Power Purchase Agreement (PPA)

The organization produces and consumes its own renewable electricity or has an on-site PPA contract, with a third-party electricity producer, as illustrated on figure 3.

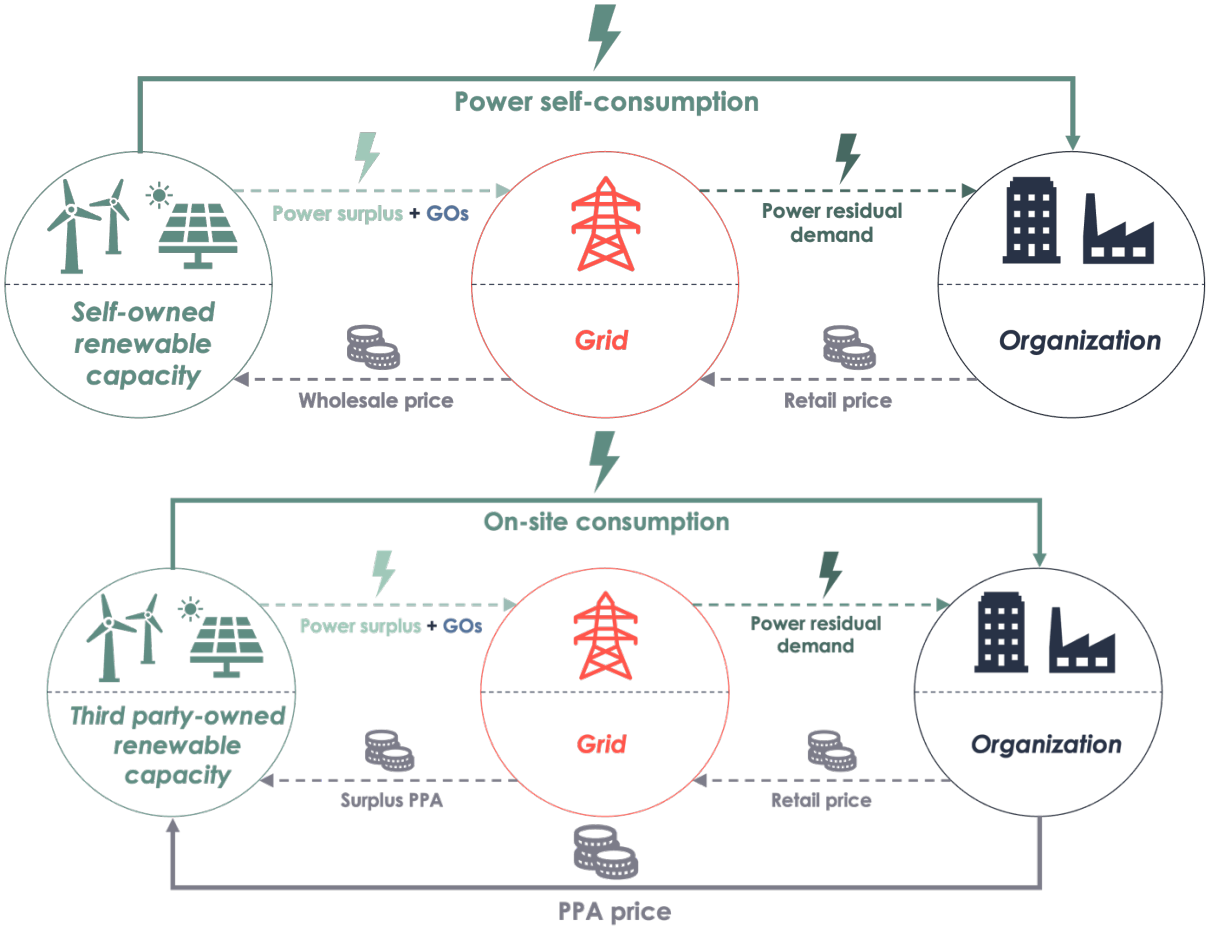


Figure 4 – (A) Self-consumption of renewable electricity (above) ; (B) On-site Power Purchase Agreement (below).

Setting up a self-generation unit within the organization or contracting an on-site PPA offers the best guarantee of using electricity from renewable sources. The self-consumption of electricity from renewable sources should be “contractual” to attest that the produced electricity is consumed by the organization who produces it, and account for emissions reductions. This “contractual” condition allows the reduction of pillar A to the single scope 3.2 "Capital Goods" where the emissions related to the manufacturing and installation of the self-generation (and storage) means should be accounted for.

- In case of overproduction of electricity, excess production can be fed back into the grid and linked to a Guarantee of Origin electricity contract. Only this surplus production can be used to claim avoided emissions. In other words, **an organization cannot simultaneously sell its production to the grid, and account for emission reductions**, even if physically the organization will use the closest electricity produced, from its own sources.

- In case of insufficient electricity production, the organization can supplement its electricity consumption by purchasing electricity from the grid.

Pillar A *Location-based accounting*	**Pillar A** *Market-based accounting*	**Pillar B** *Avoided emissions*
Scope 2: count the emissions from self-consumed green electricity **at zero.** **Scope 3 - Category 2 "Fixed assets"**: count emissions from the manufacture of electricity production (and possibly storage) facilities.	**Scope 2**: count the emissions from self-consumed (and on-site PPA) green electricity **at zero.** **Scope 3 - Category 2 "Fixed assets"**: count emissions from the manufacture of electricity production (and possibly storage) facilities.	**Category B_2** (emissions avoided by products and services) **Condition**: Avoided emissions **only** occur when excess generation is **fed back into** the grid. **Calculation**: Avoided emissions are calculated by comparing the emissions from renewable electricity generation with the **country's average EF**. For more details, see the NZI Pillar B and WBCSD avoided emissions guides.

Table 4 - Accounting rules for self-consumption of renewable electricity and/or on-site PPA.

III. Energy Attribute Certificates (EAC), Renewable Energy Certificates (REC), Guarantees of Origin (GO)

A guarantee of origin (GO), or a renewable energy certificate (REC), guarantees that for one MWh of energy purchased, one MWh of renewable energy has been produced. An organization can buy GOs from different origins and different types of production on the wholesale electricity market, as illustrated on figure 5.

Renewable Energy Certificates (RECs) in the United States and Guarantees of Origin (GOs) in Europe are regional variations of the international system of Energy Attribute Certificates (EACs). The same rules apply to these different forms of contract, which are generally treated as Guarantees of Origin in this guide.

This guide focuses on renewable electricity and therefore does not cover Guarantees of Origin or any other certificates for non-renewable electricity. These are however an interesting evolution of certificate markets, and their impact on emissions accounting could be developed at a later stage.

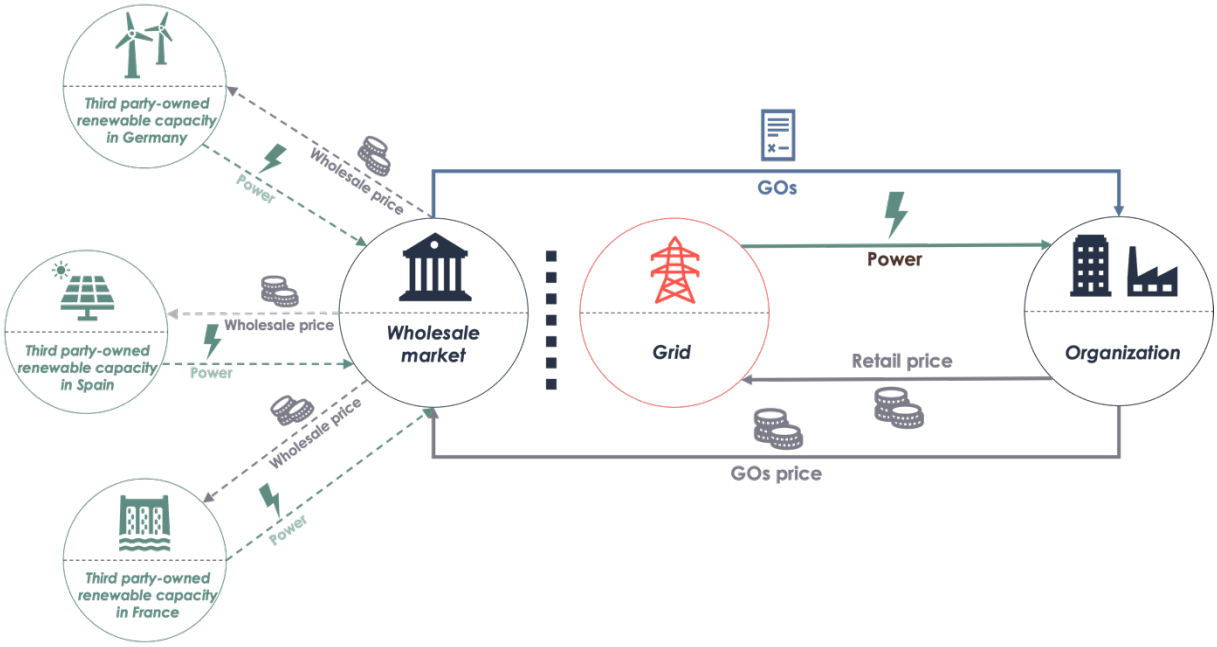


Figure 5 - Purchase of Guarantees of Origin (or EAC/REC) on the wholesale market.

From a physical point of view, the purchase of GOs and renewable certificates (including through PPAs) are not often spatially and temporally coherent with the actual consumption of the customer. Indeed, a GO emitted by a solar panel on May 2nd at 2pm in Spain can be sold to an organization for its electricity consumption taking place in Germany on February 19th at 2am. In this case, there is no spatio-temporal coherence between production and consumption. This spatial and temporal inconsistency is not only likely to slow down the real decarbonization of electricity in Germany, it is also misleading information for consumers. Conversely, some organizations are working to ensure that their electricity consumption and their purchase of guarantees of origin are spatially and temporally coherent at all times, 24 hours a day, seven days a week.

In market-based accounting, NZI proposes to account for GOs if they respect certain spatio-temporal conditions.
These conditions are:

- **Spatial coherence**: **the buyer's facilities and the renewable installation must be on a connected network and limited to bordering countries/states or province**. This condition reflects the fact that, despite interconnections between grids of various countries, states, or provinces, the amount of electricity transferring from one grid to another is often limited, particularly when the grids are not adjacent to each other.

- **Temporal coherence: the consumption must take place within 30 days of GO production time (monthly matching) and emissions reduction accounting depends on the level of temporal coherence**:
  - 100% of emission reductions can be accounted for with hourly matching.
  - 50% of emission reductions can be accounted for with daily matching.
  - 25% of emission reductions can be accounted for with monthly matching.
  - No reductions can be accounted for if coherence is greater than one month.

For guarantees of origin **that do not respect** these spatio-temporal conditions, it is the EF of the residual mix that must be used in market-based accounting.

For guarantees of origin **that respect** these spatio-temporal conditions, the EF depends on the level of temporal coherence: $EF_{GO} = \alpha \times EF_{prod.} + \mathrm{EF}_{residual}(1 - \alpha)$ where α varies according to temporal coherence (see figure below). If we note τ as the temporal coherence:

- $\tau < 1h \rightarrow \alpha = 1$
- $1h < \tau < 24h \rightarrow \alpha = 0.5$
- $24h < \tau < 30$ days$\rightarrow \alpha = 0{,}25$
- $\tau > 30$ days $\rightarrow \alpha = 0$ (the temporal coherence minimal condition is not respected)

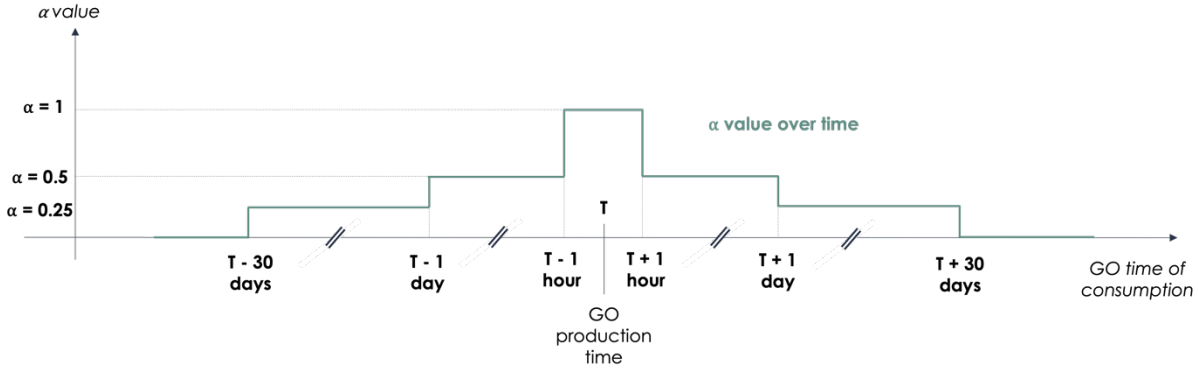


Figure 6 - Alpha value over time of consumption versus stand-alone GO production time.

As mentioned in introduction, a consumer cannot cancel several renewable certificates for the same volume of electricity consumed. For instance, if an electricity consumer covers 100% of their consumption with daily-matched GOs, they cannot buy 200% of their consumption worth of GOs to mitigate 100% of their market-based emissions.

To date, the information generally available for buying and selling Guarantees of Origin in Europe is monthly production data. However, more precise daily data is already available in some countries (Norway and Sweden, for example). Moreover, initiatives are underway to develop energy certificates with hourly granularity[8]. Metering data from certain contracts (such as PPAs) can also provide access to more granular electricity production data.

Ultimately, strict hourly matching conditions should be established for accounting GOs in a few years' time. Indeed, studies on the impact of GOs on electricity markets indicate that without hourly matching, their impact is very low, if not negligible[9]. However, given the currently available data for buyers, achieving hourly matching is challenging. Therefore, this guide recommends a **temporary approach allowing partial accounting conditions for daily or monthly matching**. This is seen as a **transitional phase** to encourage actors to improve their temporal coherence, **until conditions allow for more achievable hourly matching.** In addition, the proposed accounting rules are intended to support ongoing initiatives to develop information systems at the required level of

[8] Le certificat "Product 002 - Certification of electricity products from renewable energy sources with simultaneous generation and supply" de Tüv Süd Standard: *https://www.tuvsud.com/en/-/media/global/pdf-files/brochures-and-infosheets/energy-certification/tuvsud-product-ee02.pdf*
Le certificate Granular Certificate Scheme Standard de EnergyTag : *https://energytag.org/wp-content/uploads/2023/09/Granular-Certificate-Scheme-Standard-V2.pdf*

[9] Langer, Lissy and Brander, Matthew and Lloyd, Shannon M. and Keles, Dogan and Matthews, H. Damon and Bjørn, Anders, *Does the purchase of voluntary renewable energy certificates lead to emission reductions? A review of studies quantifying the impact* (November 17, 2023).

granularity. It is worth adding that 1 MWh of electricity consumption can only be covered by 1 MWh of renewable certificates. In other words, two GOs that are both accounted for at 50% of their volume cannot be cancelled for the same MWh of consumption to make 100%.

Regarding Pillar B, only certificates that have not been used to reduce pillar A induced emissions can be used to estimate avoided emissions. GOs contribute little to the financing of new renewable energy infrastructure. In 2022, the average price of a GO in France was €4.1/MWh[10], compared to €63/MWh[11] for the cost of producing additional renewable electricity (mainly ground-mounted solar PV and onshore wind). NZI therefore proposes to calculate avoided emissions by comparison with the average country EF, and in proportion to the financial participation (i.e. 6.5% in France), see appendix for more detail.
As for all avoided emissions in this guide, if a more specific counterfactual scenario can be proposed, the buyer is encouraged to do so.

Pillar A *Location-based accounting*	**Pillar A** *Market-based accounting*	**Pillar B** *Avoided emissions*
Scope 2: count the emissions induced with the combustion EF and fugitive emissions of the country's **average electricity mix**. **Scope 3 - Category 3:** count the emissions induced with the upstream EF of fuels, losses, and infrastructures of the country's **average electricity mix**.	**Conditions**: **Spatial coherence** (same network and limited to bordering countries/states or province) and **temporal coherence** (daily matching). If the conditions are not met, see "simple purchase of electricity from the grid". **Scope 2 and Scope 3 calculation - Category 3:** $EF_{GO} = EF_{residual} - \alpha(EF_{residual.} - EF_{prod.})$ where α varies according to temporal coherence. For temporal coherence of under an hour: $\alpha = 1$. For temporal coherence of over an hour and under 24 hours: $\alpha = 0.5$ For temporal coherence of over 24 hour and under 30 days $\alpha = 0.25$	**Category B3** (emissions avoided by financing additional projects outside its value chain) **Conditions**: Only certificates that have not been used to reduce pillar A (induced emissions) can be used to estimate avoided emissions. **Calculation**: $AE_{buyer} = AE_{prod}$ x financing factor, where "Financing factor" is around 6.5% for France in 2022 (see appendix) For more details, see the NZI Pillar B and WBCSD avoided emissions guides.

Table 5 - Accounting rules for stand-alone renewable certificates, guarantees of origin (G0).

[10] 2022 GO global results - EEX
[11] World Energy Outlook 2023 – International Energy Agency

IV. Physical ("as-generated") and financial off-site PPA

A *Power Purchase Agreement* (PPA) is a direct purchase agreement of electricity between a producer and an end-user. In this section we exclude on-site PPAs that are covered previously in section 2.

PPAs, which are usually long-term commitments to a power plant for a predetermined volume and price, can take many forms. However, two main categories of PPA can be interesting to distinguish[12]:

- ***Physical* PPA** also called "as-generated" *(figure 7 – A)*: The organization commits to buying a given amount of energy at a given price from the contracted renewable installation (on the same network as its facilities) and matches its consumption to the production of the off-site installation. In practice the organization will often pay a utility for balancing services. Excess electricity will be resold on the wholesale market and low production will be compensated by buying on the market. The contracts often last 10-20 years.

- ***Financial* PPA** *(figure 7 – B)*: The organization commits to buying a given amount of energy at a given price from the contracted renewable installation. The installation is not necessarily on the same network as the organization's facilities and its consumption does not necessarily match the production of the off-site installation.

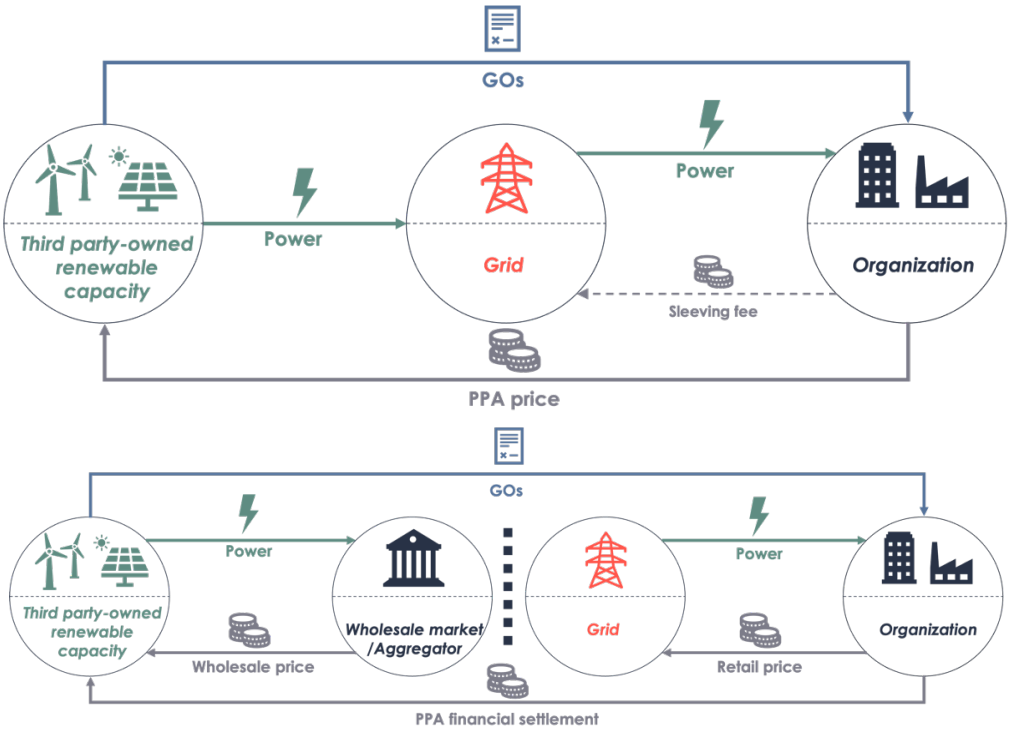


Figure 7 – (A) Physical PPA (above) ; (B) Financial PPA (below)

[12] See RE-Source platform - Introduction to Corporate Sourcing of Renewable Electricity in Europe – January 2020

In both cases, PPAs are associated with the issue of Energy Attribute Certificates (EACs), which take the form of GOs in Europe or RECs in the United States. In fact, only GOs or RECs make it possible to certify that a certain quantity of energy has been produced by renewable capacity in a given territory, and to withdraw this electricity production from the market once the guarantee of origin has been cancelled by the buyer.

For pillar A in **location-based accounting**, consumption sourced through both these categories of PPA is accounted for using the **country's average EF** as these contracts do not represent a physical link between producer and buyer.

In market-based accounting, consumption sourced through physical and financial PPAs can only be accounting for using the EF of the contracted means of production under certain spatio-temporal conditions. These conditions are:

- **Spatial coherence**: the buyer's facilities and the renewable installation must be on a connected network and limited to bordering countries/states or province. This condition is almost always respected for physical PPAs.

- **Temporal coherence: the consumption must take place within 30 days of GO production time (monthly matching) and emissions reduction accounting depends on the level of temporal coherence**:
  - 100% of emission reductions can be accounted for with hourly matching.
  - 50% of emission reductions can be accounted for with daily matching.
  - 25% of emission reductions can be accounted for with monthly matching.
  - No reductions can be accounted for if coherence is greater than one month

  If a portion of the consumption respects this condition, the EF of the contracted means of production can be used for this portion, and the EF of the residual mix can be used for the rest.

Long-term private contracts between electricity producers and consumers via a PPA may make it possible to exchange more detailed metering data than the basic GO monthly production data. PPA buyers and sellers are therefore invited to develop metering data at the finest possible granularity, so as to be compatible with the accounting proposed in this guide. If the aggregated monthly metering data differs from the information contained in the guarantees of origin, the metering data must be recalibrated to correspond to the information contained in the guarantees of origin, which is the administrative reference.

For physical and financial PPAs **that respect** these spatio-temporal conditions, the EF depends on the level of temporal coherence: $\boldsymbol{EF_{PPA} = \alpha \times EF_{prod.} + \mathrm{EF}_{residual}(1 - \alpha)}$ where α varies according to temporal coherence (see figure 3 below). If we note τ as the temporal coherence:

- $\tau < 1\text{h} \rightarrow \boldsymbol{\alpha = 1}$
- $1\text{h} < \tau < 24\text{h} \rightarrow \boldsymbol{\alpha = 0.5}$
- $24\text{h} < \tau < 30$ days$\rightarrow \boldsymbol{\alpha = 0{,}25}$
- $\tau > 24\text{h} \rightarrow \boldsymbol{\alpha = 0}$ (the temporal coherence minimal condition is not respected)

If these conditions are not met the consumption is accounted for following the "Simple purchase of electricity from the grid" method and uses the EF of the residual mix.

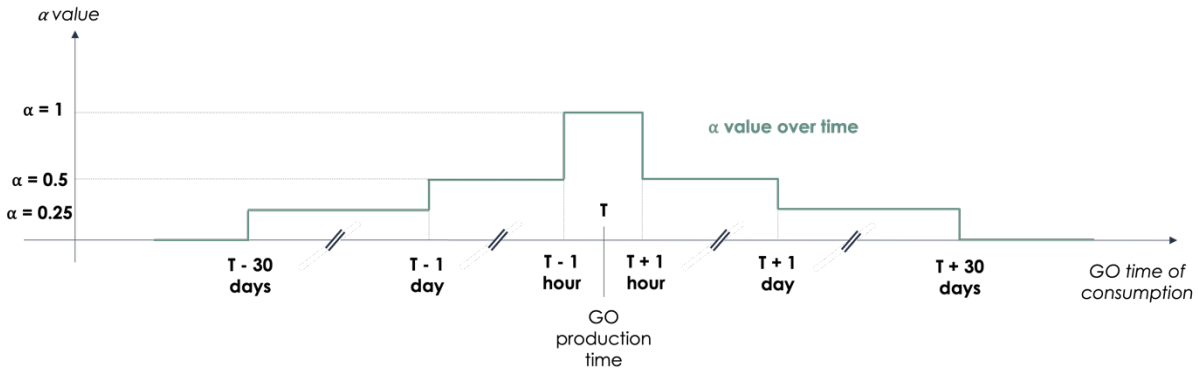


Figure 8 - Alpha value over time of consumption versus PPA production time.

For Pillar B, avoided emissions only occur for contracted volumes that have not been used to reduce pillar A induced emissions. In practice this means that avoided emissions only occur in three situations: 1) the pillar A accounting method was location-based; 2) the actual consumption was lower than the contracted volume and electricity was fed into the grid; 3) there are volumes that do not respect the spatio-temporal coherence conditions for the market-based accounting approach in Pillar A.

Estimating avoided emissions in Pillar B necessitates the use of a counterfactual scenario, describing the system as it would have been without the project.

- If establishing a counterfactual scenario is not feasible, avoided emissions can be estimated by comparing emissions from renewable electricity generation with the country's average EF. This method is generally conservative.

- If a more specific counterfactual scenario can be proposed, the buyer is encouraged to do so but must provide evidence of its legitimacy and follow the guidelines and principles laid out by the NZI Pillar B and WBCSD avoided emissions guides. For example, if the buyer wishes to compare emissions from the renewable installation with the EF of the marginal mix instead of the country's average mix EF, they must demonstrate that the renewable installation has replaced capacity from the marginal mix rather than simply adding to total production.

In addition, **an allocation of avoided emissions must be made pro rata to the financing of new renewable capacity** made possible by the sale of electricity through the PPA, particularly if the installation of new capacity is subsidized elsewhere.

	Pillar A *Location-based accounting*	**Pillar A** *Market-based accounting*	**Pillar B** *Avoided emissions*
Physical ("as-generated") off-site PPA	**Scope 2**: count the emissions induced with the combustion EF and fugitive emissions of the country's **average electricity mix**. **Scope 3 - Category 3:** count the emissions induced with the upstream EF of fuels, losses, and infrastructures of the country's **average electricity mix**.	**Conditions**: **Spatial coherence** (connected network and limited to bordering countries/states or province) and **temporal coherence** (monthly matching). If the conditions are not met, see "simple purchase of electricity from the grid". **Scope 2 and Scope 3 calculation - Category 3:** $EF_{PPA} = \alpha \times EF_{prod.} + (1 - \alpha) \times \mathrm{EF}_{resid.}$ where α varies according to temporal coherence. For temporal coherence of under an hour: $\alpha = 1$. For temporal coherence of over an hour and under 24 hours: $\alpha = 0.5$ For temporal coherence of over 24 hour and under 30 days $\alpha = 0.25$	**Category B3** (emissions avoided by financing additional projects outside its value chain) **Conditions:** Avoided emissions only occur for contracted volumes that have not been used to reduce pillar A induced emissions. **Calculation:** Avoided emissions are calculated by comparing the emissions from renewable electricity generation with **the country's average EF**. If a more specific counterfactual scenario can be proposed, the buyer is encouraged to do so. For more details, see the NZI Pillar B and WBCSD avoided emissions guides.
Financial off-site PPA	**Scope 2**: count the emissions induced with the combustion EF and fugitive emissions of the country's **average electricity mix**. **Scope 3 - Category 3:** count the emissions induced with the upstream EF of fuels, losses, and infrastructures of the country's **average electricity mix**.	**Conditions**: **Spatial coherence** (connected network and limited to bordering countries/states or province) and **temporal coherence** (monthly matching). If the conditions are not met, see "simple purchase of electricity from the grid". **Scope 2 and Scope 3 calculation - Category 3:** $EF_{PPA} = \alpha \times EF_{prod.} + (1 - \alpha) \times \mathrm{EF}_{resid.}$ where α varies according to temporal coherence. For temporal coherence of under an hour: $\alpha = 1$. For temporal coherence of over an hour and under 24 hours: $\alpha = 0.5$ For temporal coherence of over 24 hour and under 30 days $\alpha = 0.25$	**Category B3** (emissions avoided by financing additional projects outside its value chain) **Conditions**: Avoided emissions only occur for contracted volumes that have not been used to reduce pillar A induced emissions. **Calculation**: Avoided emissions are calculated by comparing the emissions from renewable electricity generation with **the country's average EF.** If a more specific counterfactual scenario can be proposed, the buyer is encouraged to do so. An allocation of avoided emissions must be made pro rata to the financing of new renewable capacity made possible by the sale of electricity through the PPA. For more details, see the NZI Pillar B and WBCSD avoided emissions guides.

Table 6 - Accounting rules for physical and financial off-site PPAs.

V. Purchase of electricity from a renewable aggregator

Organizations have the option to procure electricity from a specialized renewable energy aggregator. An aggregator can secure renewable electricity through diverse contractual arrangements, such as GOs and various PPAs, as illustrated on figure below. This aggregator resells this electricity to buyers by building up portfolios of electricity purchase contracts according to the needs of the end buyers. The aggregation of consumers and the diversification of renewable electricity contracts across different technologies play an important role in maintaining a balance between production and consumption.

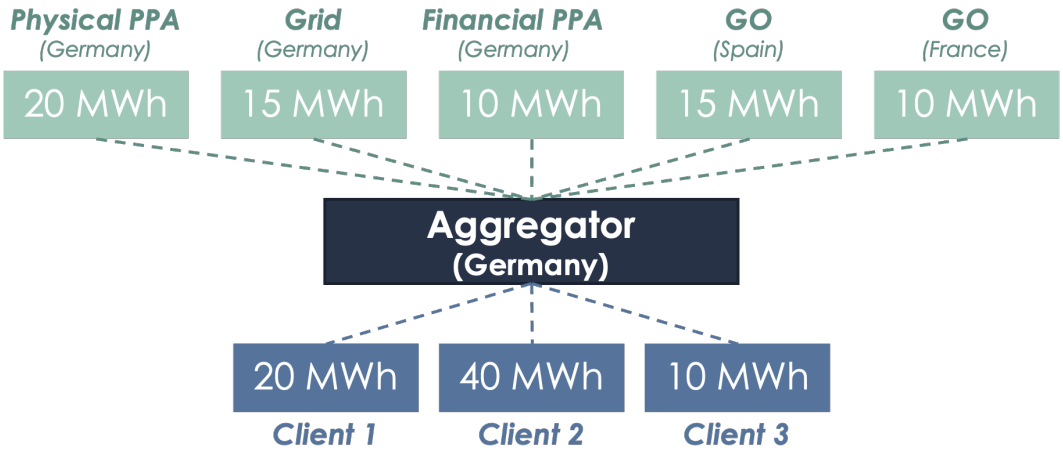


Figure 9 – Example of production sources and consumers of an aggregator.

NZI recommends calculating average 'Acceptance Rates' at the aggregator level, using the methodology outlined in this guide for each contract type. The acceptance rate corresponds to the percentage of renewable certificates (from PPAs, GOs, etc.) that can be used to mitigate emissions in market-based accounting following this guide. For example, an aggregator who buys stand-alone GOs with daily matching for all the electricity they sell to consumers would have an acceptance rate of 50% (see "3. Energy Attribute Certificates, Guarantees of Origin").

As mentioned in the introduction, to prevent double counting of emission reductions from renewable contracts, the renewable certificates should be transferred from the aggregator to the buyer. The average acceptance rate can then also be communicated to the buyer so that they are aware of the percentage of transferred renewable certificates that can be used to mitigate market-based emissions. Continuing with the earlier example, the buyer would receive GOs for 100% of the electricity they purchase from the aggregator. They would proceed to cancel all of them, but only utilize 50% to mitigate their market-based emissions.

If we note α the average acceptance rate of the aggregator, and β the portion of electricity bought from the aggregator that provides RECs, the emission factor for electricity purchased from the aggregator can be written: $\boldsymbol{EF_{agg.} = \alpha \times \beta \times EF_{REC} + (1 - \alpha \times \beta) EF_{residual}}$

Pillar A *Location-based accounting*	**Pillar A** *Market-based accounting*	**Pillar B** *Avoided emissions*
Scope 2: count the emissions induced with the combustion EF and fugitive emissions of the country's **average electricity mix**. **Scope 3 - Category 3:** count the emissions induced with the upstream EF of fuels, losses, and infrastructures of the country's **average electricity mix**.	**Scope 2 and Scope 3 – Category 3**: If we note α the average acceptance rate of the aggregator, and β the portion of electricity bought from the aggregator that provides RECs, the emission factor for electricity purchased from the aggregator can be written: $EF_{agg.} = \alpha \times \beta \times EF_{REC} + (1 - \alpha \times \beta) \times EF_{residual}$	**Category B$_3$** (emissions avoided by financing additional projects outside its value chain) **Calculation**: Avoided emissions are calculated at an aggregator level as an average of the avoided emissions from the aggregator's different contracts by following the methodologies proposed in this guide. For more details, see the NZI Pillar B and WBCSD avoided emissions guides.

Table 7 - Accounting rules for the purchase of electricity from a renewable aggregator.

Example

In the figure 9 above, the aggregator, based in Germany, sources renewable electricity through different means: one Physical PPAs, one financial PPA, GOs from France and from Spain, and the remainder is not covered by any renewable contract. This electricity is consumed by three clients.

To calculate the average acceptance rate for the aggregator, we will calculate the acceptance rate associated with each contract. The aggregator acceptance rate is the weighted average of these individual acceptance rates:

$$AR_{agg} = \frac{20 \times AR_{ph-PPA} + 10 \times AR_{fi-PPA} + 10 \times AR_{GO-FR} + 15 \times AR_{GO-ES}}{55} = \alpha$$

- **AR_{ph-PPA}**: For Physical PPAs that respect the minimal spatial coherence level, the acceptance rate depends on the temporal coherence level between consumption and emission of the GOs. In this example, 100% the RECs acquired through the PPA match with the 'aggregator' consumption hourly, therefore, the acceptance rate is 100%.
- **AR_{fi-PPA}**: For financial PPAs that respect the minimal spatial coherence level, the acceptance rate depends on the temporal coherence level between consumption and emission of the GOs. In this example, 70% the RECs acquired through the PPA match with the 'aggregator' consumption hourly, the other 30% match monthly. Therefore, the acceptance rate is 78%.
- **AR_{GO-FR}**: For GOs that respect the minimal spatial coherence level, the acceptance rate depends on the temporal coherence level between consumption and emission of the GOs. In this example, half the GOs match with the 'aggregator' consumption hourly, the other half match daily. Therefore, the acceptance rate is 75%.
- **AR_{GO-ES}**: For consumption in Germany, GO emitted in Spain do not respect the spatial coherence condition of bordering countries. The GO is therefore not accounted for, and the acceptance rate is 0%.

Therefore:

$$AR_{agg} = \frac{20 \times 1 + 10 \times 0.78 + 10 \times 0.75 + 15 \times 0}{55} = 64\% = \alpha$$

In this example, α = 0.64 and β = 0.78 as part of the aggregator's electricity mix is supply from the grid. The client 2 buys 40 MWh of electricity from the aggregator and receives 31 MWh worth of renewable certificates. They will cancel all the certificates to avoid any double counting but will only use $\alpha \times \beta \times 40 = 0.64 \times 0.78 \times 40 = 0.5 \times 40 = 20MWh$ worth of certificates to mitigate they're market-based emissions. The emission factors used for these 20 MWh are those of the means of production that emitted the renewable certificates. For the remaining 20 MWh of consumption, it is the EF of the residual mix that is used.

As we can see in this example, the aggregator average acceptance rate depends on its level of matching between production and consumption. As there is no physical difference in the electricity that is covered by these different contracts, the aggregator can decide which consumption corresponds to which contracts for calculating the different acceptance rates.

VI. Premiums

Electricity suppliers can charge a premium on electricity sales that is dedicated to funds for the installation of new renewable electricity generation capacity. In this case, the electricity consumed must be counted with the **EF of the residual mix in market-based accounting**, and with the average EF of the country in location-based emissions accounting.

Concerning pillar B, the premium allows to finance new means of production of renewable electricity, which can be leveraged via avoided emissions. They are to be calculated in comparison with the reference scenario: the average network mix of the country.

Pillar A *Location-based accounting*	**Pillar A** *Market-based accounting*	**Pillar B** *Avoided emissions*
Scope 2: count the emissions induced with the combustion EF and fugitive emissions of the country's **average electricity mix**. **Scope 3 - Category 3**: count the emissions induced with the upstream EF of fuels, losses, and infrastructures of the country's **average electricity mix**.	**Scope 2**: count the emissions induced with the combustion EF and fugitive emissions of the **residual mix** (i.e. the mix of electricity production means not covered by cancelled renewable certificates). **Scope 3 - Category 3**: count the emissions induced with the upstream EF of the **residual** fuel, losses, and infrastructure **mix.**	**Category B$_3$** (emissions avoided by financing additional projects outside its value chain) **Conditions**: Avoided emissions only occur if the incentive finances **new** generation. **Calculation**: Avoided emissions are calculated by comparing the emissions from renewable electricity generation with **the country's average EF.** If a more specific counterfactual scenario can be proposed, the buyer is encouraged to do so. For more details, see the NZI Pillar B and WBCSD avoided emissions guides.

Table 8 - Accounting rules for premiums.

VII. Direct investment in renewable capacity

Emissions related to investments in new renewable energy production capacity are accounted for in Scope 3 category 15 "Investments", in proportion to the equity stake in the project. These investments also allow the project's avoided emissions to be claimed in the B2 or B2 bis category of Pillar B, again in proportion to the capital taken.

Since it is not a question of organization consumption, no distinction has been made between location-based and market-based accounting for investments.

Pillar A *Induced emissions*	**Pillar B** *Avoided emissions*
Scope 3 - Category 15 "Investments": the emissions generated by the project are calculated in **proportion to the equity stake**. See *GHG Protocol Guidelines* for more details.	**Category B_2 or B_2 bis** **Conditions**: Avoided emissions only occur in the case of investment in new renewable energy production capacity. **Calculation**: the avoided emissions are calculated in **proportion to the equity stake**. For more details, see the NZI Pillar B and WBCSD avoided emissions guides.

Table 9 - Accounting rules for direct investment in renewable capacity.

Annexes

Pillar B: How do we value the avoided emissions enabled by GO purchases? The Financing factor (γ)

The purchase of guarantees of origin allows, under certain conditions, to accelerate the development of additional renewable capacities in a given geography.

However, GOs are not 100% financially responsible for increasing renewable energy capacity on the grid, and their true impact is widely debated and criticized. In 2022, the average price of a GO in France was €4.1/MWh[13], compared to €63/MWh[14] for the cost of producing additional renewable electricity (mainly ground-mounted solar PV and onshore wind).

To count the emissions avoided by the purchase of GOs, this guide proposes the introduction of a **funding factor**, **Gamma,** to reflect the real contribution of the GO purchasing organization in developing additional renewable capacity.

Proposal for calculation of avoided emissions:

$$EE_{GO} = EE_{prod} \times \gamma$$

Where γ is the "Financing Factor", calculable for a given country:

$$\gamma = \frac{Price\ of\ GO}{Production\ cost\ of\ the\ additional\ electricity\ source}$$

In France, γ is therefore around 6.5% for electricity in 2021. This factor could also be calculated at a company level by using the actual price paid by the company for GOs.

[13] 2022 GO global results - EEX
[14] World Energy Outlook 2023 – International Energy Agency

Glossary

Acceptance rate: The acceptance rate α is the emission reduction factor allowed by the renewable certificate depending on its spatial and temporal coherence.

Aggregator: An aggregator can secure renewable electricity through diverse contractual arrangements, such as GOs and various PPAs (cf *5. Purchase of electricity from a renewable aggregator*). This aggregator resells this electricity to buyers by building up portfolios of electricity purchase contracts according to the needs of the end buyers.

Bordering countries/states or province: In this guide we are purposefully broad in our approach to borders. This notion is used in conjunction with that of spatial coherence whose purpose is to favor local decarbonation efforts. The term 'local' refers to the geographical and political jurisdiction responsible for the electricity market or grid. Depending on the region, this can be a country, state, or province.

Energy Attribute Certificates (EACs): Energy Attribute Certificates (EACs) exist in many countries under different names but operate in a similar way. They include Renewable Energy Certificates (RECs) in the United States and Guarantees of Origin (GOs) in Europe. EACs, GOs and RECs are used interchangeably in this guide, generally under the term GO, which is generic in Europe.
An Energy Attribute Certificate enables to track the origin of a MWh injected into the grid. It is a contractual instrument designed to transmit information about the electricity produced (type of plant, name of plant, location, actual quantity of electricity produced).
EAC are generally based on a standard (e.g. The International REC Standard), an accounting system and an exchange market. EACs work as follows:

- The electricity producer indicates the quantity of electricity produced and fed into the grid.
- The electricity producer receives certificates.
- These certificates can then be traded and cancelled by market players to claim the use of the energy produced.

An EAC can also be used to transmit an emission factor (EF) to the purchaser for carbon accounting purposes (Scope 2).

Guarantee of Origin (GO): GOs are a type of Energy Attribute Certificate (see above) used in Europe. EACs, GOs and RECs are assimilated in this guide, generally under the term GO, which is generic in Europe.

Hourly/daily/monthly matching: Hourly/daily/monthly matching corresponds to a temporal coherence of less than one hour/day/month, i.e. a duration between the time of consumption of the electricity and the time of issuance of the renewable certificate of less than one hour/day/month.

Location-based accounting: Refers to an energy emissions accounting approach that considers the actual electricity consumed by a specific entity, irrespective of the energy procurement contract used. This method uses the average emission factors (EF) of the national electricity mix and is mandatory for emissions accounting.

Market-based accounting: Refers to an energy emissions accounting approach that considers the energy procurement contract used. This method uses the emission factors (EF) of the electricity purchase contracts and the residual mix for the part not covered by contracts.

Network, grid: Refers to an interconnected system able to transmit electricity from the producer to the consumer. These can cover several countries and do not have to be operated by one unique utility.

NZI Pillar A: The Net Zero Initiative (NZI) framework contains three pillars. Pillar A focuses on emissions (direct and indirect) induced by the organization's activities.

NZI Pillar B: The Net Zero Initiative (NZI) framework contains three pillars. Pillar B focuses on emissions avoided by the organization's products or investments.

Renewable Energy Certificate (REC): RECs are a type of Energy Attribute Certificate (see above) used in the United States. EACs, GOs and RECs are assimilated in this guide, generally under the term GO, which is generic in Europe.

Residual mix: The residual mix corresponds to the electricity mix not covered by electricity certificates that have been cancelled and withdrawn from the market. Market-based accounting uses the residual mix emission factor for all the electricity consumption that is not covered by purchase agreements. The residual mix typically includes a combination of various energy sources, including fossil fuels, nuclear power, and renewable sources that are not explicitly accounted for through RECs or GOs.

Spatial coherence: Refers to the level of geographical proximity between the place of production and the place of consumption of electricity.

Stand-alone Energy Attribute Certificates, Guarantees of Origin (GO): EACs, GOs or RECs bought independently from electricity. Another term also used is "unbundled" as opposed to "bundled" certificates and electricity.

Temporal coherence: Refers to the level of matching between the time of electricity consumption and the time of emission of the renewable certificate cancelled against the electricity consumption.

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