EnergyTag

Granular Certificate Scheme Standard

Version 2

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Contents

Note on Qualifying Language

Note: the guidance *shall* qualify the stringency of statements with the following terms (RFC 2119 compliant):

"Shall"	This word, or the terms "required" or "must", mean that the definition is an absolute requirement of the Standard.
"Shall not"	This phrase, or the phrase "must not", means that the definition is an absolute prohibition of the Standard.
"Should"	This word, or the adjective "recommended", means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
"Should not"	This phrase, or the phrase "not recommended", means that there may exist valid reasons in particular circumstances when the particular behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
"May"	This word, or the adjective "optional", means that an item is truly optional. One actor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product, while another actor may omit the same item. An implementation which does not include a particular option must be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein, an implementation which does include a particular option must be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides).
"Could"	This word, or "*can*", implies that the person to whom it pertains has the power to do such a thing.

Introduction

A Granular Certificate (GC) compliant with EnergyTag is a Certificate relating to the characteristics of energy produced during a period of one hour or less, Issued in compliance with the requirements and rules of operation of the EnergyTag GC Scheme Standard. This Standard lays out the requirements that must be met in order to create an EnergyTag compliant GC Scheme.

The following Chapters provide the requirements and guidelines for implementing a GC Scheme that either supplements an existing Energy Attribute Certificate (EAC) Scheme, or creates a complementary scheme where the evolution of an existing scheme has not yet occurred. All configurations seek to minimize the risk of Double Counting of the Attributes of the energy represented by the Certificates.

The current version of the Standard is written for electricity tracking only. However, generalizing to other energy carriers could be facilitated in the future if there is stakeholder demand.

A separate document, called the GC Matching Standard, specifies a mechanism for matching GCs with consumption to enable temporal, geographic and attribute matching so that consumers can demonstrate compliance with regulations or meet their own voluntary goals.

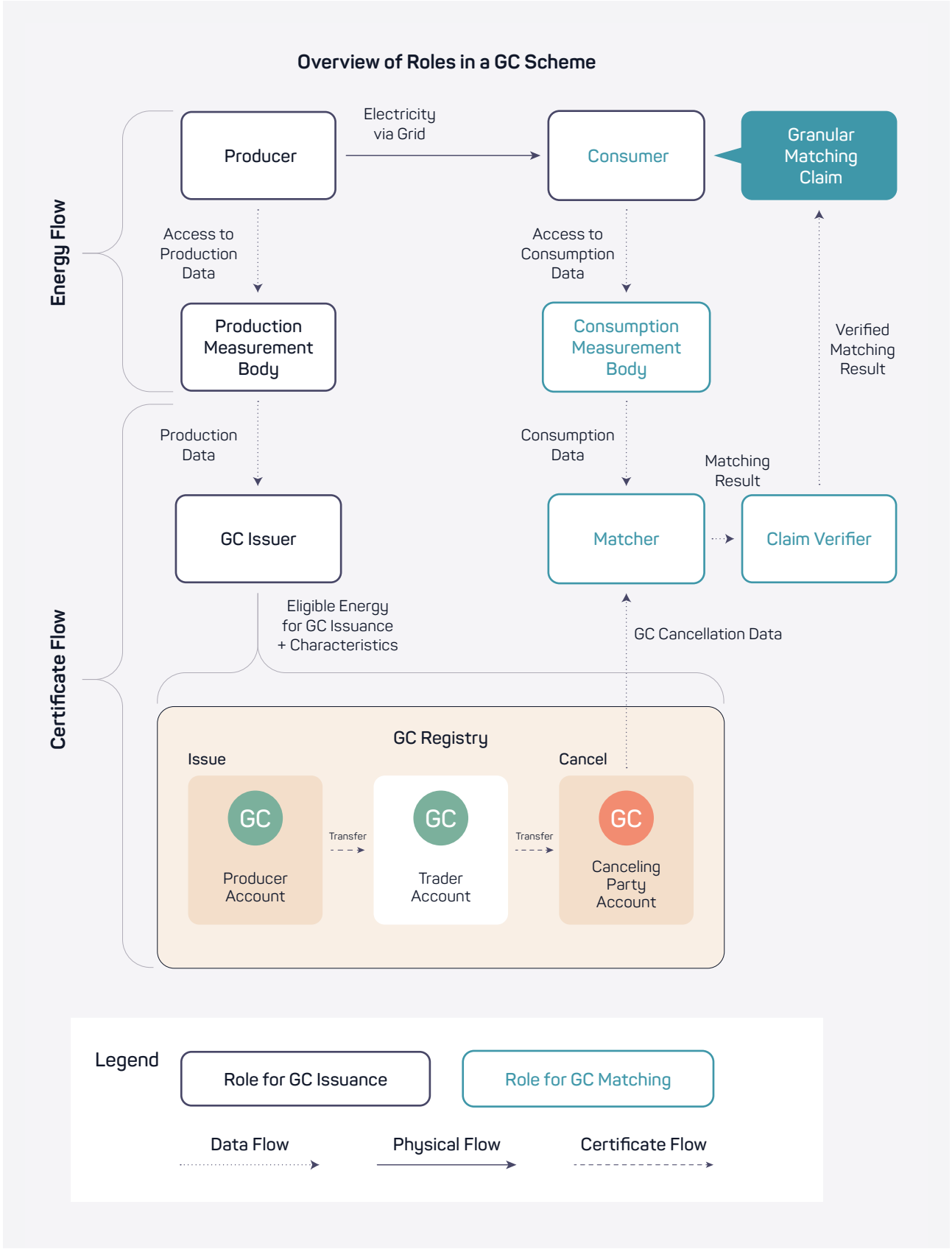
Chapter 1

EnergyTag Standard for GC Schemes

1.1 Roles

Context and Definitions

This Chapter defines the mandatory and voluntary Roles of the operational participants needed to implement a GC Scheme, and lists the requirements for each. Each Role represents a liable entity in a GC Scheme. For each Role, the Standard requirements refer to both the parent organization and its affiliates. Roles that are involved in Matching Claims, are explained in the Annex 1 with Definitions, and their requirements are elaborated in the separate GC Matching Standard.


Overview of Roles in a GC Scheme
Energy Flow
Certificate Flow
Producer
Electricity via Grid
Consumer
Granular Matching Claim
Access to Production Data
Access to Consumption Data
Production Measurement Body
Consumption Measurement Body
Verified Matching Result
Production Data
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Matching Result
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Matcher
Claim Verifier
Eligible Energy for GC Issuance + Characteristics
GC Cancellation Data
GC Registry
Issue
Cancel
GC
Transfer
GC
Transfer
GC
Producer Account
Trader Account
Canceling Party Account
Legend
Role for GC Issuance
Role for GC Matching
Data Flow
Physical Flow
Certificate Flow

Requirements

There are various Roles involved in the administration of a GC Scheme.

- These *may* or *may* not be vested in the same party. Where they are vested in several parties, attention *shall* be given to the interaction between the various Roles, with some interactions being mandatory to ensure trust in the Scheme.

Account Holder

- A GC Account Holder *shall* adhere to the criteria as set out by the GC Issuer.

GC Issuer

The GC Issuer:

- *shall* administer GCs and the registration of the GC ownership throughout their lifetime. They *may* transfer this responsibility to another entity that is approved by EnergyTag, being the Delegated GC Administrator,
- *shall* issue GCs based on input from the Production Registrar,
- *shall* exist and be identified in all GC Schemes,
- *shall* prove compliance with this Standard via the EnergyTag GC Issuer Accreditation Process,
- *shall* ensure the avoidance of Double Counting of the GCs, and the underlying environmental attributes thereof, that it administers throughout its lifetime. This responsibility *may* be transferred to another entity that has received approval from EnergyTag (being the Delegated GC Administrator) and that guarantees prevention of double ownership and double claims of the represented Attributes,
- *shall* be independent of the production, trade, and supply of GCs,
- *shall* not own or hold a beneficial entitlement to any GC, except to prove its own consumption, for testing purposes or as a means of recovery from public support mechanisms,
- *shall* set criteria for becoming an Account Holder in such a way as to prevent fraudulent usage of the GC Scheme,
- *shall* ensure that the rules and provisions of its GC Scheme are publicly available in English. For Configuration 2 & 3 this *shall* be done in the format proposed by EnergyTag, while this format should also be used for Configuration 1. This publicly available documentation enables compliance assessment with the requirements of this Standard,
- *shall* contractually require any Account Holder to declare that the environmental Attributes of the energy for which they apply for GCs are not allocated to any other Certificate application or any other claim of the environmental benefits associated with the production and consumption of this energy. This requirement does not apply in a configuration where the GC works as complementary to the EAC system in which case double ownership and associated claims of the unique attributes are to be avoided by adhering to the requirements set out in that configuration, and
- *may* or *may not* be the same body as the EAC Issuing Body. Where it is a different party, the GC Issuer *shall* remain liable to the Account Holder for its actions regarding the referenced EACs,
- *shall* write and maintain a GC Scheme Protocol.

The rules and provisions (as expressed in the GC Scheme Protocol):

- *shall* demonstrate how the GC Scheme complies with this Standard
- *shall* make reference to, comply with and support any quality assurance mechanism(s) currently in place regarding the underlying EAC Scheme, and
- *may* detail how specific Use Cases are facilitated by the GCs covered by the respective GC Scheme Protocol.

For Energy Storage, the GC Issuer (see 1.6 Energy Storage for details):

- *may* issue Storage Discharge GCs, and that where it does, it *shall* ensure that Storage Charge Records (SCRs), Storage Discharge Records (SDRs), and Storage Discharge GCs (SD-GCs) are managed in compliance with the requirements in 1.6 Energy Storage, and
- *shall* keep records of all information of the GCs/SCRs/SDRs/SD-GC for the Scheme in question.

Production Registrar

A GC Registrar:

- *shall* assess applications to register Production Devices for the purposes of issuing the relevant Certificates and, where it is a different party, *shall* report to the GC Issuer,
- *may* or the same party as the GC Issuer, and
- where not the same party as the GC Issuer, and where the GC Issuer does not perform this task, the GC Registrar *shall* be the party to determine the quantity of Certificates to be Issued and to inform the GC Issuer of this.

GC Registry Operator

A GC Registry Operator:

- *shall* exist in all GC Schemes and be identified in the relevant GC Scheme Protocol, *shall* record the characteristics of the Production Devices for which that GC Issuer is responsible, and *shall* ensure that this is consistent with the data on the underlying EAC Registry where relevant,
- *shall* record the Accounts and the Certificates held in them, and
- *shall* operate to comply with the requirements of the EnergyTag Standard.

Measurement Body

A Measurement Body:

- *shall* exist and be identified in all GC Schemes,
- *shall* hold responsibility for the accuracy and reporting of measurement data, such that:
  - a Production Measurement Body is responsible for reporting accurate measurement data to the GC Issuer for the produced energy that is eligible for GCs, and
  - a Consumption Measurement Body is responsible for reporting to the Matcher accurate measurement data regarding the consumed energy to which canceled GCs are matched, and
- *shall* either be independent of production, trade and supply, OR be subject to regular independent audits to confirm the accuracy of the reported meter data.

Accreditation

Certain roles require accreditation in accordance with the EnergyTag Accreditation Process in order to be eligible for claims of EnergyTag compliance. See "Accreditation" section on the EnergyTag website.

Explanatory Note #1 : Combining Roles and Responsibilities

Role definition by responsibilities

Roles are defined by their responsibilities. This document does not exhaustively list all actions and tasks for a specific Role. The actions undertaken under a Role, may depend on the way the responsibilities are implemented in practice.

Combination of Roles

Roles are defined in a way that identifies the key responsibilities. This enables each Role to be performed by a separate party. Unless explicitly forbidden, it is possible that several Roles are performed by the same party.

For example, the Measurement Body may be the same party as the GC Issuer, but may also be a different party.

1.2 Scheme Configurations

Context and Definitions

This Chapter provides a framework to allow market participants to voluntarily obtain GCs and enable consumer choice, while ensuring smooth interaction with existing EAC Schemes and avoiding Double Counting. The framework is based on the following key considerations:

- **System Configuration.** EnergyTag proposes three different configurations for the relationship between GC and EAC Schemes:
  - *Configuration #1 - GC Scheme evolves out of EAC Scheme*: the GC Scheme is an evolution of an existing EAC Scheme such that the currently operating EAC Issuing Body evolves into a GC Issuer,
  - *Configuration #2 - GC Scheme supplements EAC Scheme*: the GC Scheme is an extension of an existing EAC Scheme and is managed by verified and approved third-parties. Tasks and responsibilities related to the GC Scheme are performed by third-party entities in compliance with the rules and oversight of the existing EAC Scheme and EAC Issuing Body, and
  - *Configuration #3 - the GC Scheme is based on Canceled EACs*: this GC Scheme enables GC Issuance where the EAC Issuing body does not oversee the coordination with GCs for the same production. Instead, the GC Issuer takes such coordination upon itself. This involves canceling GCs upon their Issuance, for the same beneficiary as the beneficiary of the associated EACs for the same represented energy.
- **Double Counting Risk Mitigation:** all the Double Counting risks that could theoretically take place in any energy Certificate scheme are to be considered. These include:
  - *Double issuing* - meaning that there is more than one Certificate Issued for the same purpose or claim[1] per unit MWh of eligible energy production,
  - *Duplication during Transfer* - either as a result of a technical error in the electronic processes, or due to fraud, a Certificate could end up in both the receiving and sending Account of the Transfer,

[1] *It may be perfectly valid to Issue separate Certificates (i.e. for support and disclosure) based on the same MWh.*
[2] *Prevention of double usage and disclosure may be ensured by nominated competent bodies or third party verification programs.*

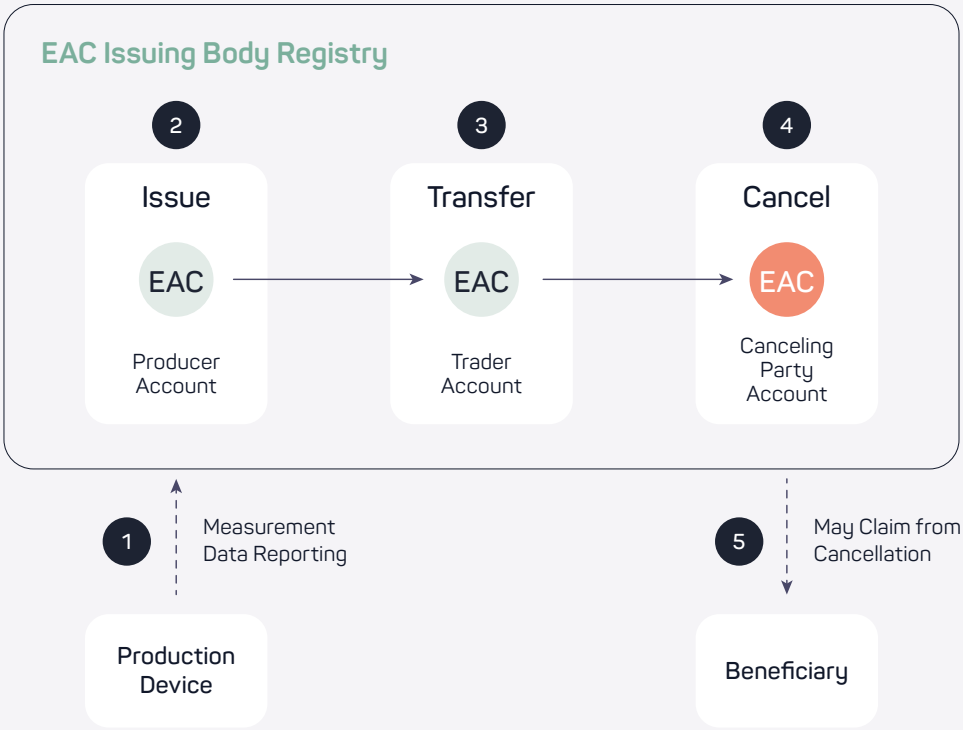
- *Double registration* - in relation to IT system security and IT operational risks, the same Certificate could erroneously get registered more than once,
- *Double cancellation* - meaning that the same Certificate is canceled more than once,
- *Double usage* - meaning that a canceled Certificate is used for more than one claim[2] (i.e. claimed energy amount is greater than produced energy), and
- *Double disclosure (double claiming)* - whereby the Attributes of the amount of energy for which a Certificate is Issued are also claimed by other means than the cancellation of that Certificate.

The GC Scheme configuration impacts its entire lifecycle, the Roles of participants and how they must interact with (or within) underlying EAC Schemes in order to prevent Double Counting. The remainder of this Chapter first seeks to give an overview of the key components of current EAC Schemes (Configuration #0), before going on to define the three alternative proposals for GC Scheme implementation (i.e. Configuration #1, Configuration #2, and Configuration #3) and give the requirements for each.

Configuration #0: Current EAC Schemes

In order to understand the changes proposed in the configurations for GC Schemes, it is first important to understand how today's EAC Schemes work.

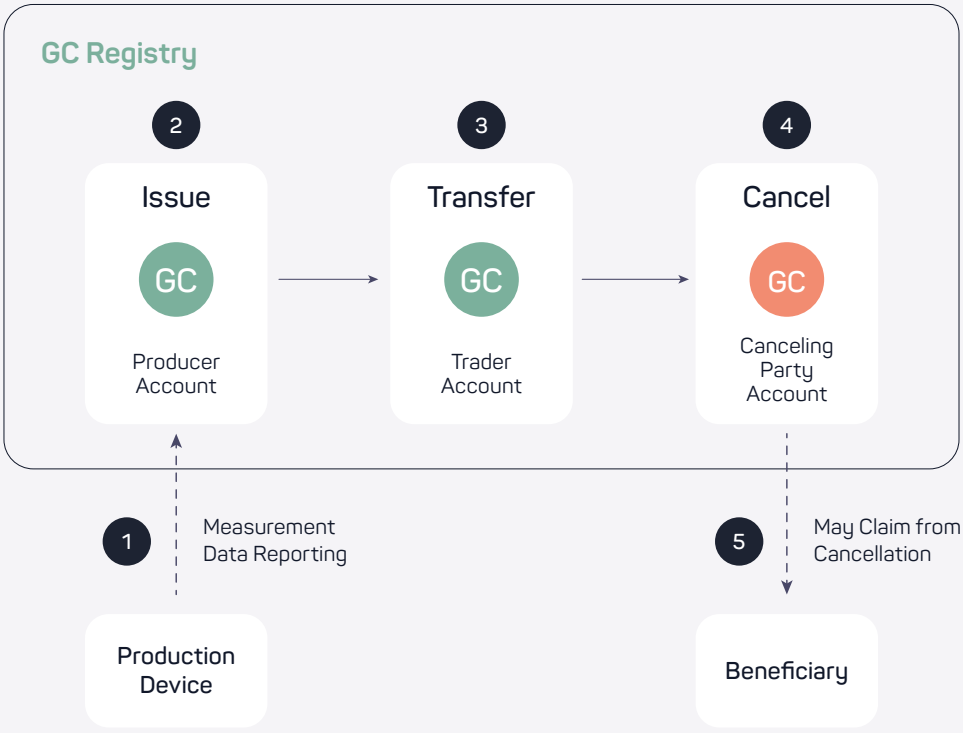
Configuration #0: Current EAC Schemes



1. Production Measurement: The Production Device converts physical energy from one Energy Carrier to another. The Measurement Body measures each unit of eligible energy (i.e. measurement data) and reports it to the Issuing Body.
2. EAC Issuance: Based on this measurement data, the EAC Issuing Body Issues EACs to the Account Holder's Account. The Account Holder of the Account to which the EAC are issued, may be the Producer or its assigned agent. The EAC Issuing Body is the only Issuer in the Domain for the relevant type of EAC.
3. EAC Transfer: The original Account Holder may Transfer the EACs to the Account of another Account Holder in the Registry governed by the EAC Issuing Body. EACs may be Transferred multiple times during their lifetime, until they have Expired or have been canceled, after which Transfer is no longer possible.
4. EAC Cancellation: At some point in time, the EAC resides in the Account of an Account Holder who decides to Cancel the EAC. An Account Holder may Cancel EACs on its own behalf or on behalf of another Beneficiary.
5. Claim: The Beneficiary (i.e. final consumer) may make a claim of consuming energy with specific Attributes (e.g. 1 MWh of wind energy consumed) based on canceled EACs (usually canceled by Producer/supplier on behalf of the Beneficiary).

Based on the fundamentals in Configuration #0 above, the rest of 1.2 Scheme Configurations describes three Granular Certificate system configurations. When considering these configurations, it is useful to keep in mind that a GC is conceptually an EAC with temporal granularity, and that an EAC and a GC are equivalent in most other respects.

Configuration #1: GC Scheme evolves out of EAC Scheme



GC Scheme Configurations

Configuration #1: GC Scheme evolves out of EAC Scheme.

In this configuration, the GC Scheme constitutes an evolution of an existing EAC Scheme. The GC Issuer is the EAC Issuing Body. GCs are Issued instead of standard EACs following five key steps:

1. Production Measurement: The Production Device generates physical energy. The Measurement Body measures each unit of eligible energy and reports it to the Issuing Body.
2. GC Issuance: Based on this measurement data, the Issuing Body[3] Issues GCs to the Account of an Account Holder. The Account Holder may be the Producer or its assigned agent. The Issuing Body is the only Issuer in the Domain for the relevant type of GC.
3. GC Transfer: The original Account Holder may Transfer the GCs to an Account of another Account Holder in the Registry governed by the Issuing Body. GCs may be Transferred multiple times during their lifetime, as long as they have not Expired or been canceled.
4. GC Cancellation: At some point in time, the GC resides in the Account of an Account Holder, who decides to Cancel the GC. An Account Holder may Cancel GCs on its own behalf or on behalf of another Beneficiary.
5. Claim: The Beneficiary (i.e. final consumer) *may* make a claim of the Attributes of the energy it has consumed based on canceled GCs (usually canceled by an Account Holder on its behalf).

Requirements

- The same Double Counting mitigation measures as in the related EAC Scheme *shall* be followed where they are applicable for GCs.
- Issuing rules:
  - The GC Issuer *shall* Issue GCs for eligible energy produced, being a Certificate relating to the Attributes of energy produced during a period of one hour or less.
  - The GC Issuer *shall* ensure its information systems manage the GC lifecycle from Issuance to Cancellation. The responsibility *may* be transferred to another entity on approval of EnergyTag, being the Delegated GC Administrator.
  - For each quantity of eligible energy, there *shall* be no more than one GC Issued.
  - The Production Device owner *may* be granted the choice to opt-in and request the Issuance of GCs.
  - Where there is no governmental restriction on the number of Certificate Issuers within a Domain, provisions *shall* be in place to hold the Registrant accountable for ensuring that for the same amount of generated energy, Certificates *shall* not be issued under more than one scheme, and
  - GC Issuance *shall* only take place for energy production which is not otherwise claimed or marketed with the Attributes represented on the GC.
- The GC Issuer *may* either:
  - i) Issue an EAC and subsequently convert it into GCs.
    - In this case, the EACs are Canceled without being allocated to energy consumption: they are no longer tradable and are not used for disclosure of the origin of energy towards consumers; or
  - ii) Issue GCs directly.
- The increased complexity of issuing GCs suggests that EAC processes or Certificate Issuer processes *may* need to be upgraded.
- The Account Holder of the Account to which

[3] *In the EU, the EAC Issuing Body is a body appointed and regulated by national/regional governments.*

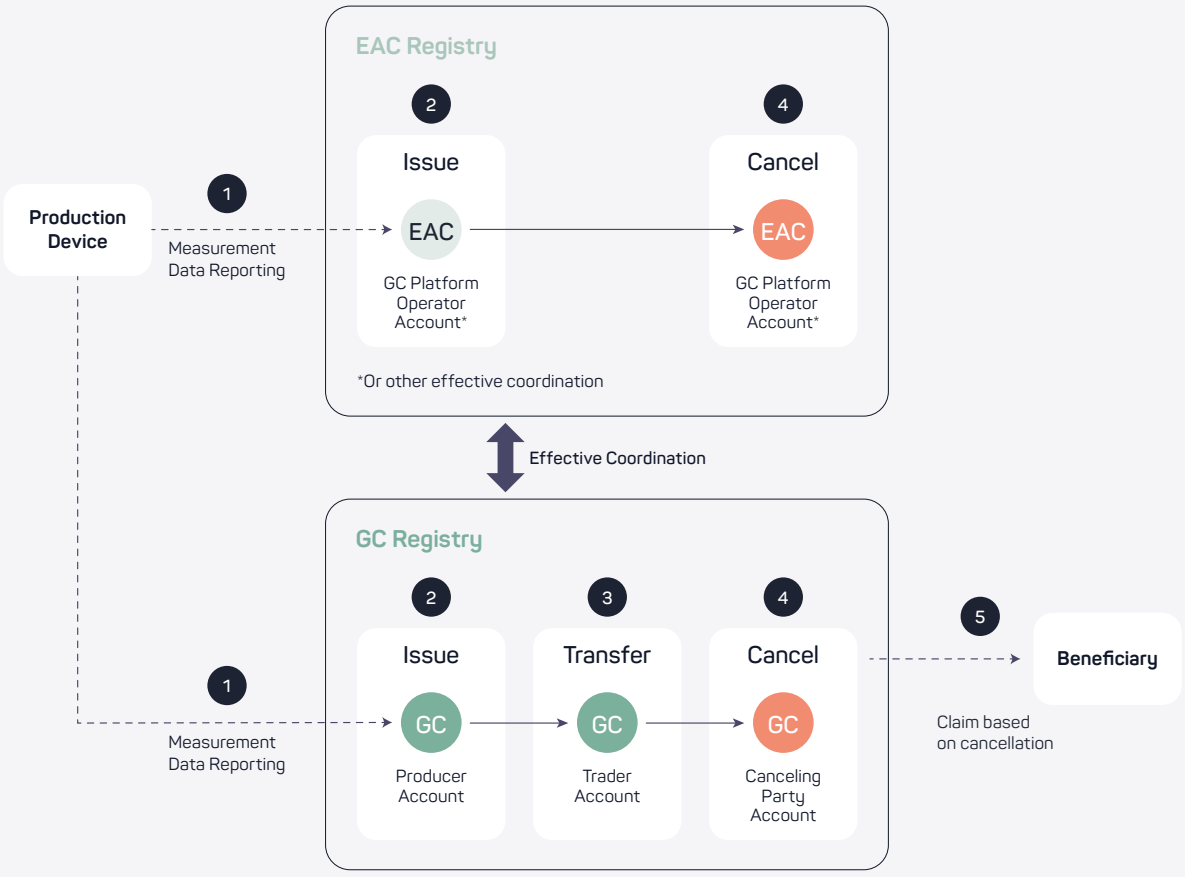
the GCs are issued, *may* be the Producer or its assigned agent.

- GCs *may* be Transferred multiple times during their lifetime, as long as they have not Expired or been Canceled.
- An Account Holder *may* Cancel GCs on its own behalf or on behalf of another Beneficiary.

Configuration #2: GC Scheme supplements EAC Scheme, EAC issuer maintains control

In this configuration, the GC is Issued on a GC Platform, which is an information system that (among other things) may provide GC Registry services. The avoidance of Double Counting is ensured by maintaining a centralized and underlying EAC Registry, which is referenced during GC Issuance. The GC is a separate instrument that must be linked to the underlying EAC. The GC Platform may be operated by a third party or by the EAC Issuing Body itself. The GC Platform Operator operates the GC Registry and is the GC Issuer in this configuration.

Configuration #2: GC Registry supplements EAC Registry[4]



[4]*Practical real-life examples can be found in the EnergyTag demo projects.*

In this configuration, the GC Scheme supplements an underlying EAC Scheme. GCs are Issued following five key steps:

1. Production Measurement: The Production Device generates physical energy. The Measurement Body measures each unit of eligible energy and reports it to the EAC Issuing Body and the GC Issuer.
2. Issuance:
   - *EAC*: Based on this measurement data, the EAC Issuing Body Issues EACs to the Account of an Account Holder. This Account Holder may be the Producer or its assigned agent. The EAC Issuer is responsible for registering EAC ownership and guaranteeing the uniqueness of the EAC. The GC Issuer should be an Account Holder on the EAC Registry if possible.
   - *GC*: The GC Issuer Issues GCs based on measurement data that relate to the same Production Device for which the EAC Issuing Body has Issued the corresponding EACs. EACs may reside in the Account of the GC Issuer in the EAC Registry. The GC Issuer allocates the temporal Attributes of these EACs, in the form of GCs, to market parties.
3. GC Transfer: The original Account Holder *may* Transfer the GCs to an Account of another Account Holder in the GC Registry. GCs *may* be Transferred multiple times during their lifetime, provided that; they have not Expired or been canceled, and that the transfer of ownership is coordinated with the underlying EAC scheme.
4. Cancellation:
   - *EAC*: Following the request of market parties in the GC Registry, who Cancel/validate the temporal value of the GCs against corresponding energy consumption, the GC Issuer Cancels EACs. The GC Issuer *may* be the Beneficiary of each cancellation. Strict criteria must be met to ensure that there is never the opportunity for double usage of the same Attribute: this is ultimately the responsibility of the EAC holder, which is ideally the GC Issuer.
   - *GC*: The appropriate Account Holder on the GC Registry Cancels the GCs[5] and, based on this, the Beneficiary may make a claim.
5. Claim: The Beneficiary may make a claim of the Attributes of the energy it has consumed based on canceled GCs (usually canceled by an Account Holder on its behalf). The ultimate Beneficiary of the claim is disclosed in this step through relevant contractual arrangements.

Requirements

- The GC Issuer responsible for GC management in this configuration *may* be the EAC Issuing Body or a third party. The GC Issuer, or its agent, operates the GC Registry,
- A GC Registry *shall* offer a granular view of the EACs from an Account in the EAC Registry and add, where relevant, the necessary temporal information to allow them to be classified as GCs,
- The GC Issuer *shall* be appointed or otherwise accepted by the EAC Issuing Body of the underlying EAC Scheme,
  - This *shall* involve adherence to such public rules and contractual arrangements as are required by the EAC Issuing Body to ensure effective coordination and prevent Double Counting.
  - Such protocols and agreements *shall* include the EAC Issuing Body and the GC Issuer. They *may* also include other parties such as the Producer, market parties and the ultimate Beneficiary of the Attributes upon cancellation of the GC and underlying EAC.

[5]*Note that given EAC is in 1 MWh units, it is likely that multiple GCs would be canceled concurrently per EAC to ensure equivalent cancellation volumes*

- The GC Issuer *shall* avoid Double Counting by ensuring effective coordination with the underlying EAC Scheme,
  - Double Counting of the same Attributes *shall* be avoided at all times.
  - The GC Issuer *should* hold an Account on the EAC Registry.
  - If the GC Issuer holds an Account on the EAC Registry:
    - it *shall* ensure proper cancellation of underlying EACs to support any claims relating to energy produced by the same Production Device in the same generation period, and
    - it *shall* not own any EAC or hold any beneficial entitlement to it except on behalf of the holder of the associated GCs.
  - Where implemented, software solutions connecting the EAC Registry and GC Registry *shall* ensure that any change to the ownership or lifecycle of the EAC or GC is automatically and instantaneously fulfilled on both Registries.
- The GC Issuer *shall* ensure that the meter data used for GC issuance relates to the same Production Device and production period as the meter data used for the issuance of the underlying EAC.
- The GC Issuer *shall* ensure that the energy volume of GCs issued is not greater than the energy volume represented by the underlying EACs.
- The GC Issuer *shall* be liable to the Account Holder for its actions regarding the referenced EACs. The GC Issuer *shall* take responsibility for and, where relevant, allocate liability to the relevant actors within the GC Registry,
- Claims based on the canceled EACs or GCs *shall* not double disclose the Attributes of the same quantity of energy. The overarching Disclosure mechanism *should* account for this:
  - To facilitate this, the GC Issuer *shall* ensure in its agreement with the EAC Issuing Body that no environmental claim or beneficial ownership allocation is made using the EACs and that the beneficiary of the GCs is acknowledged by the EAC Consumption Verifier, where such a body exists.
  - Where it exists, the EAC Consumption Verifier is responsible for supervision of the Disclosure of the origin of energy towards consumers and has oversight of the EACs canceled with and without granular information for GC Issuance. The GC Issuer and EAC Issuing Body *shall* ensure that the coordination with the EAC Consumption Verifier ensures that canceled EACs, that are linked to GC Registries, do not duplicate Attributes in overall statistics and claims regarding Attributes that are also covered by GC cancellations. This *may* require a mechanism for deducting EACs backed by GCs on a GC Registry from its figures for canceled conventional EACs.
- EACs *may* be converted into GCs in a GC registry using the functionality of an Export transaction or Reserve transaction. In this implementation option of Configuration 2, the respective EACs no longer reside in the Exporting or Reserving registry and the data representing their Attributes is transferred into another registry. As such, Configuration 2 *may* be implemented by converting imported EACs from another registry into GCs, on condition the EAC Issuing Body and GC Issuer enter into an agreement ensuring:
  - Both the EAC Issuing Body and the GC Issuer have the cooperation of the Measurement Body in order to access the measurement data of the energy production that is represented by the respective EACs and GCs. This enables verification that the correct generation data has been recorded in each registry.

  - The EAC and GC data is reported by an independent Measurement Body and not self reported by the Registrant/producer.
  - The EAC and GC Issuers *shall* cooperate to ensure that the EACs and GCs for the same energy production align in the Disclosure of the represented Attributes to a Consumer.
  - Processes are in place to synchronize Measurement Data inconsistencies regarding the represented energy production.
- In cases where the Face Value of the EAC exceeds that of the GCs, the EAC System may need to carry over the remaining energy production, of energy quantities lower than the EAC Face Value, to the next production period. In such cases, the GC Scheme Protocol *shall* detail the coordination processes in relation to the quantity of issued GCs Therefore, the GC Scheme Protocol:
  - *shall* describe how the quantity of GCs being issued avoids Double Counting of the represented attributes of the underlying EACs,
  - it *may* include a process describing:
    - how GCs will not be issued in excess of the corresponding EACs for the corresponding month,
    - how GC Issuance is withheld for hours for which there are not enough EACs to cover the reported hourly production.
  - shall clarify how the EAC Issuer endorses this practice.
- Clear rules *shall* be established between the EAC Issuing Body and the GC Issuer regarding the claims that can be made based on the canceled EACs and the lifespan, tradeability and end-of-life of GCs.
- The Account Holder *may* be the Producer or its assigned agent.
- GCs *may* be Transferred multiple times during their lifetime, as long as they have not Expired or been canceled.
- An Account Holder *may* Cancel GCs on its own behalf or on behalf of another Beneficiary.

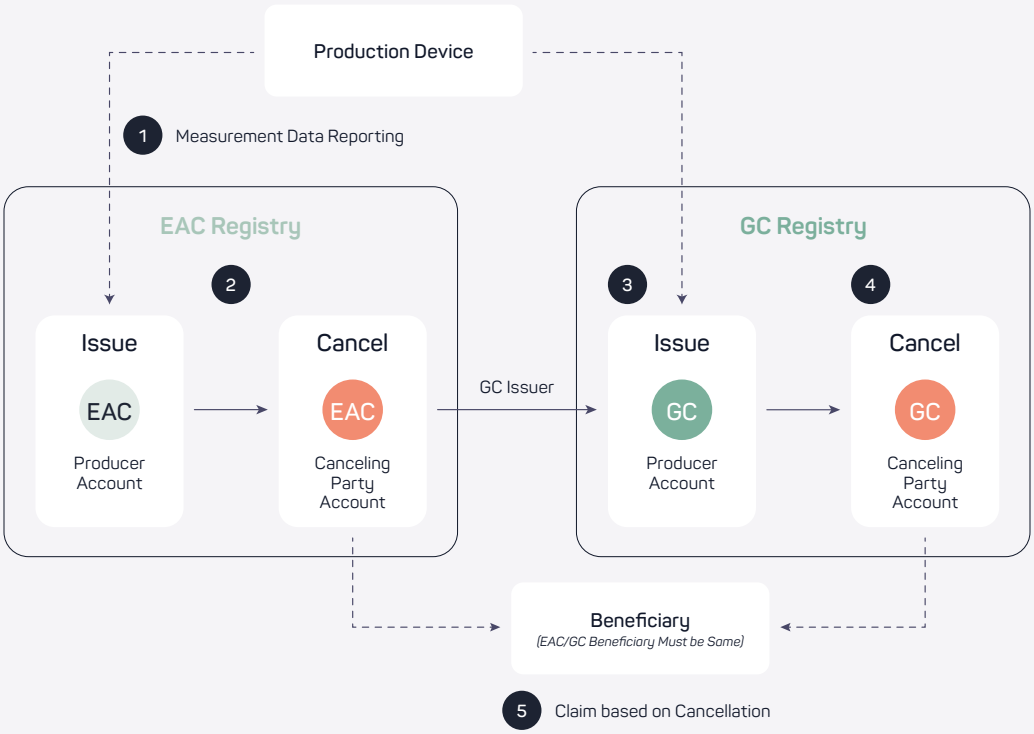
Configuration #3: GC Scheme based on canceled EACs

Where neither Configuration #1 nor Configuration #2 is supported by the EAC Issuing Body of the respective Domain, then (sub)hourly matching of production Attributes to consumption can take place in a harmonized way through a third configuration: the issuance of a special type of GCs that interact with the EAC system in a way that prevents Double Counting and double issuing risks of the represented energy.

1. Production Measurement: The Production Device generates physical energy. The Measurement Body measures each unit of eligible energy and reports it to the EAC Issuing Body and GC Issuer.
2. EAC Issuance & Cancellation: Based on this measurement data, the EAC Issuing Body Issues EACs to the Account of an Account Holder. This Account Holder *may* be the Producer or its assigned agent. The EAC Issuer is responsible for registering EAC ownership and guaranteeing the uniqueness of the EAC. Ultimately, this EAC is then canceled in the name of a specific beneficiary in a process completely independent of GC Issuance.
3. GC Issuance: A "Config-3 GC Issuer" takes canceled EACs as an input, connects them with (sub)hourly production data of the represented energy, measured from the same meter where possible, and issues not-transferable GCs. This is subject to the conditions that the total energy volume represented by canceled EACs equals the volume of (sub)hourly measured production and that the beneficiary of GCs is the same beneficiary of canceled EACs. The issued GCs must have unique IDs that relate to the corresponding EACs.
4. GC Cancellation: Cancellation occurs immediately upon GC Issuance and for the same Beneficiary as the party stated in the EAC cancellation statement.

5. Claim: The Beneficiary *may* make a claim (e.g. hourly Temporal Matching) of the Attributes of the energy it has consumed based on canceled GCs. The ultimate Beneficiary of the claim is disclosed in this step through relevant contractual arrangements.

Configuration #3: GCs based on canceled EACs, allocated to the same beneficiary



Requirements

Config-3 GCs:

- *shall* only be issued if they represent energy production that is backed by an EAC cancellation statement that unambiguously identifies the beneficiary of these EACs,
- *shall* be immediately canceled upon issuance, for the same beneficiary as the party stated in the EAC cancellation statement,
- *shall* have unique IDs that relate to the corresponding EACs,
- *shall* be prevented from transfer to another owner and carry a flag which marks that they are config 3 GCs and cannot be transferred to any other beneficiary.

A Config-3 GC Issuer:

- *shall* ensure that an agreement is in place with the EAC Account Holder that specifies that there is only one GC Issuer per EAC and that no Disclosure or an environmental claim or beneficial ownership allocation is made using the EACs for which GCs are being issued, for any other beneficiary than the one of the GCs,
- *shall* guarantee that the beneficiary, consumption

period and consumption location are the same for the canceled GCs as for the canceled underlying EACs, and that the (sub)hourly consumption periods for the canceled GCs *shall* fall within the consumption period for the canceled underlying EACs,

- *shall* ensure that the number of issued GCs *shall* not be higher than the amount of energy represented by the corresponding canceled EACs,
- *shall* elaborate in its GC Scheme Protocol how any discrepancies in Face Value between EACs and GCs are handled: In cases where the Face Value of the EAC exceeds that of the GCs, the EAC System *may* need to carry over the remaining energy production, of energy quantities lower than the EAC Face Value, to the next production period. In such cases, the GC Scheme Protocol *shall* detail the coordination processes in relation to the quantity of issued GCs. Therefore, the GC Scheme Protocol:
  - *shall* describe how the quantity of GCs being issued avoids Double Counting of the represented attributes, of the underlying EACs,
  - it *may* include a process describing:
    - how GCs will not be issued in excess of the corresponding EACs for the corresponding month,
    - how GC Issuance is withheld for hours for which there are not enough EACs to cover the reported hourly production.

The measurement data based on which the Config-3 GCs are issued:

- *shall* be the measurement of eligible production of the Production Device referred to on the canceled EACs,
- *shall* relate to the production period of the energy represented by the canceled EACs.

	Advantages	Drawbacks
Configuration #1 GC Scheme evolves out of EAC Scheme	• Easier Double Counting mitigation. • No new Roles or participants. • "Easier to trust" perception.	• Adoption process may be slow in a well-established EAC Scheme. • Complex overhaul of existing IT system.
Configuration #2 GC Scheme supplements EAC Scheme	• Potential for faster adoption. • Enables GC innovation where EAC issuing body mandate is restricted. • Stimulates competition among Platform providers.	• More complex Double Counting mitigation. • New Role (e.g. Platform) requires adoption of new Double Counting mitigation processes.
Configuration #3 GC Scheme based on canceled EACs	Enables reliable GCs where the EAC Issuing Body is not ready to take responsibility over them. With unique GC-IDs there is a verifiable and traceable mechanism that prevents double claims while keeping official EAC system statistics intact.	Non-tradeable GCs don't participate in setting a market value for specific production times.

Evaluation and Recommendation

All three configurations are capable of meeting the requirements for credible GC Schemes, with some advantages and drawbacks outlined above to facilitate a consideration of which configuration to adopt.

Requirement on Configuration Preference

- GC Scheme configuration *should* follow Configuration #1 where possible to facilitate harmonization and more easily avoid Double Counting. However, GC Schemes *may* follow Configuration #2 or #3 in order to facilitate GCs to expedite innovation during the transition to granular systems. As a transitional measure, where EAC Issuing Bodies don't facilitate GCs, GC Issuers *may* also follow Configuration #3 that enables consumers to still make reliable Granular Matching claims that are consistent with the underlying EAC mechanism.
- GC Issuers shall not provide GCs under Configuration #2 or #3 to Producers engaged with an EAC Issuer who offers Configuration #1 under a governmental mandate.

1.3 GC Attributes

Context and Definitions

Existing EACs record various Attributes (e.g. energy source, Production Device, energy input etc.) with Attribute definitions depending on the EAC Scheme / Issuer. It is important that GCs reflect the existing Attributes in their corresponding EAC Scheme, while adding Attributes to ensure higher temporal resolution.

Requirements

- GCs *shall* be immutable from Issuance to Cancellation - that is, once a GC has been Issued, then the data recorded on it is never removed or modified. This data remains intact until the point of cancellation.
- GCs *shall* not be duplicated or Double Counted, and
- GCs *shall* replicate the Attributes found on any underlying EACs in the same Domain.

In all cases GCs *shall*[6]:

- state the Energy carrier (in this version of the Standard, the Energy Carrier is always electricity),
- have a unique identification number, received at Issuance and maintained over the full Certificate lifetime (i.e until cancellation in relation with energy consumption, storage or conversion or until the Certificate Expires),
- state the date when the Production Device became operational,
- state the production/storage discharge interval, which *shall* be a maximum of one hour and expressed in Coordinated Universal Time (UTC):
  - starting Timestamp (UTC[7] "YYYY-MM-DDThh:mm:ssZ" e.g. "2023-10-03T00:00:00Z"),
  - ending Timestamp (UTC "YYYY-MM-DDThh:mm:ssZ" e.g. "2023-10-03T00:14:95Z"),
- state the GC Issuance date-stamp (UTC "YYYY-MM-DD"),
- state the source of produced energy,
- state the technology used to produce energy,
- state the name of the Production Device,
- state the unique ID of the Production Device (if available),
- state the capacity of the Production Device,
- state the country/region of Issuance,
- indicate the geographical location of the Production/Storage System that released the energy for which the GC is Issued (including zip code/postcode, street, city and country, and/or GPS coordinate). Where available, GPS coordinates *shall* be stated,
- use Wh as the base unit rather than a multiple (kWh, MWh etc.) unit,

[6] EnergyTag GC Attributes Spreadsheet
[7] Based on ISO 8601

- record the volume of energy production represented (i.e face value of the certificate),
- be rounded down to the nearest Wh whole number,
- state the identity of the GC Issuer,
- shall state whether or not it was issued following release of energy from a storage system (Storage Tag), and if so, include the attributes listed in section "SD-GC Issuance and Attributes" in Chapter 1.6.5",
- state whether or not it can be used to inform consumers of the origin of the energy they consume (i.e. Disclosure),
- state whether or not it has been Issued following Energy Carrier conversion (Conversion Tag),
- state under which configuration the GC is issued (i.e Config-1,2 or 3).

As needed, GCs *may* record the following information:

- reference the Bidding Zone and/or Balancing Authority and/or Price Node of the Production Device (if available),
- contain a reference to an identification of the grid (or other transport means) into which the energy is injected (if grid connected and available),
- legal status of Certificate (including responsible authority, where relevant),
- whether support has been received and, if so, whether for investment, production or both,
- a reference to quality schemes under which this Certificate is eligible,
- dissemination level of the physical energy,
- a reference to related GCs/SCRs/SDRs corresponding to energy that was charged and discharged from a Storage System,
- a production emissions factor (kgCO2eq/MWh) if available and a reference to the methodology for its calculation,
- such additional Attributes as are relevant to the functioning of the GC Scheme and/or the underlying EAC Scheme.

Note #1 : Standardizing GC Size

A GC corresponds to a certain quantity of energy. However, EnergyTag has not yet standardized the GC size in order to benefit from practical experience and audits prior to deciding if and how to standardize this critical aspect. When considering standardization, the following principles will be taken into Account:

1. **Immutability:** once Issued, a Certificate does not change,
2. **Splitability of Batches:** at the Transfer of GCs between Accounts, or at cancellation, it may be that only some of the energy produced in an hour by the Production Device is used by given consumers . Therefore, it must be possible to split batches of GCs.
3. **Data Volumes:** it is critical to ensure the above principles are met in the most data- and energy-efficient manner. Therefore, it may be preferable for GCs to be stored in batches identifying the start and end Certificate numbers in the batch.

In summary, while variable volume GCs are efficient in terms of data volumes stored, they may present issues with immutability and splitability, due to the difficulty in maintaining a unique ID for every basic unit of energy, from one Domain to another. Having fixed-size Certificates managed in batches could overcome this issue, while limiting data volume and energy consumption. EnergyTag will refine this aspect of the Standard in future versions of this Standard.

1.4 Time Zones

Context and Definitions

Harmonizing the Time Zone on GCs across systems and Domains helps avoid a number of complexities related to the Transfer of GCs across time zones and handling of unsynchronized daylight savings time arrangements.

Requirements

- GCs *shall* use UTC (Coordinated Universal Time) for expressing time (e.g. production interval start and end Timestamps).

1.5 Production Metering and Registration Data

Context and Definitions

In general, the Producer and production metering data requirements for GCs will be the same as existing EAC mechanisms. The major additional specific requirement will be that data are provided with at least hourly time resolution.

Requirements

General

- The party that is accountable in the GC Scheme for the accuracy of registered data from the Production Device, metering and issued certificates *shall* be named in public documentation in the Scheme Protocol.
- In the case where such party is not the GC issuer, the GC Isser *shall* verify that mechanisms are in place to ensure robust registration and reporting, failing which it *shall* secure the commitment of another relevant party to ensure robust registration and reporting of the relevant Production Device data and of the measurements of energy input and output.

Production Device Data

- If a Production Device is already registered in an EAC Registry, or if simultaneously registering for EACs and GCs (see system Configuration #2, 1.2. Scheme Configurations), all Production Device registration data from the EAC Registry Account *shall* be provided to the GC Issuer, with the consent of the Producer, to ensure consistency.
- For GC applications that are not derived from an existing EAC Registry, or where EAC Registry data omits the data below, applicants seeking to register a Production Device shall provide the following information to the GC Issuer and keep it up to date:
  - the applicant's contact details,
  - Production Device ID unique to the Domain[8],
  - the name of the Production Device,
  - the Registry Account into which the GCs for the units of produced energy will be Issued, or a request to open such an Account,
  - geographical location of Production/Storage System (including zip code/postcode, street, city and country, and/or GPS coordinates). Where available, GPS coordinates *shall* be stated,
  - a reference to an identification of the grid (or other transport means) into which the energy is injected (if grid connected and available),
  - details of any production auxiliaries associated with the Production Device,
  - all energy sources which may be converted into an output Energy Carrier of the Production Device,
  - the technology type used by the Production Device,
  - the capacity of the Production Device,
  - the date when the Production Device became operational,
  - the identity of the Measurement Body responsible for collecting and determining the energy produced by the Production Device and providing this to the GC and/or EAC Issuer,

[8] *A unique Production Device IDs could be generated by using GS1 codes as is currently the case in Europe under EECS.*

  - details of any payments of public support which have been made or are due in association with this Production Device,
  - a diagram of the Production Device, including details of the location of the entry and exit measurement point(s) for the Production Device and of any Production Auxiliaries connected to the Production Device
  - the identity of any label scheme under which this Production Device is accredited,
  - Meter ID, including an indication of whether this is gross or net measurement of generation,
  - Meter type (utility, submeter),
  - Meter serial number,
  - the associated utility consumption meter ID and any other behind-the-meter production or storage IDs, for production systems that are behind a utility consumption meter. Data for each associated consumption, production, or storage ID should be reported according to the data requirements in 1.3 Consumption Metering and Registration Data for Matching of the GC Matching Standard.
- For applications for GCs that are not derived from an existing EAC Registry, or where EAC Registry data omits the data below, applicants seeking to register a Production Device *shall* grant access to the GC and/or EAC Issuer to the Production Device together with records relating to it which will enable the information provided in connection with that application to be verified.

Production Data

Registered energy Producers or qualified reporting entities *shall* submit the following data to the GC Issuer per measurement reporting period:

- Production Device ID unique to the Domain,
- Meter ID,
- Interval Start Timestamp (UTC "YYYY-MM-DDThh:mm:ssZ" interval starting, E.g. "2023-10-03T00:00:00Z"),
- Interval End Timestamp (UTC "YYYY-MM-DDThh:mm:ssZ" interval ending, "2023-10-03T00:14:95Z"),
- Production quantity (Wh)[9], and
- Gross/net production indicator.

Storage Data

For any Storage System from which GCs/Storage Records will be issued/kept, that device will be considered both a Production Device and a Consumption Point and should be registered in the same manner as Production Devices specified above. Registered Storage Systems or qualified reporting entities *shall* submit the following data to the GC Issuer per measurement reporting period:

- For registered Storage Systems, the following data *shall* be metered and shared with the relevant verification/Issuing Body:
  - Meter ID number,
  - Interval Start Timestamp (UTC "YYYY-MM-DDThh:mm:ssZ" interval starting, e.g. "2023-10-03T00:00:00Z"),
  - Interval End Timestamp (UTC "YYYY-MM-DDThh:mm:ssZ" interval ending, e.g. "2023-10-03T00:14:95Z"),
  - Indication of state during each interval (charge/discharge),
  - Interval charge/discharge (Wh).
- For behind-the-meter storage systems, data from the storage meter *shall* be accompanied by the utility consumption meter ID data as specified in the Matching Standard section 1.3 Consumption Metering and Registration Data for Matching.

Other considerations around storage and storage metering can be found in 1.6 Energy Storage

[9] *In instances where metering data are not available in Wh, kWh metering data may be submitted.*

and Annex 2 Determining the Storage Efficiency - Quantifying Storage Losses and Annex 3 Storage Attribute Allocation Methods.

Data Transfer

- Production data *shall* be submitted to the relevant body (e.g. GC Issuer, Claim Verifier) at a frequency agreed between the parties.

1.6 Energy Storage

Context and Definitions

Energy storage deserves particular attention when managing GCs. For most historic EACs systems, cancellation for energy Input to storage is not required. The logic was that storage is not end-consumption and, in most cases the "clean-up" of storage losses was voluntarily dealt with by canceling the corresponding number of EACs[10] if specific Attributes were claimed for the stored energy. GCs related to energy fed into and released from storage cannot be managed like this, as the time interval in which the energy is charged and discharged is of essential value. EnergyTag acknowledges that storage tracking is complex and is still in an early stage of development and implementation. Therefore, the goal of this Chapter is to lay foundations that describe the most basic behavior of Storage Systems, which can evolve and eventually be further standardized based on feedback from implementation.

1.6.1 Storage VS Energy Carrier Conversion

The principles in this section are relevant for all types of energy storage where the energy carrier of the input into storage is of the same type as the energy carrier for the output of storage. Situations where this output energy carrier is different from the input energy carrier, are referred to as "Energy Carrier Conversion" and deserve dedicated attention, although many aspects of this section on storage will also apply there.

1.6.2 Introducing Charging Records

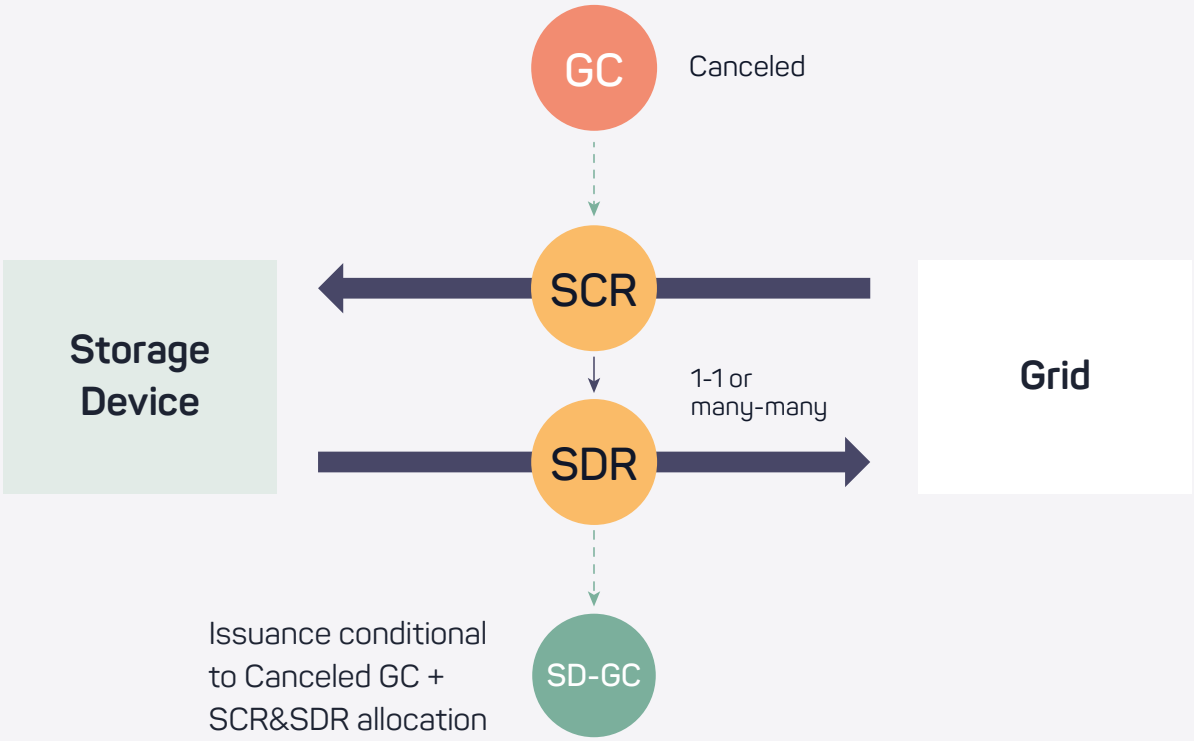
The Standard proposes that all charged energy in a given time-interval is recorded in the Registry using Storage Charging Records (SCR), and that all discharged energy in a given time-interval is recorded using Storage Discharging Records (SDR). These records alone are not equivalent to tradable Granular Certificates as they do not contain information regarding the energy source and other Attributes of the energy charged into the Storage System (unless corresponding GCs are allocated to these records).

1.6.3 Storage Overview Schematic

The schematic below presents the key mandatory concepts in any storage-related Scheme. This includes the key elements of Time-shifting input Attributes to output from Energy Storage, shown on the schematic. This implies a mandatory recording of SCRs and SDRs to reflect the quantities of charged and discharged energy. Detailed rules are given in 1.6.5 Time-Shifting of Storage Input Attributes to Output.

[10] *Note that in some cases EACs are not canceled for losses.*

Storage Schematic for GC Schemes



Key Definitions

SCR — **Storage Charge Record**
Registry record of energy charged to storage in a time interval

SDR — **Storage Discharge Record**
Registry record of energy discharged from storage in a time interval

SD-GC — **Storage Discharge GC**
GC issued after storage discharge

GC Flow for Time-Shifting

1.6.4 Accounting for and Quantifying Storage Losses

Context

Due to energy losses, the quantity of energy flowing into a Storage System is not the same as the quantity of energy flowing out of a Storage System. Consequently, the volume of Storage Charge Records for the input into storage is higher than the volume of Storage Discharge Records for the energy released from storage. The procedure outlined in Annex 2 Determining the Storage Efficiency - Quantifying Storage Losses gives potential directions for determining the storage efficiency.

Requirements

- The amount of input energy for which SCRs are recorded, *shall* be based on measurement of energy input to storage.
- The amount of output energy for which SDRs are recorded, *shall* be based on measurement of energy output from storage.

1.6.5 Time-Shifting of Storage Input Attributes to Output

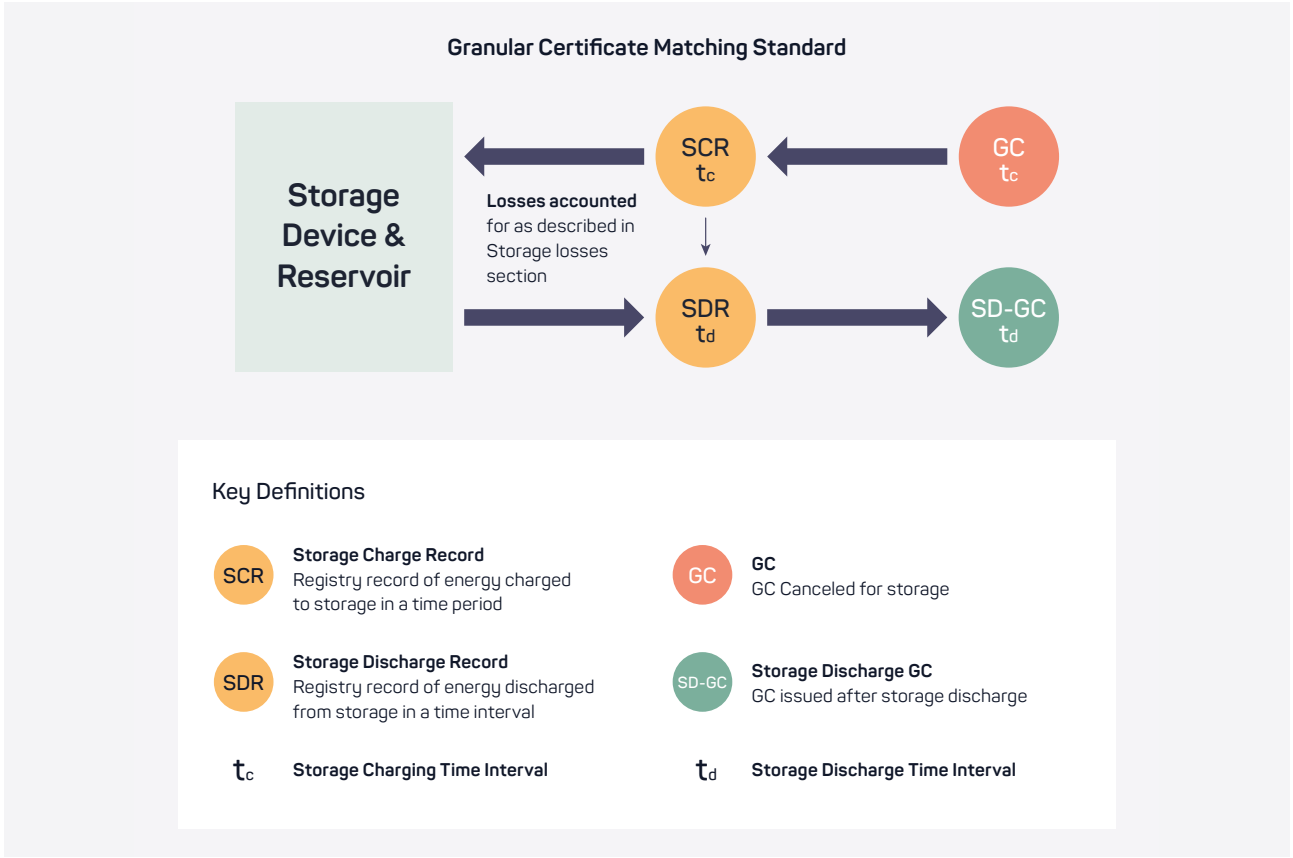
The following applies where Time-Shifting is being performed for energy storage.

Definitions and Requirements

i) Definitions

Time-shifting is considered to be the shifting of Attributes of energy production to different hours following Energy Storage, by conveying Attributes from Storage Input GCs to Storage Output GCs while accounting for Storage Losses.

Temporal Matching is considered to be the allocation of Attributes of GCs to a corresponding quantity of consumed energy, as elaborated in Chapter 1.2 of the GC Matching Standard.



ii) Process

In this section, the process to be followed in implementing Time Shifting for storage is outlined using the steps below and the Schematic above.

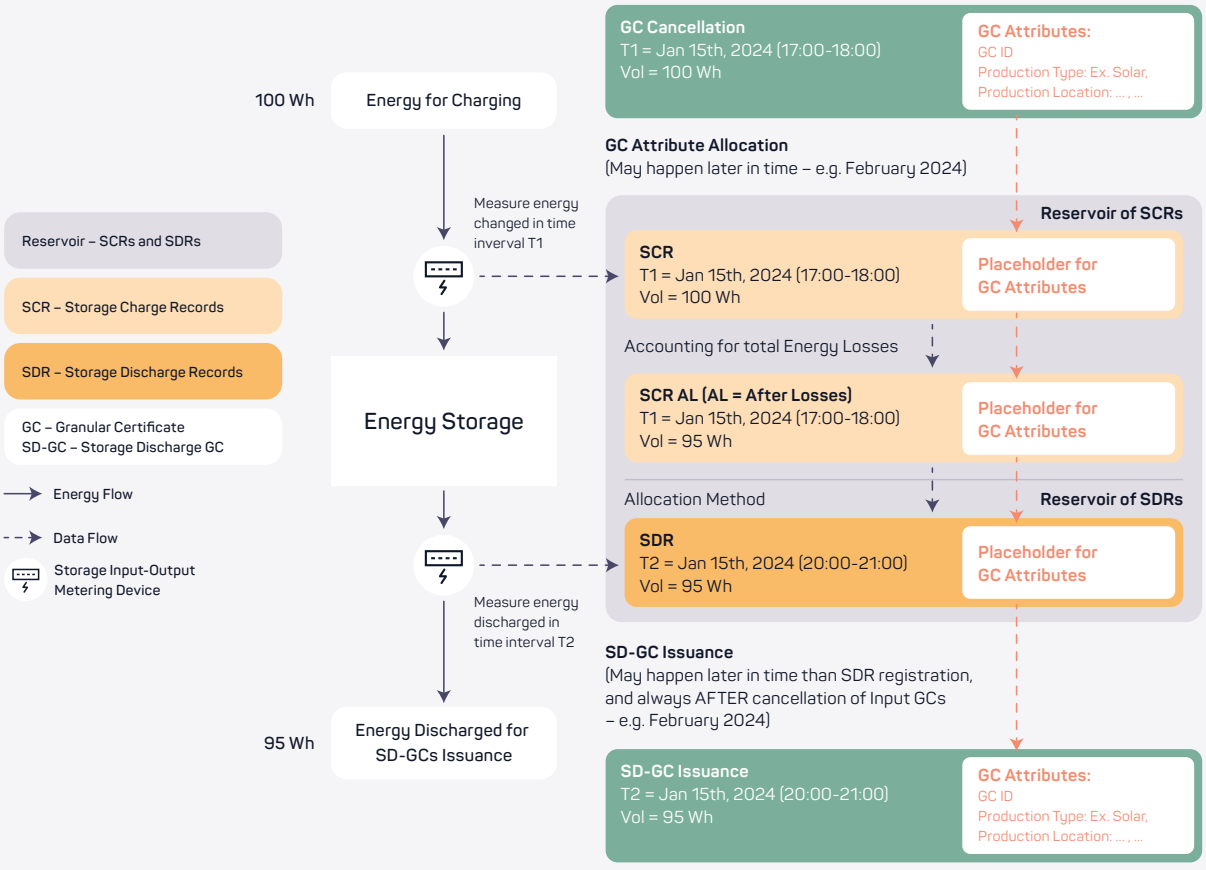
Requirements

- The Time Shifting storage scheme *shall* comply with all requirements in this chapter.

Storage System in the GC Registry:

- The Storage System is registered in the GC Registry as a specific type of Production Device. It *shall* have a Reservoir with Storage Charging Records (SCRs) and Storage Discharging Records (SDRs).
- A Storage System is reflected in a software system by keeping track of the 'Reservoir charge status'. The Reservoir holds SCRs and SDRs. Once SCRs are allocated to SDRs, they can move to the Storage System historical archive on the Registry. Where energy is discharged, but the corresponding SDRs are not allocated to a SD-GC, then the Storage System operator *may* allocate these SDRs to an 'unknown beneficiary' in order to ensure that the Reservoir reflects the physical capacity of the Storage System.

Time-Shifting of Attributes with Storage While Accounting for Losses



Location of Storage System in relation to location of the original Production Device

- Geographical Matching *shall* be done between the location of the Production Device mentioned on the canceled GC and the Energy Storage System (see EnergyTag Matching Standard), and
- Geographical Matching *shall* be done between the location of the Energy Storage System mentioned on the SD-GC and the end-consumption of the represented energy.

Reservoir: SCRs and SDRs

- Time-intervals for registering SCRs and SDRs *shall* be 60 minutes or less, corresponding to the applicable local balance & settlement period, and the SCR and SDR *shall* specify their length.
- Storage Charging data for each time interval *shall* be recorded in the Registry upon input to the Energy Storage System, as a Storage Charging Record (SCR).
- The SCR:
  - *shall* record the time interval of charging,
  - *shall* record quantity of energy charged (Wh),
  - *shall* record the energy source and other Attributes of the allocated (canceled) GC,
  - *shall* record which type of Geographical Matching has been done when canceling input GCs, in accordance with the GC Matching Standard.
- Storage discharge data for each time interval *shall* be recorded in the Registry upon output from the Storage System, as a Storage Discharge Record (SDR). The SDR:
  - *shall* record time interval of discharging,
  - *shall* record quantity of Discharged energy (Wh),
  - *shall* be allocated to a GC,
  - *shall* record a reference to the methodology and measurement interval for determining storage losses as outlined in Chapter 1.6.4,
  - *shall* record a reference to the method for allocation of Input Attributes to Output Attributes as outlined in Annex 3 Storage Attribute Allocation Methods,
  - *shall* record the type of Geographical Matching, as detailed in the Matching requirements in GC Matching Standard,
  - the Beneficiary of the SDR *shall* be a SD-GC, on condition that SD-GC Issuance follows the rules for Temporal Matching as detailed in the Matching Standard, including that SD-GC Issuance takes place only after cancellation of a GC allocated to an SCR, which has been allocated to that SDR.

GC-SCR Allocation:

- GCs for energy produced in the same time interval as the SCR *shall* be canceled, indicating that this cancellation is "for charging" energy into a Storage System.
- The Energy Source information obtained from GCs that are canceled "for charging", *shall* be recorded on a corresponding (energy volume) of Charging Record(s) by referring to these GCs.
- The corresponding quantity of Charging Records from then onwards includes the Energy Source of the canceled GCs.

SCR-SDR Allocation:

- SCRs *shall* be allocated to SDRs, provided storage losses have been accounted for as described further in 1.6.4 Accounting for and Quantifying Storage Losses and Annex 2 Determining the Storage Efficiency - Quantifying Storage Losses An SCR shall record whether or not it has been allocated to an SDR.
- Allocation *may* be done in batch or on a 1-to-1 basis, for all records and/or GCs with identical information. SCRs represent a quantity of charged energy that *shall* be allocated to SDRs except for the share related to energy losses. Each unit of energy associated with an SCR *may* only be

allocated once to an SDR. The order by which SCRs are allocated to SDRs *shall* follow the allocation guidelines explained in the Guidelines in Annex 3 Storage Attribute Allocation Methods.

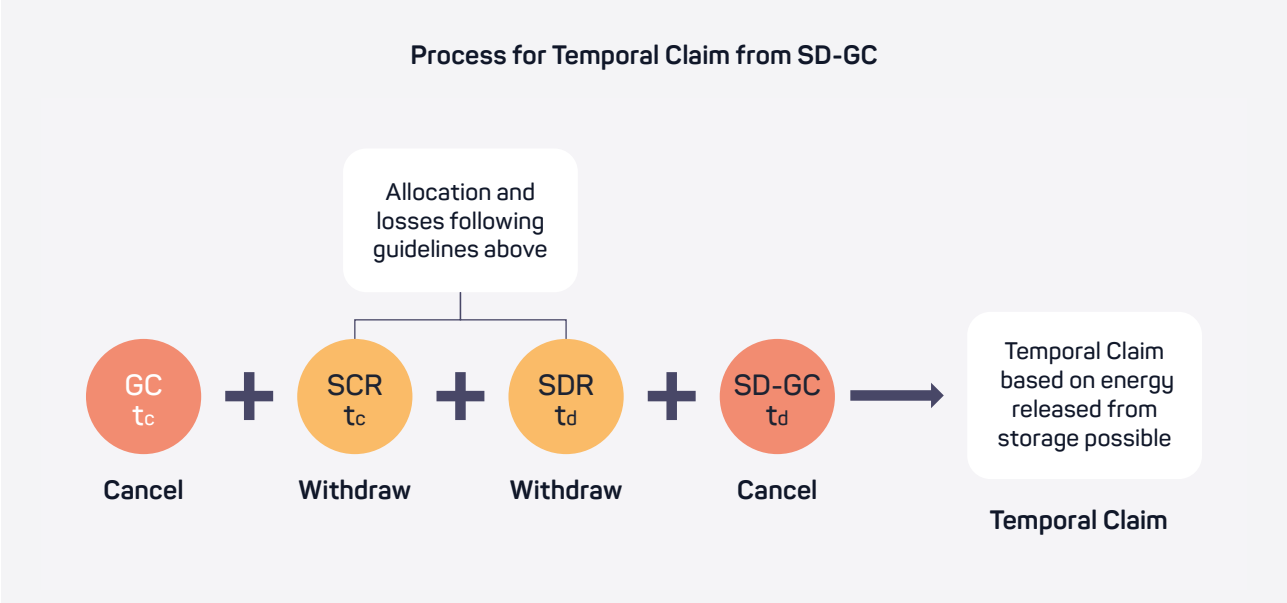
SD-GC Issuance and Attributes

- Where SCRs containing Attributes from canceled GCs are allocated to SDRs, these Attributes *shall* be copied to SDRs.
- SD-GCs *shall* be Issued in equal volume as the corresponding SDRs. Accordingly, the information on these SDRs *shall* no longer be available for further usage/allocation.
- In addition to the requirements listed in 1.3 GC Attributes, relating to the original Production Device that are transferred from the canceled GCs to the SD-GCs, all Storage (Discharge) GCs:
  - *shall* record an indication that the GC is related to energy released from an Energy Storage System (i.e. Storage Tag),
  - *shall* record the time interval of release from storage and *may* record the period of original generation of their underlying energy,
  - *shall* record Attributes like Energy Source as recorded on the Storage-Discharge GC which is conveyed from the original GC,
  - *shall* record both the location of the original Production Device (Attribute on the canceled GCs), as production location of the discharged energy, and the location of the storage device, in relation with the Storage Tag,
  - *may* record information on the storage losses (efficiency factor),
  - *may* record a reference to the SCR allocated to their related SDR,
  - *may* record additional details as determined by the GC Registry that are necessary to enable Use Cases.
- Where the SDR leads to the Issuance of a GC, this SD-GC *shall* record the mandatory data of this SDR and *may* record the optional data of it.

iii) Storage Discharge-GC based Temporal Claims

In order to make a temporal claim that an energy Storage System has moved energy Attributes from one time to another, it is necessary to ensure that the following collection of elements are no longer available for further use:

- GC from the storage charge time interval (t_c),
- SCR for from the storage charge time interval (t_c),
- SDR from the storage discharge time interval (t_d), and
- SD-GC from the storage discharge time interval (t_d).



1.7 GC Validity Period and Record Retention Time

Context and Definitions

The GC Validity Period is the period of time, ex-post, in which participants may buy and make claims using GCs. Ensuring that GCs cannot be used to make claims for an indefinite period after their production enhances the trust in the instrument. Moreover, harmonizing GC Validity Periods for interconnected EAC Schemes has proven to enhance market liquidity. Having different Validity Periods in different Domains may cause complexity, for example in handling blocked EAC/GC exports due to their having passed the expiry date in the importing country.

In cases where GCs are used for Temporal Matching of consumption with production, the need for harmonized GC Validity Periods may be rendered irrelevant, with the local ex-post limitation for the completion of Temporal Matching transactions being the critical criteria in these cases. Nevertheless, setting an absolute maximum validity is deemed prudent to allow for cases where the GC has not been temporally matched, and to avoid trades that may undermine system credibility.

Standardizing GC retention on registries after cancellation supports dispute and error resolution, taxation and investigation of market behavior etc. and hence EnergyTag also includes standardizing aspects regarding the GC Validity period.

Requirements

- GCs *shall* not be valid longer than their underlying EACs.
- Where GCs are not used in a GC Matching Claim relating to their (sub)hourly production period, they *should* be used for the same 12 month period of consumption as the energy production they represent, otherwise expire.
- All records relating to Issued, Transferred, Canceled and Expired GCs *shall* be retained on the GC Registry for a minimum of 5 years after their cancellation, or longer if required in national legislation.
- In Domains where a residual mix is calculated, expired GCs *may* be included in the Residual Mix, when this inclusion is in line with the beneficiary allocation of the associated EAC.

1.8 IT Systems Architecture

Context and Definitions

EnergyTag recognizes the crucial role of data standardization and encourages it where possible to facilitate GC Scheme interoperability. EnergyTag will develop an API (Application Programming Interface) standard and other relevant data standards to facilitate Registry interoperability and is willing, where required, to facilitate and contribute to other data standardization efforts that help GC market growth. The EnergyTag Standard is agnostic to the IT system architecture that is used to implement GC Schemes.

Requirements

GC IT Systems:

- *should* follow the EnergyTag API data specification, providing for system interoperability via API, unless they are stand-alone systems, and
- *shall* meet prevailing security and privacy standards across served territories and follow EnergyTag data standards once available.

1.9 Fraud Detection and Prevention

Context and Definitions

Fraud is a major risk in designing and managing EAC and GC Schemes, due to the serious consequences of fraud on system integrity and trust. Therefore, in order to build knowledge and awareness, this Chapter provides context and definitions and requirements of the key aspects of fraud prevention. The key questions that should be addressed when considering fraud prevention are: what risks are induced by GCs being exchanged between countries in different systems? And, in cases where GCs and EAC are Issued on separate systems, what are the additional fraud risks?

It should be noted that international and national legislation will override any EnergyTag standard in the context of fraud protection and prevention.

Fraud could happen at various parts of the process and in multiple forms:

- **Metering data fraud at the production site:** This risk involves the possibility of metering data manipulation, which could be used to obtain undeserved GCs in either the measurement or the reporting process.
- **Metering data fraud at the consumption site:** This could take place during either the measurement or the reporting process and involves the possibility of metering data manipulation, which could be used to improperly Cancel GCs - for instance, claiming that consumption took place at a time of day when energy is either cheaper or less carbon intensive.
- **Improper amendment of Registry data:** Improper GC data amendment could take place by means of illicit access including hacking. Therefore, Registry data integrity is vital to ensure well-functioning GCs Registries.
- **VAT carousel fraud:** (Missing Trader Intra Community (MTIC) fraud). Like other commodities, GCs could be threatened by MTIC fraud, especially during their early development phase. In MTIC schemes, fraudsters exploit taxation rules from different jurisdictions to steal Value Added Tax (VAT) payments. Wholesale commodity trading allows fraudsters to execute significant volumes of international deals in short periods of time, and collect the associated VAT payments. These companies disappear without remitting the collected taxes to the relevant revenue administrations. In some cases, the same commodity could be traded in a cyclical fashion, such that it is exported and imported several times from/into the same country, collecting VAT in each cycle (carousel fraud). This multiplies the potential effect of the fraud.
- **Money laundering:** GCs could be used as an instrument for disguising funds from illicit activities as legitimate funds (money laundering). This risk

could be increased by trading in GCs, due to the lack of transparency and the current predominance of over-the-counter deals in EAC markets. Price and billing arrangements between counterparties to the trade may be used as part of integration or layering operations.

- **Market manipulation:** One of the objectives of GCs is to create a trusted, tradable commodity, and the associated adequate price signals that encourage an efficient integration of clean energy. These price signals could be affected by market manipulation and insider trading. Market manipulation involves practises such as creating misleading signals on the supply or demand of the commodity and the dissemination of misleading information (e.g. through the media) that could impact the market. Insider trading is another example of market manipulation, which involves the use of insider information (i.e information that is not public and that could significantly impact the market if it were) to execute trades before that information becomes public.

Requirements

Metering data fraud at production site

- The current controls in place in EAC Schemes *shall* be adopted to help prevent this type of fraud.
  - These controls include the use of certified entities in charge of measurement and validation of production data (e.g. Transmission/Distribution System Operators), and secured channels to ensure the integrity of the data when transmitted to the GC Issuer. Although GCs require more precise data related to production (i.e. hourly profiles), the fact that measurements are done by system operators considerably reduces the risk of fraud.
- On-site audits of Production Devices *shall* be carried out by GC Issuers (or other delegated entities) to ensure the veracity of the technical specifications declared by the Producer and the adequate connection to metering devices.

Metering data fraud at the consumption site

- Similar controls to those relating to metering data fraud at the production site are appropriate, and are likely to be in place for EACs. These should also be in place for GCs.

Improper amendment of Registry data

- Improper access and manipulation of GC Registry data should be avoided by adopting strict data security rules,
  - including: regular (ideally annual) systems penetration testing and the resulting enhancement of systems, restricting physical access to data, careful definition and assignment of Roles and procedures, regular updating of systems software, recording and auditing all changes to computer systems, effective controls over access rights and passwords etc.

VAT fraud (Missing Trader Intra Community (MTIC) fraud)

Protecting GCs from MTIC risks should be done at different levels:

- GC Issuers should implement adequate due diligence procedures when admitting Account Holders into their system.
  - This includes *Know-Your-Customer* (KYC) processes, including provisions to refuse suspicious companies or suspend suspicious Accounts.
  - KYC procedures *should* be designed in a way that GC Issuers have an appropriate knowledge about the business, the managers and stakeholders of the company that will enter the GC market. AML (Anti-Money Laundering) /CFT (Combating the Financing of Terrorism) standards recommend applying a well-defined risk based approach (e.g. scoring

methods) as part of onboarding decisions and monitoring of the companies' activity.

- GCs Issuers *should* implement effective monitoring of Registry activities aimed at detecting suspicious activities and MTIC patterns in particular (e.g. sudden increases of trading volumes, carousel schemes etc.).
- GC Issuers *should* establish efficient cooperation with authorities in charge of preventing MTIC fraud, especially tax authorities and Legal Enforcement Agencies (LEAs).
- Any change of ownership of the Certificate *shall* be recorded in the relevant Registry. GC ownership *should* be primarily restricted to the Account Holder where the Certificate is held. Where a change of ownership does not lead to Transfer from one Account to another (e.g. third party trading), the ultimate owner *shall* be properly identified by the Account Holder at any time (name, country, VAT registration number). Transactions where none of the parties have an Account in the relevant Registry or have not been properly identified should not be authorized.
- *(European Union only)* GCs *should* be considered *"electricity Certificates"*, enabling Member States to apply for the derogation introduced by the EU in 2013 that allows the application of reversal liability to VAT on specific goods or services considered "at risk".[11]
  - Using this derogation, the responsibility of paying VAT is no longer with the supplier of the goods or services (the collector), but with the person acquiring the goods or services (the final consumer). This means that the missing trader cannot act as collector anymore. The implementation of this derogation by Member States *should* be encouraged.

Money laundering

- Due diligence *should* be carried out by GC Issuers and should help prevent companies with suspicious profiles from joining the market.
- Cooperation with authorities in charge of money laundering prevention *should* be ensured when suspicious companies/operations are identified. This requires procedures to declare suspicious entities/activities to competent authorities in charge of AML/CFT.

Market manipulation

Reducing the risks of market manipulation and insider trading requires several developments that *should* be seen as long-term goals for the design of GC markets:

- Transparency *should* be increased by creating robust price benchmarks, standardized products and freely accessible supply/demand information,
- Regulatory frameworks that prohibit/sanction market manipulation and insider trading and which establish accepted market practices should be implemented,
- Regulatory bodies in charge of collecting the necessary information, monitoring and investigating potential cases of market abuse *should* be in place.
- The above can and *should* be achieved by including energy Certificates (i.e. GCs/EACs) as part of existing regulatory frameworks (energy or financial regulations).

[11] *EU Council Directive 2012/43/EU*

1.10 Market Design

Context and Definitions

GC trades can be executed through the same channels and contracts that exist for standard EACs. The market for GCs will likely be influenced by the current or new rules of voluntary reporting standards.

As physical energy is also traded on an hourly or sub-hourly basis, the market design for hourly Certificates may become closely aligned with that of physical energy markets.

Trading GCs will most likely engender the need for flexibility solutions, such as storage, Demand-Side Response (DSR) or Local Energy Markets (LEMs). These solutions could provide a stabilizing effect on grids where they are used, while also facilitating consumer choice and/or retailer preferences.

Requirements

- As with the majority of contracts for buying clean energy through standard EACs, the purchase of GCs is voluntary. As such, the GC market *shall* comply with wider contract law in its chosen jurisdiction and with the regulations of the overarching EAC Scheme.
- GC Schemes in interconnected markets *should* be harmonized as much as possible in order to lower market barriers and market confusion caused by differences between separate GC Schemes.

1.11 Linkage with Support Systems

Context and Definitions

Similar to existing EACs, public financial support systems *may* also be associated with GC Schemes. For example, support mechanisms based on Temporal Matching (e.g the European Union's Renewable Hydrogen Rules), this would raise the question of how the support system would technically relate to the cancellation of the GC. GCs that qualify for a public support system would likely have a higher market value than other GCs. In either situation, it is important to prevent multiple claims of consumption based on the same underlying unit of energy.

Requirements

- If GCs can be used to receive public support, the document, or mechanism which is uniquely used for disclosure of the origin of the consumed energy *shall* be identified.
- If the support (Certificate) systems are associated with an individual Consumption Point, care *should* be taken to avoid Double Counting if a separate Certificate system allows for the disclosure of the energy source to consumers (i.e cross-purpose Double Counting avoidance).

1.12 Eligibility of Energy

This Chapter outlines which energy is eligible for the production of GCs. Some participants in existing EAC markets have expressed strong concerns as to whether Certificates may be Issued for energy that is not available for trade or electricity that is injected into public grids. Setting restrictions regarding Certificate usage *should* be done by individual consumers, lawmakers, or by labeling schemes with the GC Scheme providing the necessary and transparent information to facilitate this. In order to do this, EnergyTag considers the key categories under which eligibility *may* be considered.

i) Distribution Reach

Context and Definitions

An interesting piece of information when considering energy eligibility is the dissemination level of the physical energy for which the GC is Issued. Physical energy dissemination *may* be categorized as:

- consumed by the operator of the Production Device,[12]
- injected into a regulated distribution or transmission system,

[12] *e.g a paper mill with its own Production Device Issues EACs in order to declare renewable consumption*

- injected into a private grid, and
- transport unspecified (and not physically consumed by the operator of the Production Device).

Requirements

- GCs *shall* state the dissemination level (for electricity Certificates) of the physical energy for which the Certificate is Issued. This attribute *may* be absent from the GC only in cases where GCs are only issued for energy that is made available to the market for trade.

ii) Definition of Auxiliary Demand

Context and Definitions

Where the Transfer of GCs takes place across registries or Domains, a number of questions arise:

- Are GCs in the Transfer perimeter Issued under the same definition of qualifying output?
- Does GC Issuance take place for gross or for net energy production?
- How is the consumption of production auxiliaries accounted for?
- How is "net" energy defined?

All these factors in turn influence the number of GCs that can be Issued.

Existing EAC Schemes have rules regarding the definition and inclusion or exclusion of auxiliaries in the eligibility of energy for EAC Issuance. If GCs are to be Transferable between Domains with differing EAC Schemes, particular attention should be paid to aligning the prevailing definitions of 'qualifying output' and 'auxiliaries'. For example, if in one GC Scheme GCs are Issued for the gross output of a Production Device, and in another for its net output, a Producer in the second system will receive fewer Certificates for the same overall energy production.

Mechanisms may need to be put in place to ensure equal treatment across markets, e.g. canceling an amount of Certificates in accordance with the difference in "qualifying output" in the involved Domains. Differences between the definitions of gross and net in interacting Domains may have to be investigated in detail. The production eligible for Issuance is to be set in such a way, that consumers will maintain their trust in the system.

Requirements

- For interconnected GC Schemes, a high-level definition of net eligible energy production for GC Issuance *shall* be harmonized.
- Auxiliary energy needed to produce the output energy *shall* be deducted from the output when determining the qualifying output for the Issuance of GCs.

iii) Primary Energy Sources

Context and Definitions

The source of energy is an essential Attribute of energy production, and is of key interest when considering energy eligibility. Certain existing certification systems are restrictive about the energy sources which are eligible for the generation of Certificates. However, such restrictions limit the ability of consumers to fully understand their energy sourcing and prevent the roll-out of full disclosure mechanisms. Moreover, including fossil fuel generation sources has a Use Case for carbon accounting purposes. Ultimately, excessive restrictions of primary energy sources eligible for issuing of GCs could hinder their usefulness.

Requirement

- GCs *should* be Issued for any primary energy source, with any restrictions being left to the Producer, consumer or regulatory framework.

iv) T&D Losses and Congestion

Context and Definition

It should be noted that EnergyTag will not standardize how Transmission and Distribution losses or congestion are dealt with at this stage. However, as with other Issues, should this be required by the market in the future, EnergyTag could play a role in facilitating their treatment.

Requirement

- T&D losses and congestion *should* be dealt with as they currently are in the corresponding EAC Scheme.

1.13 Error Handling for Ex-post Corrections of Meter Data

Context

GCs are always issued after the time of production and based on measurement data. In practice however, errors can be detected in this meter data. When this occurs, the procedure below and further detailed in Annex 4 Error Handling for Ex-post Corrections of Meter Data is recommended. The goal is to remove any undue enrichment of the GC Account Holder and ensuring fair treatment for all parties.

Requirements

Where an error is detected in measurement data based on which GCs have been issued, and where corrections of this measurement data have been obtained, the GC Scheme should act as follows:

- If the corrected production data is higher than the initial issuance, then GCs *shall* be issued for the difference between corrected and issued production data.
- If the corrected production data is lower than the production for which GCs were issued:
  - if GCs have not been transferred/canceled/redeemed/expired, then the GCs *should* be withdrawn for the date of production.
  - If GCs have been transferred/canceled/redeemed/expired, then the GCs for the erroneously issued volume *shall* be subtracted from the measurement data in a comparable generation hour of the next issuance batch.
  - If the comparable generation hour has insufficient production, then GCs for the erroneously issued volume *shall* be subtracted from the measurement data in an alternate comparable generation hour of the next issuance batch.

Chapter 2

Annexes

Annex 1

Glossary and Acronyms

This Annex is an integral part of the EnergyTag Standard, as it defines the terms being used in the Standard.

Glossary of Terms

Account	A record of the Certificates held on a Registry by a company or individual.
Account Holder	The person in respect of whom an Account is maintained on a GC Registry.
Attribute	A data item on a Certificate specifying the characteristics of an energy unit produced by a Production Device in terms of the input(s) used and/or the details of that Production Device and production process.
Avoided Emissions	Emission reductions that occur outside a product's life cycle or value chain, but as a result of the use of that product.
Beneficiary	The person (usually the consumer) that ultimately benefits from EAC/GC Cancellation.
Bidding Zone	The largest geographical area within which market participants are able to exchange energy without capacity allocation. For example, Bidding Zones in Europe are currently defined according to differing criteria. While the majority are defined by national borders (e.g. France or the Netherlands), some are larger than national borders (e.g. Austria, Germany and Luxembourg or the Single Electricity Market for the island of Ireland), while others are smaller zones within individual countries (e.g., Italy, Norway or Sweden). In the US, Bidding Zones are analogous to market zones where the locational marginal price is the same (e.g. NYISO-Zone D in NYISO).
Cancel	To remove a Certificate from an Account, either 1. as proof of the Attributes (source, production time, etc.), to prevent it from being used again for this purpose, and to prevent it from being Transferred to another Account, or 2. to Reserve it for transitioning into another Certificate system. *Note: where Cancellation of Certificates relates to claims of the Attributes of supplied energy, In Europe, the term Cancellation for Disclosure is used, while in the US "Retire" is normally used, while the I-REC Standard uses "Redeem.*
Cancellation Statement	A non-transferable or printed receipt for providing evidence of the Attributes at the time of Cancellation of Certificates acquired by an Account Holder.
Certificate	A record or guarantee (in any form, including an electronic form) in relation to the Attributes of the energy consumed, and/or the method and quality used, in the production of a quantity of energy.

Claim Verifier (or GC Claim Verifier)	An organization checking that Granular Certificates (GCs) are Canceled against the energy consumption measured at one or a group of multiple Consumption Points in compliance with the Matching rules in this Standard and the guidelines in the GC Use Case Guidelines.
Config3 GC Issuer	A GC Issuer who issues GCs within the restrictions of Configuration #3 as set out in 1.2 Scheme Configurations.
Consumer	The final beneficiary of GC/EAC Cancellation and potentially the user of associated consumed energy.
Consumption Point	Location of energy consumption. For the electricity Energy Carrier, the Consumption Point is a separately measured grid access point at which electricity is consumed.
Consumption Verification Area	The geographic area or market sector containing the Consumption Points for which a Claim Verifier has responsibility for verifying that Granular Certificates (GCs) have been Canceled against consumption.
Delegated GC Administrator	Entity, approved by EnergyTag, to which the GC Issuer may delegate the responsibility to administer GCs and the registration of the GC ownership throughout their lifetime.
Disclosure	Provision of information regarding a quantity of consumed or supplied energy as having specific Attributes.
Domain	The geographic area and/or market sector containing the Production Devices for which an EAC Issuing Body and/or a GC Issuer has responsibility for a Certificate system.
Double Counting	See detailed definition in 1.2 Scheme Configurations.
EAC Issuing Body	An organization responsible for the administration of the existing EAC Scheme within a Domain for an Energy Carrier, that operates regardless of any interrelationship with EnergyTag.
EAC Consumption Verifier	A party charged with the responsibility of verifying that the correct amount and type of EACs are adequately Canceled for claims of the Attributes of consumed/supplied energy in a specific Domain. Such parties may be assigned by a government, the consumer or any other stakeholder.

EAC Scheme	The arrangements for the creation, administration, and usage of Energy Attribute Certificates.
e-Fuel	Fuels that are made by storing energy from renewable sources in the form of liquid or gaseous fuels.
Emission Factor	A unique value for determining an amount of a greenhouse gas emitted for a given quantity of activity (e.g. metric tons of carbon dioxide emitted per barrel of fossil fuel burned).
Energy Attribute Certificate (EAC)	A generic term for a unique Transferable electronic record or guarantee created to provide to a consumer evidence of the characteristics of a specific unit of energy conveyed by an Energy Carrier which may include the method and quality of its production. Examples include Guarantees of Origin (GO), Renewable Energy Certificates (RECs), and Emission Free Energy Certificates (EFECs).
Energy Carrier	Means of conveying energy – this can be electricity, gas, hydrogen, or heating/cooling.
EnergyTag	The organization that administers the EnergyTag Standard: EnergyTag Ltd being a non-profit entity registered in the United Kingdom.
Expire	To make a Certificate ineligible for Transfer or Cancellation as a consequence of the passage of a given period of time since the production of the associated energy.
Export	Transfer of Certificates from an Account Holder in one Registry to an Account Holder in another Registry. Consequently, the Attributes of the energy represented by the respective Certificates are no longer in the Exporting Registry and are uniquely represented in the receiving Registry.
Face Value	Specific quantity of energy production represented by a certificate.
Geographical Matching (or GC Geographical Matching)	Associating the geographical location of energy production or storage which has been recorded on a GC at its Issuance, with the geographical location of energy consumption and for which the GC is Canceled. For example, Geographical Matching may take place within physically interconnected zone(s) or Bidding Zone(s).

Geographical Matching Granularity Level	The three levels of Geographical Matching granularity, starting with the highest level of granularity moving to the lowest: • Single Bidding Zone Level, • Aggregated Bidding Zone Level, • Interconnected Zone Level.
GC Matcher (or GC-Consumption Matcher) (or Matcher)	An organization who matches the Attributes of Canceled GCs to a specific quantity of energy consumption of a specific Consumer/Supplier, with a view to determine the content of a GC Matching Claim.
GC Matching (or Granular Matching or Matching)	Allocating Attributes of Canceled GCs to a corresponding quantity of consumed energy, for well-specified Matching Features.
GC Matching Claim (or Matching Claim)	A statement by a Consumer or Supplier of energy regarding the proportion of their consumption being matched to GCs, and the resulting Attributes allocated to this consumption.
GC Scheme Protocol	A document that sets out all procedures and liabilities in relation with the operation of a GC Scheme.
Granular Certificate (GC)	A Granular Certificate compliant with EnergyTag is a Certificate relating to the Attributes of energy produced during a period of one hour or less, Issued in compliance with the requirements and rules of operation of the EnergyTag GC Scheme Standard.
Granular Certificate Consumer	An energy consumer, a supply company or any other party on their behalf, for whom GCs are Canceled to prove the Attributes of their energy consumption.
Granular Certificate Issuer (GC Issuer)	A Granular Certificate Issuer is an organization responsible for the administration of the Granular Certificates within a Domain for an Energy Carrier, ensuring the avoidance of Double Counting of the Attributes represented by the Granular Certificates it administers throughout their lifetime.
Granular Certificate Platform	A software service which maintains and/or accesses a GC Registry to provide GC market enabling services such as inventory management, consumption matching or trading.
Granular Certificate Platform Operator	A person responsible for administering a GC Platform.

Granular Certificate Scheme (GC Scheme)	The arrangements for the creation, administration, and usage of Granular Certificates.
Granular Certificate Validity Period	The period of time, ex-post, in which participants may buy, Cancel and make claims using GCs.
Guidelines	Refers to the EnergyTag GC Use Case Guidelines.
Import	Receipt of Certificates by an Account Holder in one Registry from an Account Holder in another Registry. Consequently, the Attributes of the energy represented by the respective Certificates are in the Importing Registry and no longer in the Exporting Registry.
Issue / Issuance	The process of creating a GC/EAC as a record on a Registry.
Market Zone	A set of geographical zones and/or virtual zones often having the same zonal electricity price. This could be a single bidding/price zone or potentially an aggregation of contiguous bidding zones.
Matcher (or GC-Consumption Matcher)	See GC-Consumption Matcher.
Matching	See GC Matching or Granular Matching.
Matching Framework	A set of parameters for the various Matching Features as laid out in 1.2 Matching GCs with Energy Consumption of the GC Matching Standard.
Measurement Body	An organization responsible for measuring the energy produced by or input to a Production Device, and/or the energy consumed at a Consumption Point.
Price Node	Location identifier in a wholesale electricity price formation mechanism in which the price paid in a particular zone is calculated by the zone's physical node. The Price Node can be an actual location where transmission lines converge, or it could simply mean the last point in the grid where supply and demand are balanced; this is typically at the consumer level.
Producer	The owner of a Production Device which is valid for GC Issuance.
Product Verifier (PV)	An optional Role (similar to a Claim Verifier) describing an organization that verifies products based on Granular Certificates.

Production Device	Separately measured facility for Transferring energy from a primary energy source into an Energy Carrier or from one Energy Carrier to another – for instance, a power station or a gasifier.
Production Granular Certificate	A GC Issued directly to a Production Device as opposed to a Storage Discharge GC.
Production Registrar	An organization responsible for assessing applications to register Production Devices for the purposes of issuing the relevant Certificates, reporting to the Issuer.
Power-to-X / PtX	The term is used to describe applications where electricity is converted into another energy form/carrier, X being Hydrogen, Steam or an e-Fuel.
Redeem	(I-REC term - in Europe "**Cancel**" is normally used, while in the USA "Retire" is used). See definition of "**Cancel**".
Registry / GC Registry / EAC Registry	A database administered by an EAC Issuing Body or GC Issuer, recording the characteristics of the Production Devices for which that Issuing Body or GC Issuer is responsible, and the Accounts and the Certificates held in such Accounts.
Reserve	Certificate disposition without claiming the represented Attributes. The result is that the Certificates end their life in a Reserved status. A Reserve transaction has the objective of transitioning the respective Certificates into another Certificate system. Reserved Certificates cannot be unreserved, or transfered.
Reservoir	Refers to the Storage System's inventory of records at time "*i*" resulting from record charging that are available for allocation to Storage Discharge Records. This mechanism is needed to record the information of the SDRs that are used to prove the Attributes of the energy input into storage.
Residual Mix	The (sub)hourly or temporal Residual Mix (RM) is the mix of Attributes for energy consumption that is not covered by Canceled Granular Certificates or other EACs.
Retire	(US term - in Europe "**Cancel**" is normally used, while I-REC uses "**Redeem**"). See definition of **"Cancel**".
Role	A liable entity in a GC Scheme.
Round Trip Efficiency	The ratio of the net total output energy in the discharging process to the net total input energy in the charging process.

Standard	Refers to the EnergyTag GC Scheme Standard.
Storage Charge Record (SCR)	Registry record of energy charged to storage in a time interval.
Storage Efficiency Factor or Efficiency Factor:	Factor that quantifies storage losses based on round-trip efficiency, being the efficiency of a full cycle of charging and discharging.
Storage System (or Energy Storage System)	Separately measured system for storing energy where the energy carrier of the input into storage is of the same type as the energy carrier for the output of storage.
Storage Discharge Record (SDR)	Registry record of energy discharged from storage in a time interval.
Storage Discharge Granular Certificate (SD-GC)	A GC Issued following Storage discharge in compliance with all necessary requirements in both the Standard and Guidelines.
Temporal Matching (or GC Temporal Matching)	Associating the period of time during which energy is produced or stored and which has been recorded on the GC at its Issuance with the corresponding time at which the GC is Canceled and the energy is consumed. The time interval is equal to or less than 60 minutes and evidence of energy production and consumption is provided by GCs.
Timestamp	The date and time when an event happened in the format (UTC "YYYY-MM-DDThh:mm:ssZ" e.g. "2023-10-03T00:00:00Z").
Transfer	The handover of a Certificate from one Account to another, whether on the same or on another Registry.
Use Case	A scenario of a possible usage of GCs.

Acronyms

AML	Anti-Money Laundering
API	Application Programming Interface
CFT	Combating the Financing of Terrorism
EAC	Energy Attribute Certificate
EECS	European Energy Certificate System
EU ETS	European Union Emissions Trading System
GC	Granular Certificate
GHG	Greenhouse Gas
GO	Guarantee of Origin
GPS	Global Positioning System
I-REC	The International REC Standard
KYC	Know-Your-Customer
LEA	Law Enforcement Agency
MTIC	Missing Trader Intra-Community
PPA	Power Purchase Agreement
PtX	Power-to-X
PVB	Product Verification Body
REC	Renewable Energy Certificate
RPS	Renewable Portfolio Standard
SCR	Storage Charge Record
SDR	Storage Discharge Record
SD-GC	Storage Discharge GC
UTC	Coordinated Universal Time

Annex 2

Determining the Storage Efficiency - Quantifying Storage Losses (Informative)

An efficiency factor is needed to allocate the attributes of input GCs to output GCs. This section considers recommendations for determining the storage efficiency factor, with a view to gathering experience and integrate learnings from practice.

Guidelines for determining the storage efficiency factor

- Measurements of total input and output over a specified time period (e.g. 1 hour/1 month) *shall* be the basis for determining an efficiency factor over that time period.
- This efficiency factor *should* be the "allocation key" for allocating attributes of input GCs to storage output GCs, in accordance with the allocation method described in the next Annex.
- The optimal length of the time interval for determining the efficiency factor *may* depend on the usage profile of the battery, the weather, temperature of operation. The GC Issuer should document the arguments behind this choice of the interval length of the efficiency factor. The efficiency factor determination method must accurately reflect actual losses.
- Only for the initial period, following start-up of a Storage System, the storage efficiency may differ from this measured factor as there may not be sufficient measurement data yet available. This initial efficiency is allowed only for a limited time and should be defined based on an efficiency test of the Storage System performed before startup (including auxiliaries, converter load).
- The period over which the initial efficiency *may* be used should not be longer than 6 months after the startup of the battery.
- Parasitic losses shall be included in this overall loss factor, which is ensured by the fact that the efficiency is determined based on measurements of in- and output over this rolling period of time with a fixed length.

A potential method for determining the losses (and the efficiency factor)

The below steps constitute an example of a practical guidance for calculation of energy losses over Energy Storage, for each time interval. The time interval here is called "hour".

- Every hour, record measurement values of charged and discharged energy, and the State of Charge (SOC).
- Calculate the energy losses of the Energy Storage System for that hour, based on the formula below.

$$Q_L(t)Total = Q_L(t)Charge + Q_L(t)SelfDischarge + Q_L(t)Discharge$$

$$Q_L\%\,(t)Charge = \frac{SoC\,(t-1) - SoC\,(t) + Q_C\%\,(t)}{SoC\,(t-1) + Q_C\%\,(t)} \times 100 \qquad Q_L\,(t)Charge = Q_L\%\,(t)Charge \times (SoC\,(t-1) + Q_C\%\,(t)) \times Q_T$$

$$Q_L\%\,(t)SelfDischarge = \frac{SoC\,(t) - SoC\,(t-1)}{SoC\,(t-1)} \times 100 \qquad Q_L\,(t)SelfDischarge = Q_L\%\,(t)SelfDischarge \times SoC\,(t-1) \times Q_T$$

$$Q_L\%\,(t)Discharge = \frac{SoC\,(t-1) - SoC\,(t) - Q_D\%\,(t)}{SoC\,(t-1)} \times 100 \qquad Q_L\,(t)Discharge = Q_L\%\,(t)Discharge \times (SoC\,(t-1)) \times Q_T$$

$$Q_T = StorageCapacity\,(Wh) \qquad t = Time\,(hour) \qquad Q_D\% = EnergyDischarged\,(Wh) \div Q_T$$

$$Q_C\% = EnergyCharged\,(Wh) \div Q_T \qquad Q_L = EnergyLost\,(Wh) \qquad SoC = StateofCharge\,(\%)$$

- Determine if a particular hour is a "net charge" or "net discharge" hour.
- Determine the "loss factor threshold" using one of following information:
  - Most frequently occurring loss over a period of time on a specific battery (e.g. 30/60/90 days), or
  - Efficiency factor measured during startup only if the period is not longer than 6 months after the startup of the battery, or
  - Based on the manufacturers guidelines.
- If the loss QL calculated in a particular hour is above zero and below a loss factor threshold:
  - Accept the measured SOC.
  - Apply the loss on the reservoir after charging for hours which are "net charge hours", and before discharge for hours that are "net discharges hours".
- If the loss calculated in a particular hour is either below zero or exceeds a the loss factor threshold:
  - Recalculate the SOC using that rolling window average loss (e.g. 7/14/30/90 days).
  - Apply this rolling loss on the reservoir in the same way as above.

Annex 3

Storage Attribute Allocation Methods (Informative)

This section elaborates options for methodologies for allocating the Attributes of GCs that are canceled for Input into a Storage System, to the GCs that are issued for energy flowing out of a Storage System, and the order for doing so.

Definitions

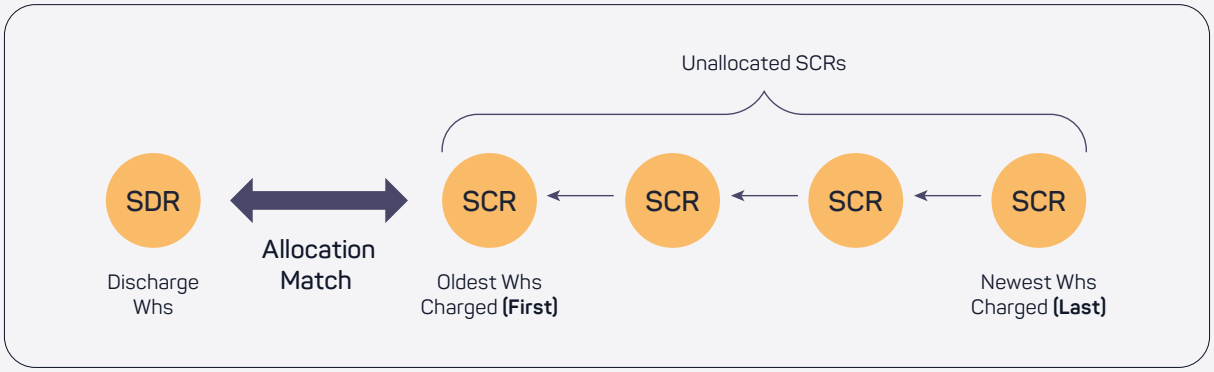
Based on Chapter 1.6 on Energy Storage, information recorded on SCRs *shall* be allocated to SDRs, following an applicable allocation methodology such as "First In, First Out", "Last In, First Out", "weighted-average", or another methodology.

"Last In, First Out", or LIFO, has the disadvantage of potentially creating unused LIFO layers for the life of the project, which would be cumbersome to track.

Therefore, the guidelines currently suggest the following approaches for the order of allocation of SCRs to the output of SDRs:

1. *Option #1 First In First Out ("FIFO")*: SDRs of the energy Storage Device first consumes unallocated SCRs on a FIFO basis. This option is simple, consistent and provides a clear standard on GC allocation.
2. *Option #2 Storage Operator Decides*: The storage operator chooses which SCRs will be allocated to SDRs. This option provides more freedom for the storage operator but requires clear rules to ensure credible allocation.
3. *Option #3 Weighted Average*: Allocating SCRs to SDRs is based on a weighted average value of SCRs present within the storage system at the time of discharge. This ensures that all types of Attributes in the Storage System will come out proportionally.

FIFO SCR-SDR Allocation Process



EnergyTag recognises that further studies and implementation are required to identify the optimal allocation methodology for grid decarbonisation, operational impact and renewable integration.

Guidelines

1. In selecting an allocation method of SCRs to SDRs, the main guiding principle shall be ensuring positive environmental impact of the storage system. The following criteria shall be considered in the choice of the allocation method:
    i. Physical accuracy (represents what happens in reality).
    ii. Simplicity to audit (auditor approval is possible).
    iii. Risk of greenwashing (low, med, high).
    iv. Simplicity to operationalize (resource intensity, data management, cost).
    v. Predictability/ability to model (tools exist today).
    vi. Adaptability to various regulatory use case frameworks (local/national).
2. A GC Issuer or storage operator who receives GCs for output from an energy storage system *shall* transparently publish its allocation logic following these guidelines. Based on this, EnergyTag will collect data for evaluation of further standardization of allocation methodologies in future publications.
3. While doing so, First In First Out, Storage Operator Decides or Weighted Average Allocation methods should be used when allocating SCR to SDRs.

Call to action

EnergyTag asks the Storage Operators to implement any of the proposed methodologies and gather data, based on the aforementioned list of criteria, to enable informed updates to this section in the future.

Annex 4

Error Handling for Ex-Post Corrections of Meter Data (Informative)

All measures should be in place to prevent erroneous meter readings of energy production for which GCs are issued. Yet in practice, these can take place. They have an impact on the quantity of GCs that may be issued regarding measured production and may require a correction of that quantity.

While GCs could have a high economic value in hours with low clean energy generation, corrections cannot simply be applied to any future production period, as is usually done with EACs that have monthly production periods.

The below example illustrates the recommended approach for correcting such errors.

Example:

There was an initial issuance (e.g., 10 MWh) of GCs for a given time period (e.g., 21:00 - 22:00 Jan 6). But a correction is triggered at a certain date afterwards (e.g., 20-March-2022). The adjustment method depends on the type of correction.

- *Positive Correction*: If the corrected production was greater than initial issuance (e.g., 20 MWh → +10 MWh correction), additional GCs (+10 MWh) should be issued for the actual production period (e.g., 21:00 - 22:00 Jan 6) of the generated energy.
  - Justification: It is always preferable to correct the actual production period of energy.
  - In case of Configuration 2 or 3, before issuing any additional GC certificates, it is necessary to establish synchronization between the EAC registry to confirm that the additional 10 MWh are accurately recorded in both the EAC and GC registries.
- *Negative Correction*: If the corrected production was less than initial issuance (e.g., 0 MWh → -10 MWh).

Scenario A: If GCs have not been transferred/canceled/redeemed/expired, and where the legal framework allows, withdraw the erroneously issued GCs (e.g., -10 MWh) for the production period (e.g., 21:00 - 22:00 Jan 6).

- Justification: It is always preferable to correct the actual production period of energy.
- In Configuration 2, synchronization between the EAC and GC registries is crucial when withdrawing GCs (here 10 MWh) to ensure accurate recording.
- (Configuration 3 GCs exist only after EACs are canceled, for which this situation should not occur in Configuration 3).

Scenario B1: If GCs have been transferred/canceled/redeemed/expired or where the legal framework does not allow for withdrawal of the GCs.

- Justification: Given that the actual production period cannot be corrected, a "comparable" period should be chosen for correction to minimize the difference in value of GCs between actual and corrected production periods.
- Where possible, agree with the affected account holders to act as in Scenario A above and withdraw the erroneously issued GCs.
- If not possible, subtract the erroneously issued volume (e.g., -10MWh) from measurement data in a comparable generation hour (e.g., 21:00-22:00 March 6) of the next issuance batch with comparable value. Clear criteria are to be set for what can be called a comparable generation hour.
- In case of Configuration 2 GCs, if this affects another month, coordination shall ensure the correction is done within the same month as corrective withdrawal of EACs.

Scenario B2: If GCs have been transferred/canceled/redeemed/expired, but a "comparable hour" has insufficient production from which to subtract (e.g., 0 MWh 21:00-22:00 March 6).

- Subtract the erroneously issued volume (e.g., -10MWh) from measurement data in an alternative comparable generation hour (e.g., 21:00-22:00 March 7) of the next issuance batch.
- Subtract a portion of the erroneously issued volume from all hours in the month (e.g., -10MWh/(hours in month).

Annex 5

Coordination of GC Issuance in Config 2 & 3 with EAC Meter Data Residues/Remainders (Informative)

EAC systems may have mechanisms in place that allow carrying over production surpluses beyond the face value of the EAC, to the next production period. For monthly certificates, only the volume has an impact. For Granular Certificates, which may be issued in different face values, it's more logical to issue GCs for actual production times. Transparency is needed regarding the applied logic for the coordination between EACs and GCs.

- For Config 2, the GC SCheme Protocol elaborates how it is ensured that the quantity of GCs being issued prevents Double Counting of the represented attributes, in accordance with the underlying EAC. It also clarifies how the EAC Issuer endorses this practice.
- For Config 3, GCs can only be issued for canceled EACs. The quantity of EACs issued in accordance with last-month residues, is lost.

Example of Fractionalized Generation

- Example 1: EAC system issues for more energy in the production period than GC system.

EAC Registry

- Fractional Generation on the Generation Activity Log, leftover from last month's production: 0.9 MWh.
- 20.8 MWh of Reported Generation.
- Issues 21 certificates.
- 0.7 MWh fraction generation applied to the Generation Activity Log.
- 21 Certificates Retired/Canceled.

GC Registry

- 20.8 MWh of reported Generation.
- 20.8 MWh of GCs issued.

- Example 2: GC system issues for more energy in the production period than corresponding EAC system.

EAC Registry

- Fractional Generation on the Generation Activity Log, leftover from last month's production: 0.1 MWh.
- 20.8 MWh of Reported Generation.
- Issues 20 EACs.
- 0.9 MWh fraction generation applied to the Generation Activity Log.
- 20 Certificates Retired/Canceled.

GC Registry

- 20.8 MWh of reported Generation.
- Config 2: 20 MWh of GCs issued.
- 0.8 MWh are not issued.
- Config 2: Over all production periods: volume GCs = volume of energy covered by EACs.
- Config 3: 20 MWh of GCs issued and allocated to the same beneficiary.

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