REGATRACE

Renewable Gas Trade Centre in Europe

D4.4 | Design study on the technical requirements of a coordinated conversion process

Deliverable:	4.4 Design study on the technical requirements of a coordinated conversion process
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Version:	Final
Quality review:	Stefano Proietti (ISINNOVA)
Date:	30/09/2022
Dissemination level:	Public
Grant Agreement N°:	857796
Starting Date:	01-06-2019
Duration:	42 months

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1 Executive Summary

This report analyses options for efficient and reliable processes for managing GO systems in relation with Energy Carrier Conversion.

The concept of Energy Carrier Conversion is by no means new. Guarantees of Origin (GOs) by default are issued following conversion of primary energy into an Energy Carrier. However, as certification regulation and schemes are expanding to cover new Energy Carriers, that can be converted into each other, the need for a common approach to GO management is needed. This report continues the work initiated in the preceding REGATRACE reports D4.1, D4.2, D4.3, especially REGATRACE report D4.3 that proposes harmonised rules for handling GOs in relation with Energy Carrier Conversion. It will focus on the identified challenges from a more practical and technical point of view, with recommendations for the design of an integrated conversion process.

REGATRACE D4.3 identified four main challenges related to GO management in energy conversion:

1. Quality check of GOs that are cancelled as Input for Conversion Issuance,
2. Match number of cancelled GOs with input measurement and corresponding data validation checks,
3. Making sure the Input GOs are cancelled,
4. Issuing the GOs for the new Energy Carrier: transfer data Attributes from the cancelled GOs.

This report addresses challenges 2, 3, and 4 from a more practical point of view and aims to assess different alternatives for these challenges.

Determining the quantity of the Attributes of the Input for Conversion and matching Input to Output: easier to automate if Cancellation and Conversion Issuance are in the same registry

Chapter 4 describes the practical steps to match the number of cancelled GOs with verified Conversion Device input measurement (challenge 2). This entails the processes of 1) measuring Input energy quantities 2) GO cancellation prior to GO Conversion Issuance, 3) information flows of Input energy and cancellation volumes between different Issuing Bodies (where applicable) and 4) ensuring the uniqueness of cancelled input GOs. It discusses the proportional allocation of Attributes of various types of Input energy to the GOs of the Output energy and the complexity related to conveying increasing amounts of Attributes to the Conversion GOs.

Specifying the related energy consumption period on the cancellation statement of the cancelled GO, allows to match that period with the production period of the Conversion GOs. Further it needs correct measurement of the Input energy into the conversion process, in order to determine the number of GOs to be cancelled. It needs dedicated attention in the verification of this meter data and its reporting to the Issuing Body to adequately link it to the determination of the amount of GOs that must be cancelled for proving the Attributes of the Input.

It is noted that when cancellation and Conversion Issuance takes place in different registries, it is probable that manual steps would persist rather long, blocking high scalability of the solution. It would be significantly easier to automate and thus efficiently scale the processes of validation, Attribute transfer, and issuing based on Cancellations if the Cancellation is done in the Conversion Issuance registry.

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Cross-registry processes for conveying Input Attributes from Cancellation to Conversion Issuance: Cancelling GOs in the Conversion registry after Importing them providing most benefits

Chapter 5 discusses the cross-registry processes of Input energy cancellation for Conversion Issuance (challenge 3). The goal of the proposed alternatives is to transfer cancellation information reliably and efficiently from the cancelling registry to the issuing registry. Four options are explored:

1. Ex Domain Cancellations
2. Ex Domain Cancellations with electronic cancellation statement transfer protocol
3. Import certificates to the Conversion Issuance registry for all Energy Carriers
4. Central cancellation database

According to the assessment, option 3 with importing GO to the issuing registry before cancellation is the preferred alternative. The approach is the most robust one for bringing the proof of the origin of the Input energy of the conversion to the Conversion Issuance registry. The downside of option 3 is that it requires registries to facilitate certificates that they would normally not support (, although this issue is not present for issuing bodies mandated for issuing GOs for multiple Energy Carriers). But when taking a deeper look, there is similar or even higher implementation effort for the other automated options. Thus, the overall suitability and reliability of option 3 was seen better compared to other alternatives. The non-automated option, alternative 1, of Ex-Domain Cancellations on paper, is not sustainable in the long run as manual workload would increase exponentially with the number of transactions.

In option 3 (Import) it is recommended that where GOs are imported in a registry of an Issuing Body of another Energy Carrier, their cancellation is only allowed for the purpose of Conversion Issuance.

It is relevant to inform the competent body/ies for supervision of Disclosure of the statistics of GOs, per Energy Carrier, that were cancelled for the purpose of Conversion Issuance. This prevents double claims and errors in statistics of overall consumption Disclosure.

Attribute Inheritance on GOs after Conversion Issuance: Balance simplicity with information relevance

Chapter 6 discusses the practical aspects of Attribute Inheritance from cancellation to issued certificates and explores the possible blockers and complexities of this process. The overall assessment affirms the recommendation of D4.3 to convey the energy source information throughout conversion chains. For other Attributes, a clear recommendation is difficult to formulate as the needed effort and required complexity vary greatly between different implementation alternatives. Thus, a general recommendation is to aim for a simple inheritance logic in the initial stages and only add complexity if required by legislation or clear customer signals.

Chapter 6 calls for assessing the strength of demand for any specific information to be carried over through Conversion Issuance. In the current landscape in Europe, the energy source information is the most important one. Technically, it will be the easiest implementation if Energy Source is the only Attribute carried forward after Conversion Issuance.

However, policy targets and consumers demand may build on information on pre-conversion financial support and on carbon footprint information. This leads to a need to consider including also those Attributes in the standardised design for an integrated Conversion Issuance process.

A dedicated data field on GOs that records information on financial support granted to the respective energy in the pre-conversion phase, may satisfy the need for information set by certain governmental

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mechanisms. Such new Attribute on a post-conversion GO can inherit the corresponding support information from the cancelled GOs. It comes however with a technical challenge, particularly dealing with multiple types of cancelled GOs for Input. As the Output from Energy Carrier Conversion is normally lower than the Input, there is no one-on-one relation from Input GOs to Output GOs. A proportional allocation of Input Attributes to the Output Attributes is therefore needed. This becomes particularly challenging when a residue of Input Attributes is to be conveyed to the next production period. At some point there will be a cut-off of information for Output fractions lower than the GO face value (generally: for the fractions lower than MWh).

While it is recommended to add a Conversion tag to a GO that was issued following Conversion Issuance, the complete information about Attributes of the cancelled GOs is better stored within the Conversion registry. This ensures verifiability but keeps the tradeable GO instrument lean and its data format standardised. The issued certificate after Conversion could link to the cancellation information where more information can be obtained from the cancelled certificates.

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2 Introduction

2.1 REGATRACE in a nutshell

REGATRACE, the Renewable Gas Trade Centre in Europe, is a joint project by major European Renewable Energy Carriers and Issuing bodies.

The project aims to create an efficient system for issuing and trading renewable gas Guarantees of Origin (GOs) while integrating GOs for various energy sectors enabling the trade to and from all Energy Carriers with exclusion of double sale. This objective will be achieved through the following founding pillars:

- European biomethane and renewable gases GO system
- Set-up of national GO issuing bodies
- Integration of GO systems from different renewable gas technologies with electric and hydrogen GO systems
- Integrated assessment and sustainable feedstock mobilisation strategies and technology synergies
- Support for biomethane market uptake
- Transferability of results beyond the project's countries

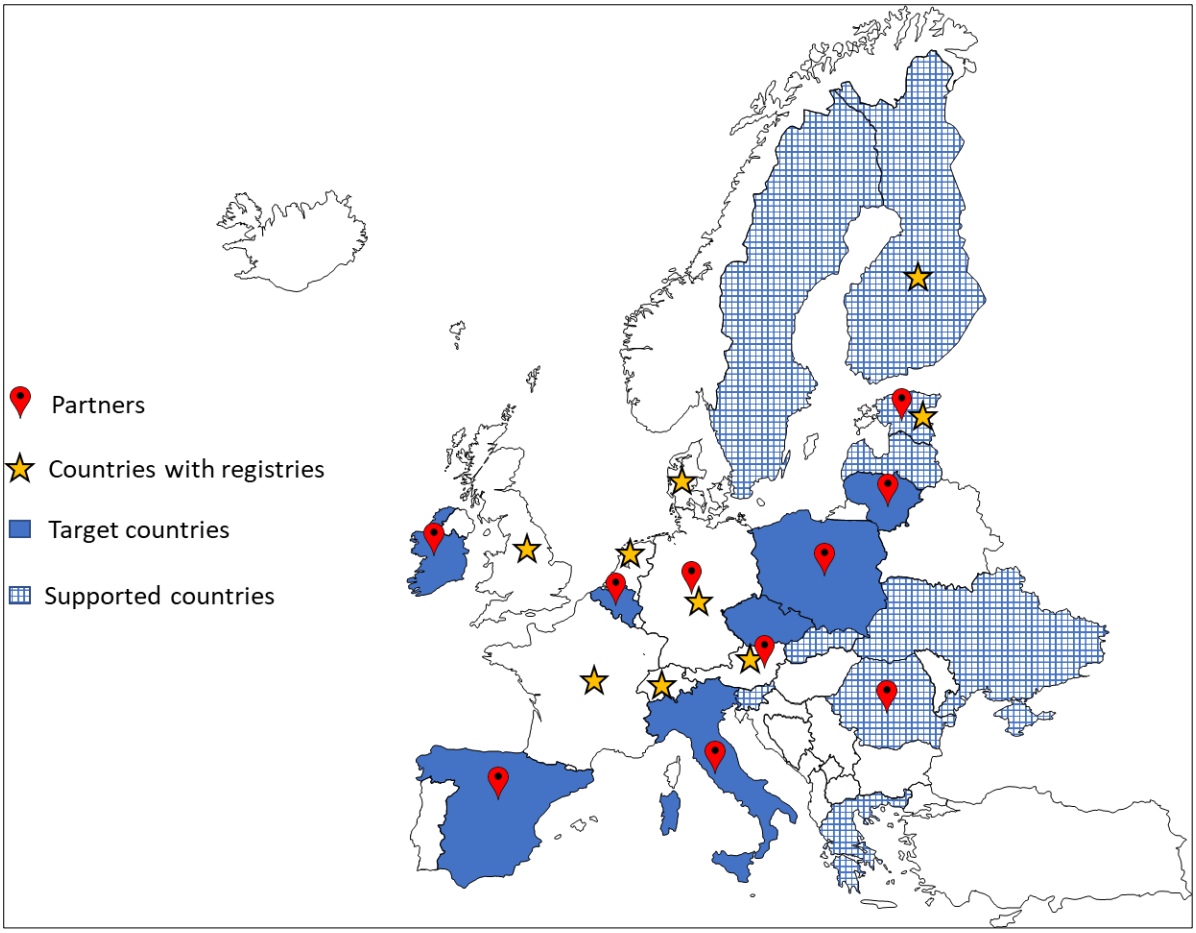

Figure 1: REGATRACE countries and partners

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2.2 Task framework - Integration of GOs for various Energy Carriers

2.2.1 Context

To strengthen a market for renewable gas certificates, the concept of Energy Carrier Conversion becomes of relevance. The integration of energy sectors depends on Energy Carriers being converted into each other. While procedures for documenting the renewable character of Energy Carriers are well established, transferring information documented on Guarantees of Origin (GOs) of such Energy Carriers across Energy Carrier Conversion needs integrated processes to ensure reliable and efficient operation.

2.2.2 Inter-relation with other REGATRACE reports

The REGATRACE work package 4 “Integration of GOs from renewable gas technologies with electric and hydrogen GO systems” consists of 4 deliverables.

1. Deliverable D4.1 (Guidelines for the verification of cross-sectoral concepts), under the lead of German Energy Agency (dena), was finalised in the end of 2020.
2. Deliverable D4.2 (Technical and operational comparison of the biomethane/renewable gas GO system and the electricity GO system), under the lead of the European Renewable Gas Registry (ERGaR) was finalised in spring 2021.
3. Deliverable D4.3 (Harmonised set of rules for the conversion between electricity and biomethane/renewable gas and hydrogen GO) under the lead of the Association of Issuing Bodies (AIB) was finalised in October 2021.
4. This report constitutes deliverable D4.4 (Design study on the technical requirements of a coordinated conversion process) under the lead of the AIB.

This report D4.4. builds upon information gathered in the reports D4.1, D4.2 and D4.3, and its drafting takes place during a time when the regulatory framework contains high-level directions while being further finetuned. They are incorporating the aspects that have taken shape, such as the relevant existing certification schemes in AIB, ERGaR and CertifHy and the draft for the EN16325 standard for guarantees of origin, and develop recommendations for further development of the cancellation, transfer, and issuance of GOs with relation to energy conversion in the changing landscape.

In addition to the mentioned work package 4, REGATRACE Deliverable D2.8 investigates potential interlinking and/or integration of AIB and ERGaR Schemes and provides input on the general set-up of the interaction between different IT-options for cross-registry transfer of GOs. The developments of that report are going in parallel with those for this report D4.4 and are closely monitored as they are essential for a coordinated conversion process.

2.3 Goal of this design study

The goal of this study is to set out technical requirements to enhance efficiency in implementing the recommended harmonised conversion rules developed in D4.3. In addition to this, the need for adapting existing systems with regards to their administrative and organisational set-up will be described.

As such, this study aims to assist registries with the practicalities of implementing the high-level recommendations into their national procedures and in automation-supported processes.

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2.4 Scope

Research question

How does a coordinated process for handling GOs in relation with conversion of one Energy Carrier into another Energy Carrier need to be designed in order to ensure efficiency and reliability towards the involved stakeholders?

Considered certification instruments

The scope of this study is on Guarantees of Origin, as defined in REDII art. 19, having the purpose of informing consumers on the origin of their energy consumption.

Considered Energy Carriers and conversion pathways

This study focuses on the conversion of the Energy Carriers biomethane, electricity and hydrogen into each other as described in D4.3.

2.5 Conversion Issuance - Recap

GO Conversion Issuance in this document is defined in line with the definition in the draft revision of EN16325 standard on guarantees of origin, which is ongoing during the writing of this report. It is defined as Issuance of a GO for Output resulted from Energy Carrier Conversion, and for which GOs representing the Attributes of the Input to that Production Device have been cancelled.

Basic rules for handling GOs following Energy Carrier Conversion have been developed in D4.3. These include that:

1) GO Conversion Issuance can take place only following physical Energy Carrier Conversion.
2) GOs for the Input Energy Carrier are cancelled in accordance with the measured Input into the Conversion Device.
3) GOs for the Output Energy Carrier are issued in accordance with the measured Output from the Conversion Device.

This is illustrated in Figure 2 below. Having harmonised rules is essential for trust in a cross-border framework. Making these high-level rules work efficiently in practice, benefits from a deeper dive in the processes for cancellation and issuance.

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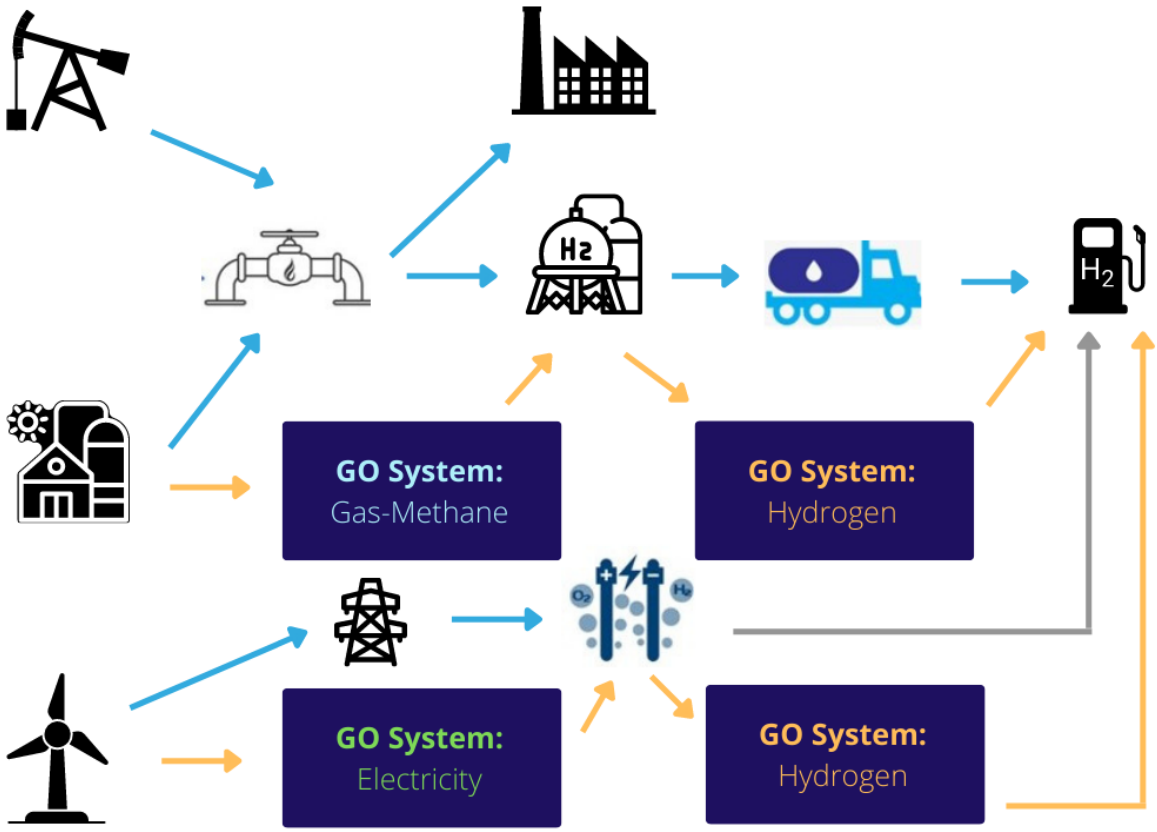

Figure 2: Illustration of handling GOs for Energy Carrier Conversion

2.5.1 Energy Carrier Conversion is everywhere

The question of Energy Carrier Conversion Issuance and the related processes are becoming ever more important due to the relatively recent introduction of new Energy Carriers under the umbrella of national and voluntary certification schemes. Nonetheless, Energy Carrier Conversion itself is already common in the energy industry. For example, biogas-based electricity production can have the biogas production, refinement, and use for electricity on the same site. Similarly, solar PV onsite power generation can be the basis for green hydrogen production.

2.5.2 Conversion Issuance

Continuing from the previous chapter about Energy Carrier Conversion, the question arises about when the Energy Carrier Conversion will lead to the concept of Conversion Issuance. REGATRACE D4.3 Rule 1 recommends that *when issuing GOs for energy produced following Energy Carrier Conversion, GOs of the Input Energy Carrier are to be cancelled to prove the energy source of the energy produced in the energy conversion.*

Onsite production of Input energy is listed as an exception to this rule and thus the before-mentioned examples of onsite Energy Carrier Conversion do not need Conversion Issuance as such. But, for example, producing electricity from grid-fed input gas would need sufficient cancellation of renewable gas GOs to be able to claim the renewable Attributes of the produced electricity.

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2.6 Methodology

The goal of this Deliverable 4.4 is to describe and recommend efficient and reliable processes for managing a GO system at Energy Carrier Conversion. It assesses the strengths and weaknesses of various implementation options, keeping in mind feasibility on either short or long term and the impact of the volume of certificates that needs to be handled. Reliability and efficiency of the overall system management are at the core of the focus.

This report mainly continues the discussion of REGATRACE report D4.3 from a more technical perspective focusing mainly on two of the four challenges to Conversion Issuance mentioned in D4.3. Thus, the report utilizes the previously done work in deliverables D4.1, D4.2, and D4.3 as well as D2.8 in parts discussing the related parts of certificate transfer between different registries. The main alternatives and approaches presented, discussed, and assessed in the report are also taken from the previous work done during the D4.3 deliverable project. While they have been analysed and documented on a higher level during deliverable D4.3, the options are here studied on a more practical level.

The main work consisted of focusing on the practical challenges from D4.3 and their solutions from a technical point of view in a smaller working group after which the draft ideas, identified challenges, as well as initial recommendations were shared within the larger REGATRACE working group for feedback and further ideas. After the commenting rounds and joint team meetings, the report content and text were finalized to support and compliment the previous work package 4 material.

2.7 Overcoming the practical challenges at the implementation of principle conversion rules

2.7.1 Practical challenges

Assuming that a fully operational GO system is in place, for the relevant Energy Carriers, the REGATRACE D4.3 report identified four main challenges regarding the handling of GO Conversion Issuance for issuing bodies and registry operators:

1) Quality check of GOs that are cancelled as Input for Conversion Issuance,
2) Making sure the input GOs are cancelled,
3) Match number of cancelled GOs with input measurement and corresponding data validation checks,
4) Issuing the GOs for the new Energy Carrier: transfer data Attributes from the cancelled GOs.

Note that mutual recognition of certificates between registries operating under different schemes, has a quality criteria compliance aspect (Point 1), which relates to REGATRACE Reports D4.1 and D4.3, and a technical aspect of getting the GOs to the right place in a trusted way (Point 2), encountering different transfer-protocols for cross-registry transfer between different schemes, relating to Regatrace Reports D4.2 and D2.8.

These challenges are illustrated in Figure 3 below.

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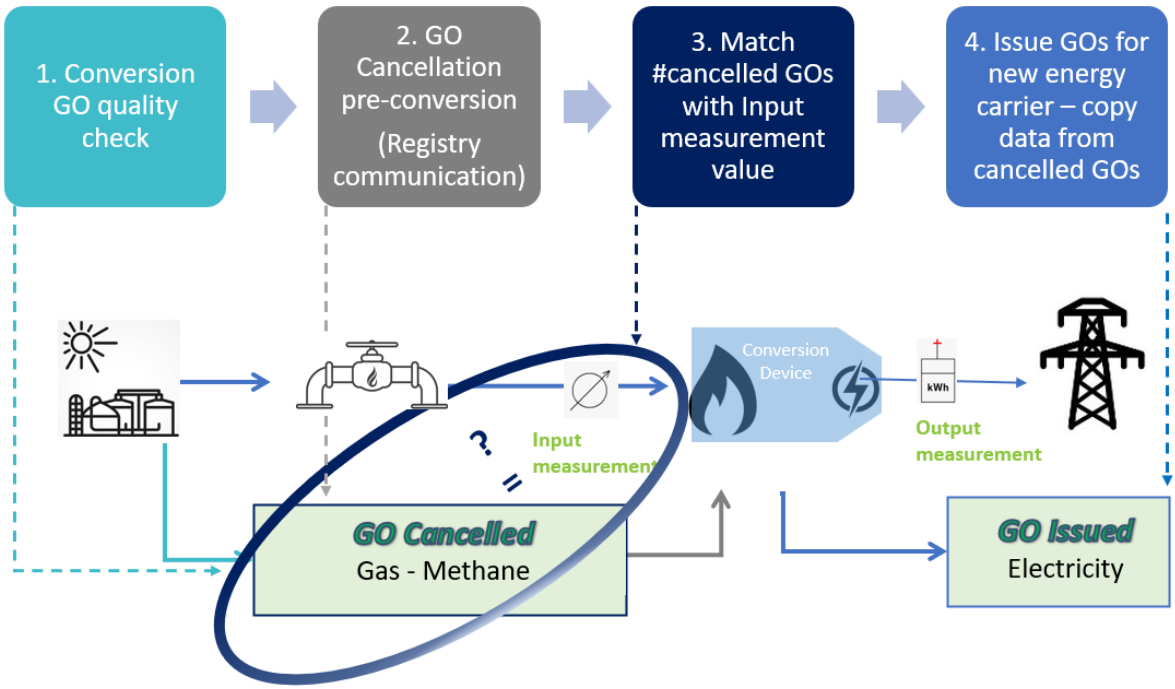

Figure 3: Illustration of challenges for an example of a conversion track

2.7.2 Challenges are interdependent

While report D4.3 recommends harmonised rules for conversion, it mainly considers challenges 1 and 2 (Points 1 and 3 in the Figures). Challenges 3 and 4 have a more practical nature and are the main focus of this report D4.4. This however also comes back to challenges 1 and 2 when implementing the recommended rules into practice.

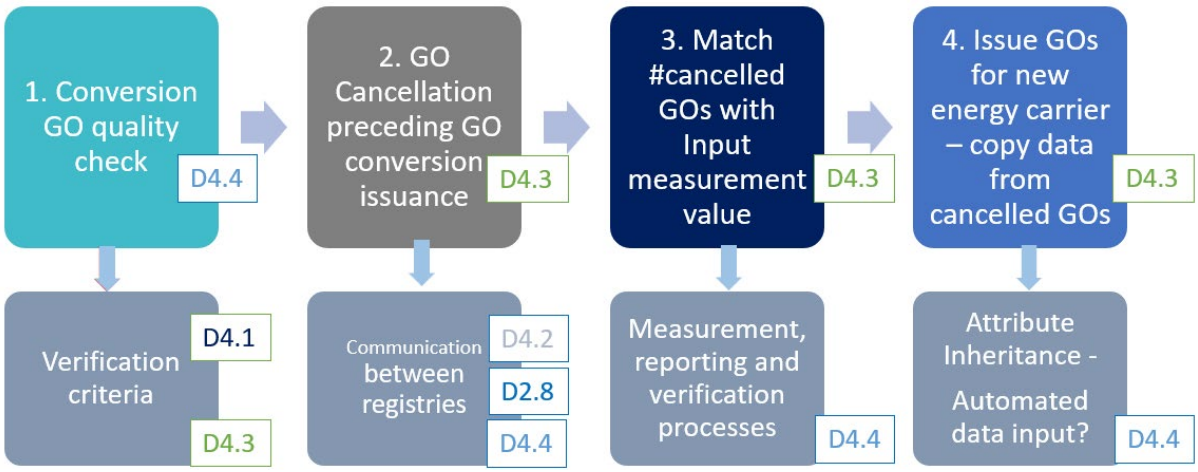

Figure 4: Illustration of interrelation of the reports REGATRACE D2.8, D4.1, D4.2, D4.3 and D4.4

Further, where issuing bodies are not using the same transfer protocol for cross-registry transfer of GOs, the challenges have an additional dimension compared to the situation where they are using the same cross-registry transfer framework.

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2.7.3 Recap from D4.3 on Harmonised rules for conversion

From the REGATRACE report D4.3, this report D4.4 adopts the following recommended rules for handling certificates in relation with conversion, see Figure 5 below:

Figure 5: Recommended rules for certificate handling in relation with Conversion

In addition to clear recommendations for rules, the D4.3 report also gave an overview of elements to monitor while the market is further developing, to establish further harmonised rules in the future, see figure 6 below:

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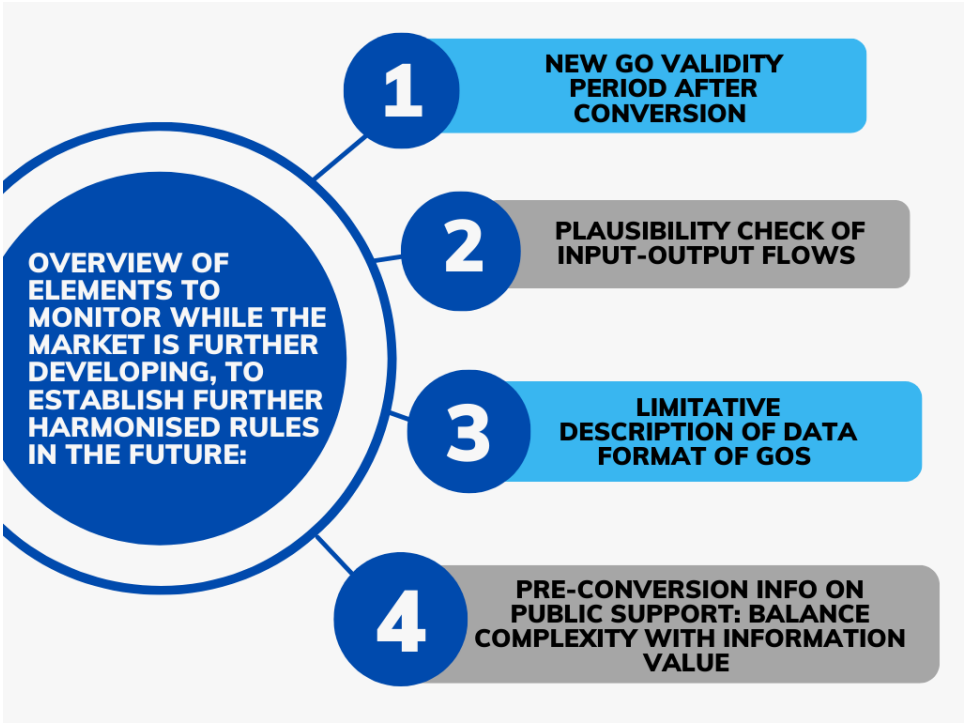

Figure 6: Kick-off recommendations for evaluation while gaining experience from the market on energy carrier conversion

The harmonised rules defined in D4.3 are a key prerequisite for defining the technical requirements and are thus used as the basis for this report.

3 Roles and mandates: single or multiple issuing bodies for different Energy Carriers

The variety of different scenarios in Conversion Issuance regarding the roles and mandates as well as operating IT-systems is well-presented and discussed in chapter 6.1 in REGATRACE report D4.3. As pointed out, the process becomes progressively more complex with the increasing number of stakeholders. The complexity of technical implementation is lower in a case where a single Issuing Body is responsible for GO systems of the input and Output Energy Carriers compared to a case where the Issuing Bodies in a Domain are different for every Energy Carrier.

The subject is also extensively discussed in REGATRACE report D2.8 “Techno-economic feasibility study on a harmonized system for cross border title-transfer of the renewable character of gas in Europe”. The report focuses on renewable gas GO transfer options between issuing bodies under currently different schemes and assesses the different options for information transfer. However, the same arguments and logic also apply in Conversion Issuance and communicating certificate Attributes after cancellation from cancelling registry to the issuing counterparty.

Particularly relevant is following conclusion made in the D2.8 report “(…) a single transfer protocol with generic data fields and common data field specifications for all certificate transfers in Europe will substantially enhance the efficiency of the interoperability between schemes, Issuing Bodies and biomethane registries”. This aligns with the option in Conversion Issuance where, regardless of the

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Energy Carrier, GOs are first imported to the issuing registry and only then cancelled. This option is further discussed in chapters 5.1.3 and 5.2.3.

While assessing the impact of role allocation in handling GOs for Energy Carrier Conversion, report D4.3 identified three main situations, each with their own challenges for acknowledging the cancellation of a GO for an Input for Conversion Issuance:

1. Issuing bodies acting under various certification schemes: an Issuing Body for gas GOs, facing market demand to import GOs that are issued under another scheme than the one it is operating in.
2. Issuing bodies responsible for a single Energy Carrier, needing to deal with conversion from another Energy Carrier:
3. General recognition criteria for GOs issued by another Issuing Body.

The above-mentioned situations and their related challenges in technical business logic require dedicated mandates in the Issuing Body registry systems as well as the integrations between them. On the registry side there arises the need to accommodate certificates and/or their Attributes in structures that would not necessarily be put in place if energy conversion would not be facilitated. Integrations, growing in quantity, will need to make sure that the immutability requirement for transferred certificates or their Attributes after conversion cancellation is sustained. Additionally, previously more separate registry systems (e.g., separate Energy Carriers and schemes) will need to become more compatible, including in terms of IT security.

Issuing Body roles and mandates can expand considerably in the future due to the required support for different schemes and Energy Carriers. Thus, a considerable amount of effort and resources in technical implementation can be saved by focusing on legislative and operational compatibility as well as solving the issues and following the best practices discussed in previous reports D2.8, D4.1, D4.2 and D4.3.

4 Ensure cancellation and uniqueness of Input GOs

4.1 Recap: What is GO Cancellation and what is it for?

As a brief description of the guarantee of origin (GO) cancellation, the following definitions from AIB EECS Rules, ERGaR CoO Scheme Rules, and CertifHy Scheme can be considered.

EECS Rules Release 8 v1:

> *"Cancellation is the mechanism whereby the EECS Certificate is removed from circulation. Cancellation occurs at the point at which the value of the Certificate is realised. Examples of circumstances in which the Cancellation of an EECS Certificate may occur include: in connection with payment from a consumer in recognition of the qualities it represents; in connection with the award by government of a financial incentive, such as a tax rebate; or by way of discharge of a contractual or legal obligation. The EECS Rules provides for EECS Certificates to be Cancelled only once, at which point they may (support certificates) realise their value and (Disclosure certificates) be used to adjust any Residual Mix."*

ERGaR CoO Scheme Rules V1.2:

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"Recording the final use of the Biomethane on the CoO by way of a cancellation statement in order to ensure that the CoO cannot be used again for any other purpose. The CoO is not deleted and continues to be available for auditing."

CertifHy Scheme v2019-03-11:

"The Attributes of an amount of hydrogen can only be claimed through cancellation of the corresponding GO"

"To change the status of a CertifHy GO at the request of an Account Holder to "cancelled" and to prevent it from being transferred to another Account Holder"

Previously listed schemes defined GO cancellation in the context of (a) specific Energy Carrier(s). A more comprehensive definition for GO cancellation is expected to be available in the EN16325 standard, which currently only covers electricity GOs, is being extended to GOs for gas, hydrogen and heating and cooling.

EN 16325 – Committee draft of the revision v 2022-06-10:

"The Cancellation (use) of a GO enables a claim on the origin of the energy supplied to a final customer. Cancellation hence means the realization of the value of the GO for the Disclosure of energy origin to a final customer."

Summing up the different definitions, GO cancellation marks the action by which the value of the GO is realized, by claiming its Attributes. After the cancellation, the certificate cannot be used for any other purpose and is removed from circulation. Thus, cancellation is essential for avoiding double counting of Attributes in all the mentioned schemes.

It is important to keep a record of a GO cancellation in a respective database and install appropriate measures so that the certificate cannot be revived again.

4.2 Registration of Conversion Production Device and measurement values

For an amount of produced energy to be certified under a scheme, the relevant Production Device must fulfil the set of requirements set by the relevant certification scheme. This is ensured by scheme- and often Domain-specific Production Device registration and possible auditing procedures. These are in place for all before-mentioned schemes: AIB EECS Rules, ERGaR CoO Scheme Rules, and CertifHy Scheme. Thus, the basic registration steps for a non-conversion Production Device are assumed to be in place.

The additional requirements for a conversion Production Device registration are:

- Inclusion of information about energy conversion
- Inclusion of information about Input energy
- Handling of the variant energy source information (and additional inherited Attributes from pre-conversion cancellation as discussed in chapter 6)

In addition, handling the energy Conversion Device in the registry can differ further as it should be defined how the Attribute information from input cancellation is received and processed as well as which related functionalities are enabled for the device (e.g., which Attributes to inherit).

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4.2.1 Inclusion of information about Input energy

Rule 6 of the REGATRACE report D4.3 “Measuring Input energy into conversion” states that “The amount of energy input into the Energy Carrier Conversion shall be measured, for determining the number of GOs to be cancelled in accordance with Conversion Issuance.” The rule was also supported fully (except for those without opinion) in a survey, answered by representatives of 20 issuing bodies and registry operators from 16 countries in Europe, carried out by the REGATRACE project team.

The current Production Device registration procedures in AIB EECS Rules, ERGaR CoO Scheme Rules, and CertifHy Scheme include requirements for measuring energy Output, considering aspects like auxiliaries, energy storage, and on-site or own consumption. Thus, the technical capabilities for entering energy measurements (often meter readings for a single Energy Carrier) in registries are already widely in use. This includes registration of the Input energy, currently usually in the form of a primary energy source. Similar metering/measurement and reporting structure for registering Production Device Input energy, can be used where the Input energy is consisting of one or more other Energy Carrier(s) rather than a primary energy source. The practicalities of Input energy quantity measurements and validations are discussed in chapters 4.4.1 - 4.4.3.

4.2.2 Handling variance in Input energy source (and additional inherited Attributes from pre-conversion cancellation)

For a non-conversion Production Device many of the Attributes of the issued certificates, often but not always including the energy source, are defined, and inherited from the Production Device. As defined in REGATRACE report D4.3, in case of Conversion Issuance, some of these Attributes should be inherited from the cancelled certificates instead. The information about the energy source is the clearest example of this.

Thus, the Production Device registration should allow to define, which Attributes are not set as constants from the Production Device but are determined only after the cancellation information for the Input energy is available. Here, one possible analogy to utilize would be the handling of fuel declarations in multi-fuel Production Devices. This mechanism of the multi-fuel input registration is usable because also there the final allocation of energy sources into different certificates for proportions of the produced energy Output is dynamic and can vary between different issuing cycles.

It should be noticed however, that in this report inheriting the Attributes from cancelled certificates (automatically) is assumed in an ex-ante alternative as described in the REGATRACE report D4.3 chapter 7.2 “Assessment of options”.

In an ex-post alternative, the Attributes of issued GOs set the requirements for “finding” a set of suitable GOs for Input energy certificates cancellation. As this latter mechanism was generally not the preferred one in the survey of issuing bodies held in 2021, and elaborated in the REGATRACE report D4.3, for the purpose of this report D4.4. this is just mentioned here as an attention point and not further elaborated.

4.3 Process of GO Cancellation preceding GO Conversion Issuance

4.3.1 Intro

As stated in chapter 4.1, GO cancellation marks the action by which the value of the GO is realized, by claiming its Attributes. After the cancellation, the certificate can no longer be traded, and the disclosed Attributes and information should not be changed.

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REGATRACE report D4.3 defines clear recommendations for rules of this cancellation process and handling the disclosed Attributes. In the survey conducted as part of the REGATRACE report D4.3, 58% of the issuing bodies and registry operators that answered favour the ex-ante check in which adequate proof of the cancelled GOs needs to be available before the new GOs following conversion are issued. Only 16% of the issuing bodies favoured an ex-post check while 26% responded with 'other', meaning either they prefer a simultaneous cancellation at the Conversion Issuance process, they feel both options work depending on the conditions, or they have no opinion.

In order to fulfil the requirement of immutability of disclosed Attributes, the GOs shall not be modified for the sake of conversion but shall be cancelled for Input to conversion and new GOs, shall be issued for the Output of conversion.

4.3.2 Recording additional data during the cancellation process

For transparency and avoiding double counting in cancellation statistics of the originating Input Energy Carrier, it is important to record that the corresponding GOs have been cancelled for the purpose of Energy Carrier Conversion.

Regarding the additional data required during the cancellation, for both the ex-ante and ex-post cancellation options elaborated in REGATRACE report D4.3, it should be possible to define information about the relevant Conversion Device and the period of energy conversion, on the cancellation of input certificates.

The validity period of the issued certificates should not be extended due to unspecific consumption period mentioned on the Input energy cancellation statement. The mentioned consumption period should correspond to the production period of the newly issued GOs following Conversion Issuance and should not be longer than a month. The technical implementation would most probably not require extensive changes in current data structures or technical processes. However, the update could result in changes in (often Issuing Body -specific) cancellation statements and in requiring additional acceptance steps.

The added information would make it possible to find and backtrack Conversion Issuance -related cancellations thus making the process more robust and transparent, particularly when automated. Validations related to the consumption time-period on cancellations should consider the following:

- The consumption period mentioned on the cancellation statement should be specific and short enough to prevent unreasonable extension of the validity period of certificates.
- Therefore, the length of the consumption period on the cancellation statement should correspond to the length of the production period of the newly issued GOs, following Conversion Issuance, and be no longer than a month.
- It shall be mentioned that the cancellation purpose is Conversion Issuance.

Chapter 5 of this report describes in more detail the possible processes for cancellation information communication between registries.

4.3.3 Proportional allocation of various Input Attributes to Output GOs

REGATRACE report D4.3, especially in rules 11 and 12, describes the data to be recorded on Conversion Issuance GOs and their inheritance from the cancelled GOs. Attributes like energy source are carried across the process from the cancelled GO to the newly issued GO. However, in some cases the newly issued GOs for energy conversion may have Attributes that need to be combined/calculated (like carbon footprint) or cumulated (like information about production and/or investment support). In the

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latter cases, the required data structures to handle e.g., cumulating Attributes would be different from current versions. This may result in more extensive changes in issuance logic and issuance-related data structures than described in the previous chapter.

4.4 Requirements to ensure cancellation and uniqueness of Input GOs

Previously, REGATRACE report D4.3 identified four main challenges (presented in Figure 3) regarding the practical handling of GO Conversion Issuance for issuing bodies and registry operators. One of the challenges, "Match number of cancelled GOs with input measurement and corresponding data validation checks" is introduced in REGATRACE D4.3 chapter 7. This report aims to extend the rules and guidelines given in D4.3 by addressing this challenge from a technical perspective.

The chapter is divided into (chronological) steps within and between the involved registries from Production Device Input energy measurement to ensuring the uniqueness of cancelled input GOs. The following steps are described:

1. Measure Input quantity
2. Report Input quantity to Conversion Issuing Body
3. Verify Input quantity
4. Cancel GOs in accordance with Input quantity
5. Inform Conversion Issuing Body of Cancelled GOs[1]
6. Ensure Uniqueness of Cancelled Input GOs

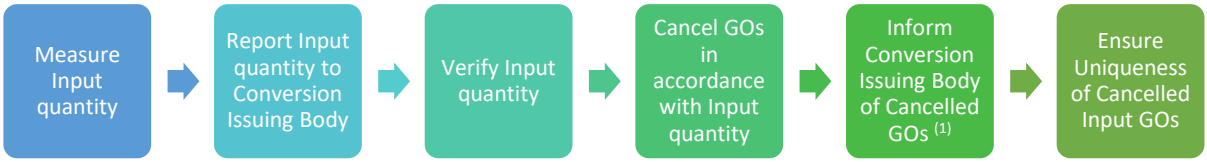

Figure 7: Steps for ensuring the uniqueness of cancelled input GOs

4.4.1 Measure Input quantity

REGATRACE D4.3, and the cited Issuing Body and registry provider survey, underlines the need for measured values for conversion input. REGATRACE reports D2.2 and D4.1 give more insight to the verification methods of the various criteria e.g., metering for the plausibility check and discuss the principles of gathering the relevant data.

For Production Devices registered in existing GO registries, energy measurement processes are typically already in place. The energy production (Output) measurements are typically sent to the registry operator by the measurement body in specific file formats using existing IT-integrations. In some cases, measurement values can also be input manually.

[1] This step is only needed when the conversion Issuing Body is another party than the Issuing Body that manages the Conversion Issuance.

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For input quantity measurements for a Conversion Device, similar or already existing energy measurement processes can be used as for the existing Output and energy source measurements.

Technical considerations in data registration should be given to e.g.:

- Separating Input meters from Output meters
- Different types of Input depending on the measurement point
- relevant validation (see chapter 4.4.3) and calculation functions.

This is particularly needed in cases where the required data registration is similar to the input side as mentioned in ERGaR CoO Scheme – Scheme Rules V1.2, chapter 9 "Appendix A – Net and Gross measurement of gas production".

Where Input energy consists of multiple Energy Carriers or a single Energy Carrier with shares of different energy sources the Issuing Body should aim to separate the measurement of the Input energy flows as much as possible. Determining such shares by default values or estimates, should not be encouraged, and can only defended in specific cases.

Partial cancellation for Input energy: proportional allocation of Attributes

In cases where GOs are not cancelled for the full quantity of the measured energy Input into the conversion, the full amount of Input energy needed for the conversion should still be measured in order to carry out validation steps matching Input and Output energy volumes. This is important to be able to determine the proportion of Input energy for which GOs are cancelled, and thus to know the corresponding proportion of Output energy for which Conversion Issuance can be allowed.

Dealing with Limited data availability

During the registration of the Conversion Device, Input measurement logic should be defined as discussed in chapter 4.2 above. However, in some cases (for example when Conversion Device consumption metering is not on the same level as production side metering) data for the volume and quality of the Input energy can be limited. In such cases, the measurement intervals can be longer or in some cases the data can be inserted manually according to billing information (or similar), which can reduce the quality of the available data. In these cases, matching and validation of input and Output data should still be done even if the validation calculations can be carried out only as a pre-step to Conversion Issuance.

In cases of missing measured input data, the possibility of calculating the amount based on Output can be considered using default conversion factors for process and conversion efficiency in order to set a limit on needed cancellations for the Input energy. Setting such default factors should always be done with care, as set out in the REGATRACE report D4.3.

4.4.2 Report Input quantity to Conversion Issuing Body

The reporting can be done by the Production Device operator or owner (or other designated stakeholder), a third-party gathering input data, or a national operator like a transmission system operator (TSO).

The responsibilities and roles regarding Input energy reporting to the conversion Issuing Body and its registry are similar to conventional Output (production) energy reporting.

The overall responsibility of gathering the Input energy data should be on the Conversion Issuance Issuing Body (who may have delegated it to its registry operator).

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From the IT-point of view, it is important to clearly define the data format and its origin. This enables to set up the relevant data integration in the registry as well as agree on intervals of sending the data. Some of the more developed file formats have well documented schema and built-in validations, for example sum of all measurement values, that can ease validation procedures on the receiving side.

4.4.3 Verify Input quantity

Like in the previous chapters, it is assumed that registries have already implemented sufficient validations for the Output (production) data. Here, the basic input data checks (e.g., missing data, schema, and input data type validations) implemented for Output measurements can be utilized also for the input data.

Often a reported production Output quantity is compared to the theoretical capability of the Production Device to produce energy. The validation is built using the installed capacity of the Production Device that is combined with the information about the production period. Similarly, a validation based on conversion Production Device installed capacity should be set for Input energy.

As stated in REGATRACE D4.3 Rule 3, GO Conversion Issuance requires physical Energy Carrier Conversion. As tied to the physical energy conversion, this condition sets a boundary to the amount of Input energy GO cancellations per Conversion Issuance production period. Technically, it is possible to define, per conversion Production Device, the relative proportions of input and Output measurements. In practice, defining thresholds for data validation, requires the understanding of the underlying physical conversion process. Conversion efficiency and energy losses, as well as temporal delays of the measurement and reporting process, can make it more complex to match periods of input and Output volumes. The effect of temporal differences can be assumed to diminish as validation cycles are longer. For general checks on order of magnitude, any such differences should balance out when cumulated over longer periods.

It should be noted also that the input and Output correlation validation should be separate from the basic installed capacity validation since the latter would not be separately triggered if conversion Production Device is utilized on lower capacity.

In addition to well-defined reporting procedures, it is essential to clearly define and allocate the responsibilities regarding validation of measured data correctness and procedures for correcting the measured data afterwards (including required additional certificate issuing or withdrawal actions).

The granularity of the input data (Input energy time period length variance) will set limits on the granularity of data validation cycles. For example, a quarterly reporting of input data will allow validations between input and Output to be carried out quarterly, but not at shorter periods of time.

4.4.4 Cancel GOs in accordance with Input quantity

As described in REGATRACE report D4.3 rules, and according to the survey for issuing bodies and registry operators, it is essential to cancel GOs for Input energy in Conversion Issuance. Also, it was seen important to do so prior to the Conversion Issuance (ex-ante), although also possible after the Conversion Issuance, subject to sufficiently strong fraud detection and handling mechanisms.

It is also important to notice that cancellations are not necessarily needed for the entire Input energy but conversion GOs are only issued for the proportional amount of Output covered by cancellations on the input side (after considering the energy losses).

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4.4.4.1 General considerations for cancelling GOs in accordance with Input quantity

In general, the cancellation procedure for Input energy should follow the same premises and requirements as set out by AIB, ERGaR, and CertifHy in their respective schemes and rules as well as set out in Domain protocols. Following the same processes as in use for normal cancellation will most efficiently utilize the benefits of existing registry systems. It will have the lowest additional risk from a new type of cancellation.

However, in addition to the general rules for cancellation, as the latter is done for Conversion Issuance, it should be clearly stated in the cancellation information. Also, where a cancellation is done for proving the Attributes of the Input energy of Conversion Issuance, the following information would be helpful to link the conversion to a specific cancellation if stated in cancellation information:

- Conversion Production Device identification
- Conversion period (start and end dates).

Adding the information about the Energy Carrier Conversion, conversion Production Device, and the relevant period will help back-track the chain of energy Attributes even in the case of multiple different registries/databases. Also clearly defining the information in the cancellation will help avoid double counting as the certificates and their Attributes are clearly marked as used for specific Conversion Issuance.

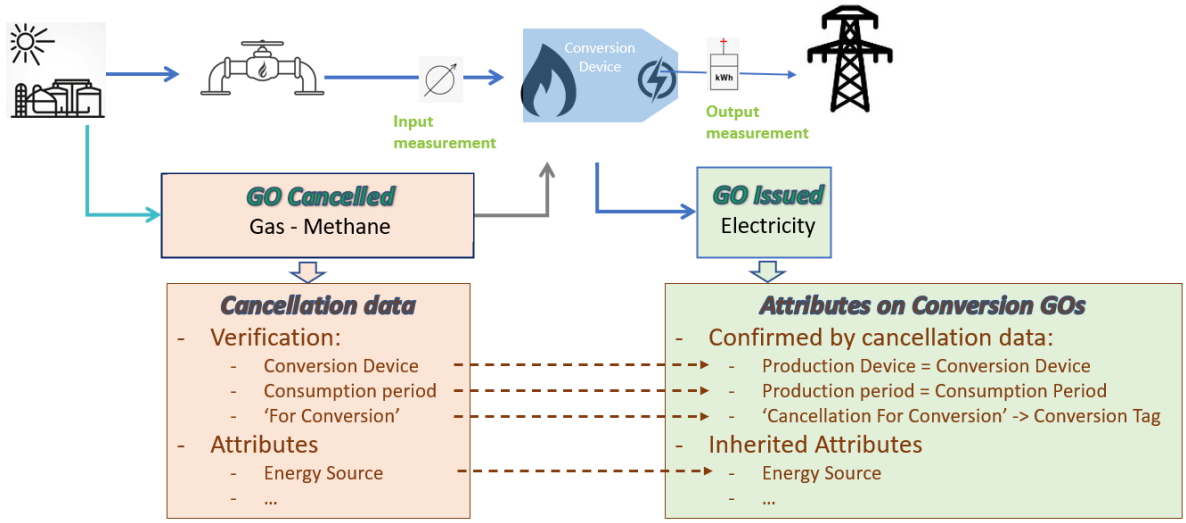

Figure 8: Verification of Input Attributes based on cancellation data

It should also be noted that Input energy measurement for a specific period should only set the upper limit to the cancellations for that period in order to allow cancellations for only a share of the Input energy. The number of GOs to be issued following conversion, will thus be determined according to the following formula:

 # Conversion GOs Issued = (cancelled GOs / Input measurement) x nett Output measurement

4.4.4.2 Cancellation and Conversion Issuance in different and same registries

As elaborated in chapter 5, the cancellation of certificates for the Input energy can take place in the same or a different registry than the one used for Conversion Issuance. Additionally, the options include the possibilities to store cancellation information in the cancelling registry or in a central

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cancellation database. In all cases it is essential to follow the rules as well as the already pre-existing frameworks for energy conversion listed in REGATRACE D4.3.

When considering all ex-ante cancellation alternatives (cancellation before the Conversion Issuance), it is important to be able to validate the amount of cancelled GOs against energy measurements. In first implementations, the registry user (e.g., Account Holder) will most probably have to initiate the cancellation of the correct certificates manually, i.e.: choose the certificates for cancellation and have the cancellation information available during the conversion request. However, when considering that the majority of GO certificates today are issued automatically based on meter readings and automated validations, then it would be preferrable that manual steps in Conversion Issuance would also be minimized. Automation possibilities will differ based on number of registries involved.

In cases where the GO cancellation for proving the Attributes of Input energy takes place in a different registry than the one where the subsequent Conversion Issuance takes place, the high-level steps leading to cancellation for the Input energy are:

1. The issuing registry will receive meter readings (energy measurements) for input and Output energy for a conversion Production Device for a certain period, and

2. After validations, the issuing registry and its relevant users will have the information about the amount of Input energy for a certain time-period and thus the needed amount of GOs to be cancelled for that period, and

3. checking cancelled GOs through either of the following alternatives:

    a) This information (the quantity of GOs to be cancelled) needs to be made available in the cancelling registry in order to cancel the correct amount of GOs specifying the conversion Production Device as well as the conversion period (see chapter 4.4.4.1), (see also section 4.4.5 below), and subsequently, the correct amount of GOs is cancelled

or,

If the cancellation registry operator does not engage in the process of determining the amount of GOs to be cancelled,:

    b) A certain amount of GOs is cancelled in the originating registry and subsequently, Information about this amount of cancelled GOs and their Attributes reaches the Issuing Body for Conversion Issuance. This Issuing Body checks whether these GOs have validly been cancelled ‘for conversion’ usage category. Subsequently, this amount of cancelled GOs is matched with the reported Input energy for the conversion, and proportionally can be allocated to Output GOs for Conversion Issuance. In this situation the cancelling Account Holder has more responsibility in determining himself in time the correct amount of GOs to be cancelled.

Considering step 3, it is estimated that implementing the automation of this process between different registries would require first engagement of the cancelling Issuing Body. Step 3b elaborates an alternative to step 3 that allows to proceed more independent of the cancelling Issuing Body. It however also needs manual checks of the quality of the received cancellation.

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Thus, when cancellation and Conversion Issuance takes place in different registries, it is probable that manual steps would persist rather long, blocking high scalability of the solution.

Notice that this efficiency constraint is also present in the alternative for a common cancellation database.

Cancellation and Conversion Issuance in the same registry

In cases where the Input energy cancellation and Conversion Issuance take place in the same registry, the high-level steps leading to the cancellation are similar. However, it will be much easier to build an automated logic for selecting and cancelling the correct number of certificates according to Input energy measurements as these are both available in the same system. This enables automated validations of the cancelled GOs for Conversion Issuance.

The identity and quality of GOs to be cancelled, should still be chosen by the Account Holder but for the Issuing Body it will be much easier to automate the rest of the process.

Looking at steps beyond Input energy cancellation in the Conversion Issuance process, it would also be significantly easier to automate and thus efficiently scale the next steps like validations, Attribute transfer, and issuing based on cancellations if the cancellation is done in the Conversion Issuance registry.

4.4.5 Inform Conversion Issuing Body of Cancelled GOs

**** This section is only relevant where cancellation takes place in a different registry than the one where Conversion Issuance takes place****

In order to ensure the correct inheritance of Attributes and conversion issuing volumes, the information about cancellations must be available to the conversion Issuing Body. Similarly to the previous chapter, there are different alternatives for disclosing the information to the conversion Issuing Body depending on the number of registries involved.

Chapter 5 of this report dives more deeply into the assessment and comparison of different cross-registry processes related to cancellation for Conversion Issuance. Additionally, REGATRACE report D2.8 extensively describes the technical and economic feasibility of alternatives in a similar setup where renewable gas Attributes transfer between systems and relevant Domain are discussed. This report, especially in chapter 5, bases many of its assumptions on the results of D2.8.

In the context of this report, four different setups for information transfer about the cancellation to the conversion Issuing Body are considered:

- Ex Domain Cancellations
- Ex Domain Cancellations with electronic cancellation statement transfer protocol
- Import certificates to the Conversion Issuance registry for all Energy Carriers
- Central cancellation database

In the first two options, both based on ex Domain cancellations, the cancellation takes place in a different registry than the conversion issuing registry. The third option, with a preceding import followed by cancellation, will have both the cancellation and the Conversion Issuance in the same registry. The final option, considering a central cancellation database, will include a separate database to store the cancellation information making it possible for all relevant registries to build only one integration for cancellation information extraction.

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The technical suitability of different options can be assessed by their efficiency, scalability, and possibility for automation as well as required resources and complexity of the system. This is done in detail in chapter 5.

4.4.6 Ensure Uniqueness of Cancelled Input GOs

As elaborated in REGATRACE D4.3, in order to be able to issue a GO for the newly produced Energy Carrier, the only acceptable certificate for cancellation is a GO, or a voluntary equivalent of a GO, that ensures avoidance of double counting and double claims of the same amount of produced energy. This would automatically also mean that requirements specified for GO cancellation must apply ensuring that the core process, and thus the uniqueness of Gos, is ensured.

However, as discussed also in previous chapters, in case of Conversion Issuance, in addition to conventional double counting avoidance mechanisms, it is important to establish a clear and transparent link between the issued new certificates and cancelled certificates for the Input energy. Following the recommendations in chapter 4.4.4, information about the Conversion Device and the relevant conversion time-period should be added to the cancellation. Adding this information makes it possible for a conversion Issuing Body to validate that the cancellation was done only for conversion. This is the case both in ex-ante and ex-post cancellation scenarios.

As an optional extension, similarly, to including the conversion Attributes to the cancellation, the information about cancelled Gos could be added to the newly issued Gos. This makes back-tracking easier. It should be considered however whether the information about the cancelled certificates should be linked to the certificates or the meter readings (energy measurements) of the issuing registry. A balance should be made between the need for detailed backtracking and cost/simplicity of the outcome solution, depending on the design criteria, legislative requirements and available needs.

4.5 Chapter summary

An Issuing Body for Conversion Issuance follows all normal issuance procedures for Gos for the Energy Carrier they are responsible for. In addition, they need to integrate all the above-mentioned processes in their normal GO issuance processes, most notably:

- Measurement of various streams of Input energy when conversion is made simultaneously from multiple Energy Carriers or sources.
- The process (manual or automated) for exchanging data between the Input and Output Energy Carrier registries (in case separate registries are implemented).
- Additional validations with regard to, e.g., matching of the Input and Output volumes and cancellation and conversion times.
- Additional information in cancellations (Conversion Device and time-period) to link a cancellation to a conversion.
- Additional information in the registry to link recorded meter readings and conversion GOs with the cancelled Input energy GOs.

In a piloting situation this is feasible with a manual process. When dealing with significant volumes of GOs and Production Devices, this requires automated processes. Coming to automated processes for

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compiling all this information, requires describing detailed business rules that can be implemented unambiguously in IT systems.

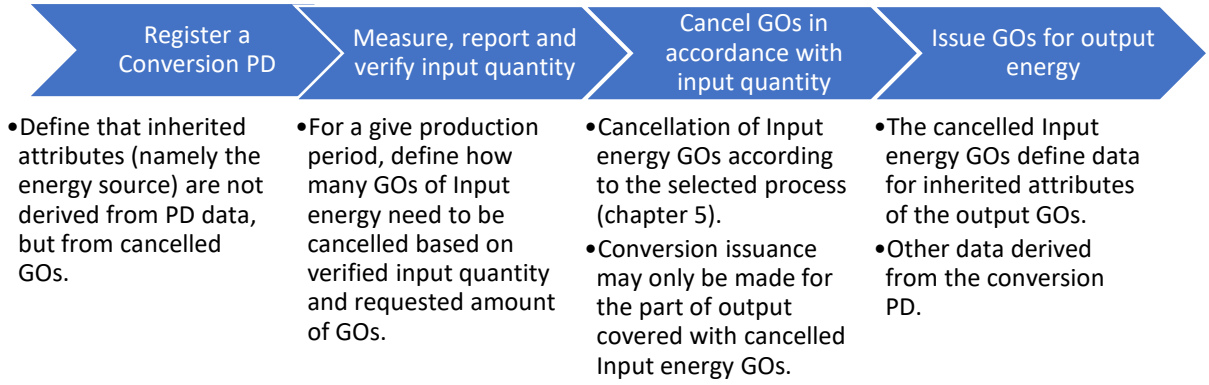

Figure 9 The high-level process for Conversion Issuance

5 Cross-registry processes related to cancellation for Conversion Issuance

This section displays options for how Issuing bodies can be informed of cancellation as input to Conversion Issuance. It assumes that normal issuing processes are already in operation and focuses merely on the needs of Conversion Issuance. In practice, this part defines, discusses, and evaluates options for transferring cancellation information content from one registry to another. Thus, fulfilling the Conversion Issuance requirement to match conversion Input energy amount with cancelled GOs.

The chapter mainly draws from the previous REGATRACE D4.3 and REGATRACE D2.8 reports. The main challenge from REGATRACE 4.3 chapter 5 to explored here is no. 3 “Making sure the input GOs are cancelled”.

The first section below describes the options which will subsequently be assessed in the next section.

5.1 Options for cancellation processes

In REGATRACE D4.3 report, four distinct process options were identified for transfer of cancellation information between issuing bodies:

1. Ex Domain Cancellations
2. Ex Domain Cancellations with electronic cancellation statement transfer protocol
3. Import certificates to the Conversion Issuance registry for all Energy Carriers
4. Central cancellation database

The following chapters will present the four options in terms of the cancellation and transfer process, as well as how the conversion Issuing Body is informed of the quantity, Attributes, and uniqueness of the cancelled guarantees of origin.

The high-level differences between these alternatives were already presented in chapter 4. However, in this section, the assessment is done with more granular comparison.

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5.1.1 Ex Domain Cancellations

Ex-Domain Cancellations are cancellations that take place in one registry (usually in one country), for use of the relevant Attributes in another. For example, the AIB EECS Rules (Release 8 v1.1) defines cancellation steps as follows:

C7.1.1 A Scheme Member may Cancel a Scheme Certificate solely:

> *(a) for use in its own Domain (in relation to any EECS Product in respect of the relevant Output); or*
>
> *(b) for use in a Domain (in relation to any EECS Product) of another Scheme Member; provided:*
>
> > *(i) it is not possible to transfer EECS Certificates directly or via the Hub to a Scheme Member for the other Domain; and*
> >
> > *(ii) a Cancellation Agreement exists between the Cancelling Scheme Member and the Scheme Member for the other Domain; and*
> >
> > *(iii) such Cancellation Agreement requires:*
> >
> > > *1. the provision by the Cancelling Scheme Member to the Scheme Member for the other Domain of statistical information concerning Cancelled EECS Certificates; and*
> > >
> > > *2. the inclusion on any related Cancellation Statement of the identity of the Domain, Account Holder, and purpose for which the EECS Certificates were Cancelled; or*
>
> *(c) for use in any country or region which is not a Domain.*

In line with the above description, these sections C7.1.1 (b) and section C7.1.1 (c) refer to an Ex-Domain Cancellation.

In the context of this report, the Ex-Domain Cancellation here covers the situations where due to IT technical, energy-carrier-specific or Domain differences it is not possible to transfer and cancel the GOs in the conversion issuing registry under the control of the conversion Issuing Body. This could occur, for example, because the conversion registry has not implemented the needed fields for a specific Energy Carrier.

From the process and technical point of view, using ex Domain cancellations for informing the Conversion Issuance registry of Input energy cancellations will be based on a process that involves a lot of manual work. It implies doing an ex-Domain cancellation in a registry and sending the ex-Domain cancellation statement to the issuing registry or conversion Issuing Body for review/proof of the cancellation.

The high-level steps for this alternative would be:

1. Cancellation of GOs for input of conversion
   Cancellation based on the Input energy measurement as described in chapter 4.
2. Cancellation statement creation (e.g., in PDF format)
   Creation of a registry- and scheme-specific cancellation statement, by the Issuing Body of the cancellation registry.

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3. Sending the cancellation statement from the cancelling registry to the Conversion Issuance registry. This can be done by the relevant Account Holder but is more fraud proof if done by the Issuing Body of the cancelling registry.
4. Importing the information of the cancellation statement into the issuing registry, by the conversion Issuing Body.
5. Using the imported cancellation statement as proof of sufficient cancellations for the Input energy

The manual workload related to at least step 5, and probably also to the other steps, is hard to translate into automated processes and thus increases proportionally to the volume of Conversion Issuance to be managed.

The fraud-risk of double-using, copying or faking cancellation statements comes with notable credibility risks for the whole GO system.

5.1.2 Ex Domain Cancellations with electronic cancellation statement transfer protocol

Identical to general Ex-Domain Cancellations described in chapter 5.1.1, this alternative follows the same principle of cancelling a specific amount of GOs in one registry and transferring the information retained after the cancellation procedure to the Conversion Issuance registry.

However here, the option would be to allow a registry to export a new type of electronic message being an electronic cancellation statement for the issuing registry. The message would resemble a typical export message and would allow the user to avoid having to create a PDF (or another print format) cancellation statement reducing manual steps in the process.

A transfer of an electronic cancellation statement would be an alternative to normal imports of active certificates. It may help the issuing bodies to omit to import certificates from Energy Carriers not supported in the importing registry. However, importing electronic ex-Domain cancellation statements will require an importing registry to install mechanisms to read these messages and to process them appropriately in the Disclosure supervision procedures in their Domain. Similarly, the exporting registry will need to build a new functionality for exporting the information or making it available.

The high-level steps for this alternative would be:

1. Cancellation of GOs
   Cancellation based on the Input energy measurement as described in chapter 4.
2. Electronic cancellation statement creation
   Creation of a registry- and scheme-specific cancellation statement in a pre-defined format and storing it
3. Sending the electronic cancellation statement from the cancelling registry to the Conversion Issuance registry
   a. Alternative 1: Build an automated transfer logic (similar to certificate transfer) where the cancellation registry, after being initiated by the relevant user, will send the electronic cancellation statement to the Conversion Issuance registry. The process is initiated by the cancelling registry.

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b. Alternative 2: Build an automated logic where the electronic cancellation statement or the cancelled certificate Attributes are available via a new endpoint[2] (similar to reporting or statistical endpoints) and from where the conversion issuing registry, or the user can retrieve the information. The process is initiated by the issuing registry.
c. See further details about the alternatives in Box 1 below.

4. Importing the information of the cancellation statement into the issuing registry
    a. Alternative 1: Receive the electronic cancellation statement. The process is initiated by the cancelling registry.
    b. Alternative 2: Get the electronic cancellation statement or relevant Attributes. The process is initiated by the issuing registry.
5. Using the imported electronic cancellation statement as proof of sufficient cancellations for the Input energy, in an automated process in the Conversion Issuance registry.

The type of information from the cancelled GOs to be transferred in the cancellation statement is the same as defined in relevant scheme rules for cancellation information to be disclosed.

When considering the design of the electronic cancellation statement, the transfer integration options as well as the formats and data structures should be selected based on requirements for efficiency and scalability but as well on the simplicity and easiness to adapt or implement. In general, the same technological solutions as used in modern certificate registry systems should fit the requirements for the electronic cancellation statements.

[2] An endpoint here refers to an available programmatic interface, like a REST API, through which information can be made available. In the context of this chapter, the exposed information would consist of the cancelled certificates' attributes needed by the conversion issuance registry and Issuing Body.

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As described above in steps 3 and 4, there are two alternatives when considering the transfer of an electronic cancellation statement and/or its information.

Box 1: Two main alternatives for conveying the cancellation information electronically

Alternative 1: Electronic cancellations statement sent by the cancelling registry

In the first alternative, the cancelling registry initiates the transfer and sends an electronic cancellation statement to the conversion issuance registry in a predefined format (e.g., XML file) using a specific integration. This is very similar to the certificate transfer between registries today.

In initial stages this would most likely require bilateral agreements and integrations between registries as well as agreeing on the format and content of the electronic cancellation statement. It could however be expected that, if scaled up, a coordinating HUB would facilitate the transfers and allow for a single integration between the HUB and the registry, facilitating a one-to-many registries connection. The development could highly resemble the development of certificate transfers within and between different certification schemes and thus the discussion in REGATRACE report D2.8 is applicable in this context.

For this first alternative, the possibility of using an existing HUB for electronic cancellation statement transfers and process management and overview should be assessed for the long term.'

Alternative 2: Electronic cancellations statement accessible for the issuing registry

The second alternative introduces a different approach. Here the cancelling registry simply makes the electronic cancellation statement available for the conversion Issuing Body and registry. This could be done using a standard API approach. The conversion issuance registry or the relevant user initiates the process by requesting the electronic cancellation statement or its attributes from the cancelling registry. Unlike for certificate transfers, this option is assumed to be available for an electronic cancellation statement, since no attributes can change after the cancellation and the certificates cannot be further traded.

Either way, it remains paramount that the recommendations from chapter 4.4.4 are implemented, meaning that the electronic cancellation statement shall clearly be linked to a specific conversion device and conversion period. This makes it feasible to simply disclose this information using an electronic cancellation statement in the cancelling registry without the risk of double counting through erroneous or fraudulent use of the cancellation statement.

This alternative could also introduce a certain flexibility into the design of the system as the cancelling registry could disclose all relevant information using one or one set of endpoints that all issuing registries could use without having to agree on and build exclusive integrations bilaterally. Also, the responsibility for converting the data structure according to issuing registry needs would more clearly dealt on the issuing registry side. On the other hand, variation of format of information on cancelled certificates between registries, may again induce cost when interacting between many registries.

Briefly comparing this option to the next (5.1.3 Import certificates to the Conversion Issuance registry for all Energy Carriers), the main benefit is not having to support all relevant Energy Carrier certificates and their schemes in the registry as living certificates. However, before making a decision to build towards this option, it should be estimated how much less effort (if any) this would actually mean, and what it does to the overall GO system when certificates can be "transferred" (via cancellation statements) after the end of their life. The manageability of the Disclosure supervision mechanism should also be considered.

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5.1.3 Import certificates to the Conversion Issuance registry for all Energy Carriers

The alternative of importing the GOs into the Conversion Issuance registry differs from the other alternatives mainly by not including cross-registry transfers of cancellation statements or Attributes after the cancellation. The alternative is very similar to current Energy Carrier and scheme specific set-ups where the certificates are first transferred to the destination registry during their lifetime and subsequently cancelled in that registry. Thus, all the Attributes become automatically available in the issuing registry and the cross-registry transfer involves living GOs. In a system that needs to manage huge volumes of certificates for conversion, this facilitates the highest level of automation, and liberty to Account Holders.

For Issuing Bodies mandated to issue GOs for multiple Energy Carriers, this is the easiest and most straightforward option. They need to implement it anyway, given their multi-Energy Carrier responsibilities, and it would save them the implementation of another additional cancellation option.

For issuing bodies who issue certificates for only a single Energy Carrier, the main challenge with the approach is that it requires the involved registries to support imports of certificates for Energy Carriers and/or schemes for which they do not issue certificates. While facilitating their Account Holders to import and transfer GOs of such other Energy Carrier, it is therefore recommendable to restrict their cancellations to Conversion Issuance purposes only.

Alternatively, there may be a Hub that supports different format conversions between registries. D2.8 however explains how this risks to hamper evolution of schemes as well as elaborates the issue with supporting different scheme and Energy Carrier certificates between registries. Thus, this report does not study the different possibilities for certificate transfers between previously unconnected registries and schemes and refers such questions to D2.8. However, the alternative should be compared as a possible solution for Conversion Issuance.

The high-level steps for this option are:

1. Export – Import
   Transfer the living GO certificate from the sending registry to the Conversion Issuance registry.
2. Handling and storing of the imported certificate by the Conversion Issuance registry
   After import, the Conversion Issuance registry should be able to store and handle the certificate prior to cancellation even though the Energy Carrier or scheme is not otherwise supported (the Issuing Body is not responsible for the specific Energy Carrier and/or scheme)
3. Cancellation of the GOs (that prove the Attributes of the Input to Conversion Issuance)
   A pre-defined cancellation procedure for conversion, resulting in usage and/or transfer of Input energy certificate Attributes to the Conversion Issuance certificates.
4. Using the cancellation information as proof for Conversion Issuance

It is important to notice that in this option the needed effort is mainly on the Conversion Issuance registry side, compared to more distributed load in the case of electronic cancellation statement protocol or the case of the central cancellation database. The required effort here mainly focuses on the acceptance and handling of actual certificates for different Energy Carriers and schemes (as described in REGATRACE D2.8).

5.1.4 Central cancellation database

In the option for a central cancellation database, the cancellation information would be stored (or at least copied) to a central database with access for all relevant issuing bodies. The central database

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would have integrations to the relevant certificate registries and gather the data about cancellations, including cancellations for Input energy in energy conversion.

The logic would be rather similar to an operational HUB as registries would build connections toward the central database instead of bilateral integrations. However, the difference is that the issuing registry should request the data itself from the common database (instead of it being sent to it as in regular certificate transfers)

The concept of a central database is discussed in FaStGO task 3.3 report[3] "Technical support for RES policy development and implementation: Establishing technical requirements & facilitating the standardisation process for guarantees of origin on the basis of Dir (EU) 2018/2001 - Task 3: Developing IT Systems Specification – 3.3: High-level Requirements Specification". There it is stated that:

> *"Centralised cancellation provides the registries with a centralised facility to cancel certificates both for use domestically, and ex-Domain (for use in other Domains). The centralised facility would enable Account Holders in any Domain to cancel guarantees of origin for use in any (other) Domain, provide standard and on-line cancellation statements, and manage Domain-specific rules and restrictions. It can also be a useful tool for facilitating the cancellation of GOs for the purpose of Energy Carrier Conversion. Centralised cancellation is evaluated to offer clear and numerous benefits, but it might be difficult to agree, because it would mean national authorities conceding some control over cancellations to a central supervisory body and system."*

However, the report also mentions concerns regarding centralized cancellation, e.g., in the following:

> *"[…] national competent authorities might feel that central cancellation would damage their technical ability to supervise and restrict the use of GOs, and they could well be unwilling to have to rely on a party that is not under their competence to supervise (even if this is legally possible, which is not always the case)."*

As the option for a central cancellation database is assumed to in any case be a mid- to long-term solution and not really applicable in the short-term, it is somewhat difficult to assess the division of tasks between the national/scheme-specific registry and the central database. Here, two options are considered:

- Cancellation in a separate registry and transfer/Disclosure of cancellation information in the central database
- Central cancellation in a common database after transfer of certificates to the central database

The high-level steps for this alternative would be:

1. Cancellation process as described in the FaStGO 3.3-report mentioned above
2. Cancellation information to become available in the central database
3. Conversion Issuance registry accessing the cancellation data for Input energy cancellation validation and Attribute access

From a technical perspective it is essential to design the central database interface so that accessing and managing processes moved to the central database are as efficient and easy to use as possible.

[3] https://www.aib-net.org/news-events/aib-projects-and-consultations/fastgo/project-deliverables

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However, as mentioned above, there are high concerns about delegating/moving national Issuing Body actions to a central database. Additionally, the cancellation information format should be selected to serve the connecting registries in the best possible way. Here, the logic is rather similar to the option in chapter 5.1.2, where electronic cancellation statement is exposed via an endpoint (instead of sending it).

From the point of view of the Conversion Issuance, a positive aspect would be that the conversion Issuing Body, like all other issuing bodies, would have up to date knowledge about the amount and quality of cancellations for different schemes and Energy Carriers via the central database. This ability to keep track of the otherwise bilateral ex-Domain cancellations would probably reduce the supervision and administrational loads of the Issuing Body, in case the direct-import option would not be chosen. The following section will go into a deeper assessment.

5.2 Process Assessment of cancellation options for Conversion Issuance

This part of the report assesses the four cross-registry information transfer options against a common criterion. The goal is to give an assessment-based recommendation for implementation from the technical point of view and describe the differences between the options. Also, based on the assessment, the main hurdles for implementation are listed and potential actions to overcome these hurdles are drafted.

The assessment is done for the following criteria:

Process assessment:

- Needed manual work effort
- Automation potential
- Process reliability
- Process efficiency
- Process scalability
- Related risks
- Applicability as a short-term solution
- Applicability as a long-term solution
- Ex-ante vs. ex-post cancellation suitability

Technical implementation assessment:

- Technical implementation effort
- Technical efficiency
- Robustness to future changes

As the alternatives for cross-registry processes differ significantly and the number of involved stakeholders is high, evaluation is done on a five-point-scale:

1.		Most negative assessment
2.		Somewhat negative assessment
3.		Neutral
4.		Somewhat positive assessment
5.		Most positive assessment

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After the assessment of the different criteria, the main positive and the main negative aspects are listed for each alternative and presented in the beginning of the assessment section.

The following chapters will present and discuss the assessment for different cross-registry alternatives as well as give a brief overview of the suitability of the proposed alternative in short term and long term.

5.2.1 Ex Domain Cancellations

The ex-Domain cancellation option, as described in section 5.1.1, consists of a regular cancellation for which the cancellation statement document is sent to the Conversion Issuance registry as proof of sufficient cancellations done according to the Input energy measurement.

5.2.1.1 Main positive and negative aspects

ASSESSMENT	**Ex Domain Cancellations**
Main positive aspects	Theoretically suitable for very low volumes in the initial phases when the amount of manual work is preferable to solution development efforts needed in other options.
Main negative aspects	The highest amount of manual work. The lowest process efficiency. Risks of double counting through error and/or fraud.

5.2.1.2 Process assessment

As a short summary of the process assessment below, the option of using typical cancellation statements to match Input energy measurements would require high amount of manual work effort with a low potential for automation and efficiency. The alternative would cause significant delays in Conversion Issuance if implemented ex-ante and would be relatively better in an ex-post alternative. From the presented options, this alternative also poses most risks in terms of possible fraud and double counting. For very low volumes, the alternative could be used as an initial setup, for example in Conversion Issuance demonstration projects or proofs of concept.

PROCESS ASSESSMENT		**Ex Domain Cancellations**
Needed manual work effort	1	Compared to other alternatives, the needed effort to transfer cancellation information from the cancellation registry to the Conversion Issuance registry is significantly higher due to heavy reliance on manual work.

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Automation potential	1	Analysing PDF-format cancellation statements can be somewhat automated using AI-based tools but compared to more traditional integration alternatives between registries, this would require far more development effort. This is further increased since registries have differing cancellation statement designs.
Process reliability	1	As cancellation statements are sent as digital documents, like PDF files, the process is more fragile in terms of fraud detection and avoiding double counting.
Process efficiency	1	Due to the high amount of manual work in checking and transferring the cancellation information in each case, the processing time per unit is high. Additionally, improvements in efficiency are marginal as volumes increase.
Process scalability	1	Adding manual work in almost direct correlation to increased cancellation volumes is not viable.
Related risks	2	Fraud. Double counting. Inability to scale in proportion to demand.
Applicability as a short-term solution	5	In theory, if the cancelled volumes are very low, first Conversion Issuance -related cancellations could be transferred and approved using ex Domain cancellations. In fact, it is the only options that is applicable at the time of writing this report as all the other options require developments that are not yet in place at the time of writing this report. However, when considering the very low volume capability of this solution, it would not be recommended to implement even in the initial stages.
Applicability as a long-term solution	1	Low.
Ex-ante vs. ex-post suitability		Using ex Domain cancellation option ex-ante would cause a significant delay in the Conversion Issuance process due to manual tasks. In theory, for an ex-post alternative it could be more efficient if larger quantities of certificates could be cancelled at the same time. However, in the ex-post alternative, if required certificates for cancellation are heterogenous due to required Attributes, the manual effort needed would be significantly high.

5.2.1.3 Technical assessment

The technical implementation effort needed would be low if the process would mainly rely on manual work. In that case it would also be robust for future changes. However, the technical efficiency is also very low with very few options for improvement.

TECHNICAL ASSESSMENT		**Ex Domain Cancellations**

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Technical implementation effort	5	As cancellation procedures for ex Domain cancellations are assumed to already be available, and Conversion Issuance Input Energy Carrier cancellation checks are assumed manual, the development effort needed is lower than for the other alternatives. Some effort is however required in order to allow Conversion Issuance cancellations as well as a possibility for the conversion issuer to mark needed cancellation as checked.
Technical efficiency	1	Based on manual process.
Robustness to future changes	4	The technical implementation needed for Conversion Issuance-related cancellation does not significantly change even if the design of cancellation statements or cancellation process changes.

5.2.1.4 Main hurdles and possible solutions for implementation

The main hurdles for implementation are the high risks of fraud and double counting as well as the high required manual work effort. In theory, ex-Domain cancellation statements on PDF (or another traditional format) could serve only for an initial kick-start. They entail fraud risks like duplication of Attributes, and thus they jeopardise the reliability of the GO system. The risks can only be minimized by even more manual work by the issuing bodies which is already too high for any scalable implementation. Correspondingly, the survey amongst issuing bodies and registry operators showed clear and unambiguous standing against this option.

5.2.2 Ex Domain Cancellations with electronic cancellation statement transfer protocol

For an electronic transfer protocol of the (Ex Domain) Cancellation Statement, similarly to a traditional cancellation statement procedure, the GO cancellation for Input energy measurement is initiated and completed in another registry than the Conversion Issuance registry. However, the needed manual work effort is significantly reduced by transferring the information between registries in an electronic (machine-readable) format using a bilateral or HUB-based integration, or by making the cancellation information programmatically available (e.g., using APIs).

The below assumes that agreements for acceptance and cooperation are in place between the involved issuing bodies who manage the cancelled GOs and the Conversion Issuance, and from there onwards focuses on the technical aspects.

5.2.2.1 Main positive and negative aspects

Efficient and robust electronic cancellation statements solve some of the most problematic aspects of using a traditional cancellation statement. Additionally, the registries would not have to implement import and support for numerous new certificates they wouldn't normally have in their system (option 3).

However, it is up to the issuing bodies to determine which messages they allow at import into their database. A survey with 25 responding issuing bodies showed that 12 respondents see it unlikely to allow import of an (electronic) cancellation statement.

PROCESS ASSESSMENT	**Ex Domain Cancellations with electronic cancellation statement transfer protocol**

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Main positive aspects	A scalable and robust system if built similarly to the current certificate transfer system. May need less development effort compared to import-first option since full certificate/scheme support for all Energy Carriers is not needed - only the capability to import electronic cancellation statements.
Main negative aspects	Although better than traditional cancellation statements for ex Domain cancellations, it is hard to see this alternative as superior to the import first alternative, for which the transfer protocols are already developed and in use. This is because the workload to handle the import and exports of the electronic Ex-Domain Cancellation statements, is not substantially lower than for important export of living certificates for the other Energy Carrier, while there always remains risks of double counting when allowing transfer of 'dead' certificates.

5.2.2.2 Process assessment

The manual work for an electronic cancellation statement alternative is significantly lower compared to PDF-based traditional alternative. Thus, also the potential for increases in efficiency and automation are higher. The process would be less prone to error and would rely more on automated validations and checks reducing the potential risks of fraud and/or double counting.

Here, the short-term option is assumed to be based on bilateral connections which would need a moderate amount of design and development as well as higher maintenance and administration. The long-term solution would include a transfer Hub for these electronic cancellation statements mimicking the current certificate transfer evolution between registries. Thus, the fully developed option would serve well as a long-term solution.

From a process point of view, the alternative where the cancelling registry would provide the cancellation information via a readable endpoint (like an API or online cancellation statement) would be similarly suitable for a longer-term solution.

PROCESS ASSESSMENT		**Ex Domain Cancellations with electronic cancellation statement transfer protocol**
Needed manual work effort	4	After initial development and setup, the needed manual work is relatively low. In this option, however, initially it could be that there is no central transfer hub or proxy to transfer these electronic cancellation statements and registries should most probably implement this transfer as bilateral connections first. This will require work during acceptance criteria setup and agreement phases,

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		which increases in proportion to the number of connected registries.
Automation potential	4	Can be automated. However, compared to current import-export options available the needed setup phase work would be higher.
Process reliability	4	After the setup phase, the process itself is reliable. However, centralized tracking of cancellations would not be possible without a hub or a common database. For transparent oversight, it would need an agreement by the involved issuing bodies to not further transfer the cancellation statement beyond the destination registry.
Process efficiency	4	After the setup phase, efficiency is similar to bilateral transfer systems. If for any reason the cancellation however is not accepted in the target registry for Conversion Issuance, there is a risk of certificate loss at the cancelling Account Holder in the cancelling registry. This may come with extensive mitigation conversations requiring a lot of human attention.
Process scalability	3	Medium (if only bilateral transfer setup). Building and maintaining multiple distinct connections to multiple other registries will not scale well. Higher (if transferring the cancellations over a Hub that enables a one-to-many connection). If Hub transfer is possible, scalability is on a good level.
Related risks	2	A parallel transfer system between registries being built will have risks similar to a bilateral certificate transfer system. Sending cancelled certificates might create a risk of double counting if not carefully addressed. If for any reason the cancellation however is not accepted in the target registry for Conversion Issuance, there is a risk of certificate loss at the cancelling Account Holder in the cancelling registry.

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Applicability as a short-term solution	3	As cancelation and transfer functions are widely in use, their modification for electronic cancellation statement creation and transfer need moderate development effort. Agreeing on transfer protocols and/or facilitating transfer over a Hub would need significant effort, before an alignment between the relevant issuing bodies is reached and a harmonised solution is implemented.
Applicability as a long-term solution	4	If the design and development of the long-term solution would mimic the development of certificate transfer evolution, the later stage solution would be as efficient and robust as certificate transfer is today. To be considered whether a roll-back option would be needed and acceptable, to deal with non-accepted cancellations in the receiving registry.
Ex-ante vs. ex-post suitability		Preference for the ex-ante cancellation solution since cancellation statement information should be transferred automatically from the cancellation statement to newly issued certificates. Ex-post cancellation would need significant effort in cancelling the right certificates in the cancellation registry.

5.2.2.3 Technical assessment

The technical implementation effort is estimated to be relatively high. The evolution process from two-party bilateral connections to a fully functional cross-scheme and Energy Carrier Hub would be similar to the history of the current GO transfer between registries. (This has not yet reached the cross-scheme phase as discussed in REGATRACE D2.8). If the connections are built using a later-stage model (e.g., a Hub), the technical implementation effort per registry would be lower. To defend such centralised development however, this would need a clear market signal that shows a need for facilitating high transfer volumes for the electronic cancellation statements and a commitment for a higher initial investment by the stakeholders.

TECHNICAL ASSESSMENT		**Ex Domain Cancellations with electronic cancellation statement transfer protocol**

Technical implementation effort	2	For initial setup between distinct registries (bilateral transfers) would need medium effort as unique solutions, but significant effort if bilateral connections are created between multiple parties one-by-one. The effort should be used to create a hub-like solution, but there the initial effort also be relatively high.
Technical efficiency	3	Medium (if only bilateral transfer setup). Building and maintaining multiple distinct connections to multiple other registries will not be efficient. Higher (if using the Hub options). If a Hub-supported EDC transfer is possible, efficiency is on a good level.
Robustness to future changes	3	If the transfer protocols or message content would be changed it would require updates to both transfer functionality as well as updates in the registries.

5.2.2.4 Main hurdles and possible solutions

If built up gradually, the transfers of electronic cancellations would first be implemented as bilateral integrations between different registries requiring a significant amount of administration and agreement for recognition between issuing bodies. Alternatively, a more centralized implementation would require higher up-front costs.

Depending on the implementation, a risk of ambiguity can become relevant. A basic principle has always been that the ownership of GOs cannot be transferred after cancellation. This measure has been a big step forward in overcoming double counting risk in the first years of operation of the electricity GO system. The implementation should ensure that this principle is followed.

Lessons from the electricity GO sector have taught that a serious double counting risk occurs in sending around cancelled certificates. It is possible that the various intermediate holders of the cancelled GO make each their own claims regarding the origin of their consumption and subsequently transfer the same cancelled GO to another party. This risk of double counting has to be avoided by clearly finalizing the cancellation and only transferring the information about the cancellation – not be mixed with the transfer of certificates themselves after cancellation.

> Note: Transferring cancelled certificates, is against the current set-up of the Cancellation and Transfer concepts of the EECS Rules. Following EECS Rules section C7.1 Ex Domain Cancellations between members are only allowed on condition that the transfer over the AIB hub is technically impossible and where an Agreement exists between the involved issuing bodies.

5.2.2.5 Specific considerations regarding the use of electronic cancellation statements for Conversion Issuance

Disclosure supervision

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If cancellation is possible in another registry than the country of consumption, this may be applied on big volumes. This has an impact on Disclosure figures. It may need agreement by the Disclosure competent body of the country of consumption to decide whether such would be allowed.

Actions would be needed to:

- Take into consideration national legislative restrictions
- Make certain that the national Disclosure mechanism is properly adapted to the new cancellation practices, with all the relevant stakeholders included in the process and information loop
- Set up cooperation and communication mechanisms to ensure that competent bodies for Disclosure are timely and accurately informed about GOs cancelled in all Domains involved.

Regarding the last bullet, it should be agreed whether the cancelling registry should send the electronic cancellation statement to the Conversion Issuance registry or would it be sufficient to have the information disclosed and available via a readable endpoint (e.g., API or online cancellation statement) as described also in chapter 5.1.2.

Scheme changes

Allowing for a practice like this, will require adding conditions for it in the certificate scheme. The principle of the scheme may need to be revised for allowing cancelled certificates to be transferred and strong risk mitigation measures need to be installed.

5.2.3 Import certificates to the Conversion Issuance registry for all Energy Carriers

As discussed in chapter 5.1.3, importing the certificates to the conversion issuing registry before cancellation would utilize the existing integrations and technologies at optimal level. The issues mainly revolve around certificate transfer between schemes and registries that don't otherwise support the schemes and/or Energy Carriers of the imported certificates.

The subject of certificate transfer in this kind of cases is best described in REGATRACE report D2.8.

5.2.3.1 Main positive and negative aspects

PROCESS ASSESSMENT	**Import certificates to the Conversion Issuance registry for all Energy Carriers**
Main positive aspects	Most of the structure is already available within certificate transfer protocols. Least effort on the transfer infrastructure. Highest double counting prevention.
Main negative aspects	The ability of certificate registries to handle other Energy Carrier certificates than the issuing body is mandated for.

5.2.3.2 Process assessment

Certificate transfer is already widely in use and expected to be further developed during the coming years via introduction of higher volumes of new Energy Carrier certificates. Therefore, the option to first import certificates before cancelling them as proof of the Input for Conversion Issuance, is highly efficient and robust compared to other options. Having the cancellation in the same registry with the

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conversion issuing prevents typical risks of double counting and immutability as well as follows the existing requirements for cancellation procedures. This saves substantially on alternative risk mitigation measures and therefore outweighs the downside of the needed effort for certificate recognition across registries.

PROCESS ASSESSMENT		**Import certificates to the Conversion Issuance registry for all Energy Carriers**
Needed manual work effort	5	As the solution uses already available functionalities and Attributes from cancelled certificates are transferred automatically to newly issued certificates, the required manual work is low.
Automation potential	5	Compared to other options, the heaviest IT-development part, being the information transfer between registries, is already handled in certificate transfer (import).
Process reliability	5	Since certificate transfer systems (through a Hub) already have anti-fraud and backtracking measures implemented, the Conversion Issuance IB can assume uniqueness and system robustness.
Process efficiency	5	Efficiency would mainly be dependent on the registry provider solution for linking cancellation and Conversion Issuance since other parts of the process are the same as now.
Process scalability	5	Would not require additional effort in terms of cross-registry information transfers.
Related risks		General system development risks that are applicable for all alternatives such as errors in Attribute Inheritance from cancellation to Conversion Issuance.
Applicability as a short-term solution	3	The requirements are mostly already met, and design and development efforts are needed mainly for updates within registries.
Applicability as a long-term solution	5	The most suitable solution in terms of the number of applications to be maintained.
Ex-ante vs. ex-post suitability		Preference for the ex-ante solution, since cancellation information should be transferred automatically from the cancellation to newly issued certificates. Ex-post would need effort in finding correct certificates from different registries, import them to the issuing registry, and a solution to verify cancellation Attributes against issued certificates.

5.2.3.3 Technical assessment

The technical implementation effort is mainly needed for importing the other Energy Carrier and/or scheme certificates into the registry. Avoiding parallel information transfer channels for certificates and cancellation information improves technical efficiency and robustness to change.

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To facilitate the import of certificates of another Energy Carrier than then the ones issued by the relevant Issuing Body, the related data fields of these certificates need to be readable and storable in the importing registry.

The user interface of the registry shall make visible what type of certificate (and Energy Carrier) the Account Holder has in portfolio and facilitate correct selection of certificates for cancellation with the dedicated Purpose of Conversion Issuance.

TECHNICAL ASSESSMENT		**Import certificates to the Conversion Issuance registry for all Energy Carriers**
Technical implementation effort	3	The solution would need development in the importing Conversion Issuance registry, but not in cross-registry transfers. The solutions would rely on current and future certificate transfer options between registries. The user interface should display to the Account Holders of the imported certificates the Energy Carrier of the imported GOs and facilitate the selection of these certificates for cancellation for Conversion Issuance.
Technical efficiency	5	The lowest number of systems to be maintained. No parallel transfer protocols.
Robustness to future changes	5	Least number of additional changes compared to current systems.

5.2.3.4 Main hurdles and possible solutions

The main hurdles of this alternative lie in cross-registry support for different certificates as the registries will need to import them before cancellation. The effort in design should be moderate since imports have already been widely developed and utilized with industry standards and best practices.

The main solution to the issue constitutes of moving towards a single format for GOs, and for energy tracking certificates in general. Maintaining a single Hub for cross-registry transfer of certificates of multiple Energy Carriers and for multiple Purposes reduces the needed number of integrations per registry. The subject is closely related to what is set out in REGATRACE report D2.8: where D2.8 focusses on the import of gas certificates that are issued under different schemes; similar solutions work for importing certificates of all different Energy Carriers.

Questions could arise whether gas GOs can be cancelled in a registry of an electricity-only Issuing Body (or vice versa), for claiming normal gas consumption. This risks to confuse the overall Disclosure supervision exercise for the respective Energy Carrier (here gas). Therefore, it is recommended that where GOs are imported in a registry of an Issuing Body of another Energy Carrier, their cancellation is only allowed for the purpose of Conversion Issuance. Also, it is relevant to inform the competent body/ies for supervision of Disclosure of the statistics of GOs, per Energy Carrier, that were cancelled for the purpose of Conversion Issuance. This prevents double claims and errors in statistics of overall consumption Disclosure.

5.2.3.5 Conclusion

This option to first import certificates before cancelling them as proof of the Input for Conversion Issuance is the most logical mainstream implementation. Liability is clearly allocated for all processes and cross-registry integrations would maximally utilize the existing infrastructure without parallel information transfers for certificates and cancellations.

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5.2.4 Central cancellation database

A central cancellation database would make bilateral cancellation information transfers redundant by providing a common database to store the cancellation information. Registries would connect and retrieve the needed Input energy cancellation data from this database to match the required volume.

5.2.4.1 Main positive and negative aspects

From a technical point of view, the central cancellation database would in theory be an excellent alternative for the long-term solution, despite high development and administrative effort. However, national competent bodies would have to move some of their responsibilities to a centralized international system, which makes it hard to implement the alternative in practice (as long as the EU has delegated this responsibility exclusively to the Member States). Management of cancellation data may be integrated with other information management systems or services that are available only at national level, which may make it hard to disentangle the certificate cancellation information management from the rest of the national certificate management process.

PROCESS ASSESSMENT	**Central cancellation database**
Main positive aspects	Centralized database for commonly used information as a long-term solution.
Main negative aspects	High development effort, high cost. Member States letting go of their control over the management of cancellation data.

5.2.4.2 Process assessment

When fully implemented, the alternative would be technically efficient and robust. The efficiency would be gained from reduced number of needed integrations and central management of cancellation information. Robustness would benefit from all parties using the same system with same formats and change procedures and updates. However, it should be noted that the central database would have to be used by most of the registries to result in the mentioned benefits.

PROCESS ASSESSMENT		**Central cancellation database**
Needed manual work effort	4	Expected to have the process automated once the central cancellation database has been implemented.
Automation potential	5	Expected to automatically have the cancellation information sent to the central database after cancellation in any connected registry.
Process reliability	5	A centrally monitored system with anti-fraud and other similar features available.
Process efficiency	5	Expected to automatically have the cancelation information sent to the central database after cancellation in any connected registry.
Process scalability	4	Potential for covering cancellations in all joined registries. However, additional development effort needed per registry.

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Related risks	3	It may require a lot of work in agreeing between all the involved Issuing Bodies on the exact specifications and thus implementation may be delayed.
Applicability as a short-term solution	2	Due to high up-front effort needed the short-term suitability is low.
Applicability as a long-term solution	4	Higher.
Ex-ante vs. ex-post suitability		Preference on ex-ante since Conversion Issuance should most likely retrieve the needed Attributes before the issuing is done. Also, ex-ante is preferable in order to prevent double-booking of same cancellations.

5.2.4.3 Technical assessment

The technical implementation effort is very high before the database can be operational. After completion the technical efficiency should be relatively high due to similar and repeating structure for all connecting registries.

TECHNICAL ASSESSMENT		**Central cancellation database**
Technical implementation effort	1	High.
Technical efficiency	4	Sending and storing the cancellation information in a central database would most likely be efficient. However, booking cancellations for Conversion Issuance and retrieving the Attributes design might affect the overall efficiency.
Robustness to future changes	5	As registries connect to one database, the change management can be done efficiently.

5.2.4.4 Main hurdles and possible solutions

The main difficulties in implementing the central cancellation database on the technical side are the high up-front effort needed for the system. Also, the system should be in wide use before full benefits can be achieved. Also, it should be considered that the system may interfere with national Disclosure supervision practices which can make the option less attractive for the needed stakeholders.

5.2.4.5 Ex cursus: the Union Database as Central Cancellation Database or handling electronic Ex-Domain Cancellation Statements?

For the Union Database, as is under development in relation with REDII art. 28.2, the above assessed concepts of electronic cancellation statements or of a centralised cancellation database might be for consideration. To ensure avoidance of double counting of gases recorded in the registry, a link with any gas GOs issued for the respective gases would be needed. To avoid double usage claims of the gas, at the point of end consumption of gaseous energy, it should be ensured that a consumed consignment of gas registered in the Union Database, links with the cancelled GOs originating from this consignment.

Some considerations:

- At metalevel, there is a benefit that (all/part of) cancellations are in scope in one single monitoring system. This reduces the workload for manual transactions related to EDC for technical reasons and is a possibility to inform Disclosure competent bodies in a harmonised way.

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- *There may be a disadvantage for issuing bodies that would prefer to install more advanced cancellation mechanisms (like matching cancellation with a month or hour of consumption)*
- *Cooperation and communication mechanisms are needed to ensure that Competent Bodies for Disclosure are timely and accurately informed about GOs cancelled in all Domains involved for consumption in their country, for which they supervise reliability of origin Disclosure.*
- *Also, it is yet unknown what kind of technical interfaces are eligible to connect to the UDB*

5.2.5 Chapter summary

In this chapter the different cross-registry alternatives for cancellation information transfer in Conversion Issuance were explored. The assessment of different alternatives was done on process and on technical level.

Out of the four options, using traditional ex-Domain cancellations with typically pdf-format cancellation statements was seen as the least applicable solution, though it has the highest short-term applicability. Roll-out of this alternative at scale would expose the system to risks of fraud and double counting and would require highest amount of manual work effort from Account Holders and issuing bodies with very limited options for automation. The only scenario where the alternative could be suggested is the very initial proofs of regulatory concept of the process where volumes would be very low and hands-on involvement of issuing bodies and other stakeholders would be anyway high.

The other three options would better suit situations where Conversion Issuance volumes as well as related Input energy cancellations would rise to levels where automation and process efficiency need to be increased.

The option of using an electronic cancellation statement would allow cancellation and issuance to occur in different registries with a possibility to transfer the information electronically/automatically. The implementation would require registries to agree on and develop a new format for the information transfer which could, at least initially, lead to different implementations for different bilateral or scheme-specific arrangements. The evolution of this option could look similar to certificate transfers with more centralized and automated options emerging with growing volumes. This would also mean that the design and development would be repeated multiple times as different options become viable and profitable unless a centralized approach can be agreed early in the process.

The third and preferred option, importing the certificates into the Conversion Issuance registry first, can avoid such cyclical development by fully utilizing the already-existing infrastructure. This will free resources to further solve the current issues in cross-registry, cross- energy source, and cross-scheme certificate transfers as identified in REGATRACE report D2.8. The option however builds upon conditions that would need to be in place: The registries and issuing bodies need to support importing certificates for Energy Carriers and schemes for which they don't issue certificates themselves. This would result in additional system requirements and changes as well as some additional administrative tasks for the stakeholders, especially the Issuing Body. Where GOs are imported in a registry of an Issuing Body mandated for issuing only certificates of another Energy Carrier, it is recommended that their cancellation is only allowed for the purpose of Conversion Issuance.

The final option of introducing a central cancellation database would require high amount of resources for design and development but also for stakeholder collaboration as the issuing bodies would need to agree on and maintain a common framework for storing Attributes of cancelled certificates. The option would most likely be feasible in the longer perspective at a time where Conversion Issuance volumes would be high enough to make such high resource needs feasible (or if it serves other needs of the energy certificate market, beyond carrier conversion, see Chapter 5.1.4). Also, there may be

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scepticism toward the central database option as competent bodies should transfer parts of their responsibilities to a common authority.

6 Issuing GOs with Attributes of cancelled GOs

This section discusses the rules and challenges of Conversion Issuance certificate Attributes that depend on the Attributes of the cancelled certificates for the Input energy (see REGATRACE report D4.3). In chapter 5 of the D4.3 report, one of the identified challenges was summarized as "*Issuing the GOs for the new Energy Carrier: transfer data Attributes from the cancelled GOs.*" In brief, the challenge is that while it is possible to transfer all information to issued certificates, the complexity of this process increases rapidly as inherited data expands to cover multiple Attributes.

This section assumes that registries with normal issuing processes for GOs are in operation and focuses merely on the needs for the case of Conversion Issuance. Verification guidelines for Conversion Issuance process can be seen in detail in REGATRACE report D4.1. for the conversion routes Power-to-Gas, Biomethane-to-Bio-LNG and Biomethane-to-Biomethanol.

6.1 Process of GO Issuing following Energy Carrier Conversion

All certification schemes considered in this report have well established and clear rules and requirements in place for certificate issuing. The rules and issuing processes are documented within EECS Rules, ERGaR CoO Scheme Rules, and CertifHy Scheme.

6.1.1 Ex Ante: Cancelling GOs BEFORE Conversion Issuance is needed for accurate Attribute Inheritance

In this part of the report, it is assumed that the Attribute Inheritance takes place in an ex-ante alternative where the cancellation of GOs according to measured Input energy occurs prior to the Conversion Issuance and the Attributes from the cancellation are available during the issuing.

In the ex-post alternative, the issuing would happen before the cancellation. The issuing body could for example require reserving an amount of live GOs for later cancellation on a specified account similar to some certificate-based support schemes. It would be possible to technically link the cancellation to a prior issuing and also check the feasibility of input and Output volumes summing them over a set time period. However, the Attributes would not be copied from cancellation to Conversion Issuance. Thus, the ex-post alternatives are excluded from this chapter.

6.1.2 Different alternatives for Attribute Inheritance

Regatrace report D4.3 presented different Attributes that should be copied from cancelled certificates to the newly issued ones as well as Attributes for which the inheritance should be considered when feasible. The alternatives for Attribute Inheritance logic are described below and include:

1) New Attributes (New information solely after conversion)
2) Linking Attributes (Links between cancellation and issued certificates)
3) Directly copied Attributes (Attributes that always remain the same in cancelled and issued certificates)
4) Cumulative Attributes (Attributes that should be summed from the cancelled certificates and conversion process)

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5) Additional Attributes (Attributes to store pre-conversion information apart from after conversion information)
6) Label information

Figure 9 below illustrates how Attribute Inheritance can look on the GOs after Conversion Issuance.

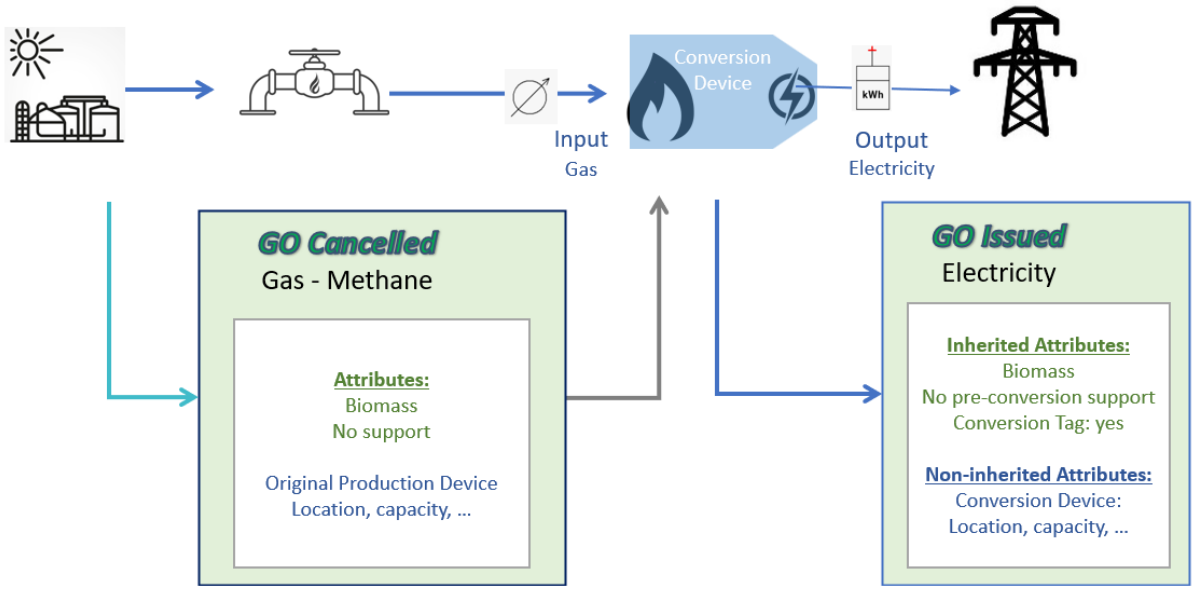

Figure 10: Illustration of Attribute Inheritance

6.1.2.1 New Attribute - Conversion Tag

As stated in REGATRACE report D4.3, the new GOs issued following Energy Carrier Conversion should inform that the GOs were issued as a result from Energy Carrier Conversion. This "*Conversion Issuance tag"* should be added as a new Attribute to the Conversion Issuance device as well as the issued GOs. The Attribute does not need input from cancelled certificates and should be added to all GOs issued for Energy Carrier Conversion.

6.1.2.2 Link to the cancellation

In addition to the Attribute for indicating Conversion Issuance, it may also be beneficial to store the information about the ID or other unique identification for the cancelled certificates as an Attribute in the newly issued certificates. This would significantly help to backtrack and audit Conversion Issuance procedures – especially in cases of multiple involved registries.

However, constructing and storing logic required for this kind of link on a certificate can be complex and require significant effort.

Easier to implement, and equally facilitating verifiability, is to store the information about the cancelled certificates to the conversion issuing event in the registry (e.g., in the place where Meter Reading data is stored) and keep a record of related Cancellation Statement(s) without adding it to the tradeable certificate.

6.1.2.3 Directly copied Attributes

As described in REGATRACE D4.3 the Attributes of energy source and purpose should be copied to the newly issued GOs as they are, without changing their value. For example, the energy source of the issued GO in Conversion Issuance should match the energy source of the cancelled input GO. In the

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case of cancelling GOs with different energy sources, the issued GOs should maintain the relative shares of different energy sources after the Conversion Issuance.

The technical implementation of this alternative would be rather straightforward as in the simplest form it would mean matching the cancellation Attribute to the issued GO Attribute forming inheritance pairs.

6.1.2.4 Cumulating Attributes

One of the Attributes needing dedicated attention and growing in significance is the information about the carbon emissions of the produced energy. In the case of Energy Carrier Conversion, the number of emissions allocated to one unit of Output energy should include the emissions from the original energy production of the primary energy source as well as the emissions resulting from the conversion process. Thus, the overall value added as an Attribute to the Conversion Issuance certificate should cumulate over each cycle of conversion.

For this kind of Attribute Inheritance, the structure (schema) of the issued GO does not have to be altered since, similarly to the previous chapter, the needed Attributes should already be present in the certificate format (meaning that the cancelled and issued GOs both have a dedicated Attribute to store carbon emissions' value).

Complexity of conveying carbon emissions information in Conversion Issuance

The process for cumulating information about carbon emissions are IT-technically rather simple. The registry should receive an emission factor from the cancelled certificates which can be used as the emission factor for Input energy. The logic is similar in the case of multiple different GOs used in Input energy cancellation or partial cancellation for the Input energy - the emission factors should simply be allocated in correct proportions for the issued certificates.

Also, adding the information about emissions from the conversion process and possible other sources, like transportation, can be technically implemented with rather low complexity or needed calculation capabilities of the system.

However, the complexity and/or needed effort stems from the requirements of the cumulation calculation needed to determine the new Attribute value. It needs an agreed common methodology for calculating such cumulated values. As discussed in report D4.3 for carbon emissions:

> *"To determine a meaningful carbon footprint to be recorded on a GO however, this carbon footprint is recalculated upon issuance of the new GO after conversion, and it needs to take into account both the carbon footprint of the conversion process and of the original energy input into this conversion process (and potentially of other processes like transport). The carbon footprint information is in fact carried to the newly issued GOs but not directly copied from the original GOs.*
>
> *This only works if the same methodology and supply chain scope for the carbon footprint calculation are applied for both the cancelled GOs for the input carrier as for the GOs resulting from Conversion Issuance."*

Defining and storing the information about matching methodologies and calculation scopes may need high levels of manual effort with little possibilities for automation. Especially in cases where the cancellation and Conversion Issuance take place in different registries, only the Attribute value of carbon emissions may be transferred to the issuing registry without extensive information about the calculation and/or scope.

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In short, executing the emission calculation procedures themselves is assumed to be rather simple in nature, but determining and agreeing the methodology and, documenting and storing the data them in a manner that would ensure transparent and reliable emission factor cumulation with common rules and scope can require significant amount of effort.

6.1.2.5 Additional Attributes informing on pre-conversion Attributes

From the process logic perspective, one of the more complex alternatives arises when the cancelled GO and the issued GO have the same Attribute but would need to populate it with different values. The difference compared to the cumulation in the previous chapter would be that the values are not calculated but determined.

The main example under discussion here is the information about received public support. In an example case where the wind energy, cancelled for energy input, has received investment support and the energy Conversion Device has received no support. The question arises whether to give the relevant Attribute a value of “no support” (different from D4.3 alternative for “no public support ever given”), “investment support”, or “production support” (if previous "investment support" and "production support" are both considered as “production support” after Conversion Issuance).

Although the determination may not require extensive case-specific calculations, the logic for determining the correct information for the Attribute value may become very heavy and inefficient as different cases will have to be manually added. The effect is multiplied when cancellations for Input energy consist of GOs with different values for the considered Attribute.

A dedicated data field on GOs that records pre-conversion support-info, may satisfy the need for information set by certain governmental mechanisms. It comes however with a technical challenge, particularly dealing with multiple types of cancelled GOs for Input. As the Output from Energy Carrier Conversion is normally lower than the Input, there is no one-on-one relation from Input GOs to Output GOs. A proportional allocation of Input Attributes to the Output Attributes is therefore needed. This becomes particularly challenging when a residue is to be conveyed to the next production period. At some point there will be a cut-off of information for Output fractions lower than the GO face value (generally: for the fractions lower than MWh).

6.1.2.6 Label information

As discussed in REGATRACE report D4.3, additional Labels (e.g., sustainability Labels) should independently determine whether certificates from an energy Conversion Device should receive the Label.

If the Label is granted to a Conversion Device without requiring the cancellation of certain type of certificates for Input energy, then the implementation design and logic are similar to the current Label handling. However, if a Label is only granted after confirmed cancellation of certain type of certificates, the design and implementation will be more complex.

In case the Labels for cancelled Input energy certificates and issued energy conversion certificates are different (or independent) and should both be recorded on the issued certificates, then the logic would be similar to what is described in the previous chapter 6.1.2.4.

6.1.3 Assessment of copying of various Attributes to conversion GOs

The following table presents a list of possible Attributes to inherit or copy from the cancelled GOs to the issued GOs during the Conversion Issuance. The type and complexity of the process are assessed from the technical implementation effort and complexity point of view.

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The list is not considered to be exhaustive but to present examples of different Attributes.

ATTRIBUTE	TYPE	COMPLEXITY	EFFORT	COMMENT
CONVERSION TAG INFORMING THAT THE GO WAS ISSUED AS A RESULT OF ENERGY CARRIER CONVERSION	New Attribute	Low	Low	With no required link to cancelled certificates, the complexity and effort for implementation are estimated to be low.
LINK TO CANCELLED GOS (ID OR SIMILAR UNIQUE IDENTIFIER)	New Attribute	High	Medium	A link to the cancelled certificates required moderate effort and may need a highly complex solution as the registry should determine which certificates to link to which cancellation. The complexity and effort might be reduced if the link to cancelled GOs is stored in the registry (e.g., in meter readings), but not in the issued GO.
ENERGY SOURCE	Directly copied Attribute	Low	Low	The implementation may need moderate effort, but complexity is reduced due to the clear calculation and allocation rules defined in previous reports.
PURPOSE	Directly copied Attribute	Low	Low	Effort and complexity are reduced due to an assumption that only the same purpose GOs are cancelled in a single case.
CARBON FOOTPRINT	Cumulative Attribute	Low	Medium (/High)	As information needed for calculation can vary highly between cases the complexity may be high. Effort assumed to be moderate since many of the calculation procedures are assumed to be reused.
SUPPORT	Additional Attribute	High	High	The logic for determining the final combination may need high effort from the Issuing Body. In cases of variable-Attribute Input energy cancellations, the complexity can become very high.
LABELS	Additional Attribute	High	High	The case for inheriting and recording all Labels automatically to the Conversion Issuance certificates.

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LABELS	Independent Attribute	Low	Medium	The case for determining Label-applicability on energy Conversion Device level without automatic inheritance. The Label is granted to the Conversion Plant regardless of the Labels in the cancelled GOs of the Input energy.

The above-made assessment results may be vary depending on the chosen process and registry designs as well as additional requirements introduced to the alternatives. Thus, this assessment should be considered as a high-level guideline to point out possible (and probable) differences in Attribute Inheritance complexity and effort.

The options above only consider conveying a single Attribute content from the cancellation to issuance with possible required measures of updating the content. However, it is crucial to note that if the inheritance of Attributes is done over a set of cancelled certificates with different Attribute values and multiple Attributes are to be inherited, the process will exponentially increase in complexity and effort needed.

Additionally, when deciding on Attribute Inheritance, the handling of residue or leftover on the Output energy side may produce additional inefficiencies and increase the design and implementation effort significantly. REGATRACE report D4.3, as well as the reviews of this report, repeatedly noted that having a Conversion Issuance with some of the Attributes being inherited to leftover shares (leftover shares here meaning the residue under 1 MWh or a standard unit of one certificate) would create a situation where the number of these different shares could grow significantly. The examples of this are also presented in chapter 6.3.

6.2 Process of conveying data from cancelled GOs to issued GOs

The following chronologically listed requirements are needed on a high level to successfully convey data from cancelled input GOs to the newly issued conversion GOs.

6.2.1 Receive and import the cancellation data

As discussed in previous chapters, an Issuing Body should clearly agree on the methods and practicalities related to receiving, recognizing, and importing information about cancelled GOs. As presented in chapter 5, the cross-registry processes can vary, and different Issuing Bodies might require different approaches to transferring the information. The challenges of developing these integrations are discussed above in this report as well as in REGATRACE report D2.8 for the option of importing live certificates before cancellation.

6.2.2 Match Attributes from cancelled GOs to GOs following Conversion Issuance

The Conversion registry needs to map the Attribute values in cancellation Attributes to newly issued certificate Attributes.

In most cases, the relevant Attributes (like the energy source) are already included on the cancelled GOs. However, if information that is to be inherited is not found within the issued certificate schema structure it should be considered whether it can be derived from another Attribute. Alternatively, the issued certificate could link to the cancellation information where more information can be obtained from the cancelled certificates.

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6.2.3 Develop clear and harmonised Attribute Inheritance rules

As presented in chapter 6.1.2, conveying the Attribute values can be a straightforward task. However, for certain Attributes, the process can also include rather complex and heavy logical rules or calculations that can require a lot of initial effort to design and implement.

Especially in the initial stages of implementing Conversion Issuance, it can be beneficial to strive toward simple solutions where Attribute Inheritance does not leave room for different possible interpretations or doubt about the calculation scope or premises.

As stated in REGATRACE D4.3, it would be beneficial and efficient to study the consumer expectations and demands for inherited information before initiating heavy implementation. This could also harmonise the technical high-level principles between registries and avoid unnecessary rework as in later stages the consumer requirements would equally harmonise.

6.2.4 Define new Attributes

As marked in REGATRACE D4.3 and the chapter above, the issued GOs for energy conversion would need to explicitly communicate that their origin is in energy conversion. For that, a new Attribute was suggested, which could be called a 'Conversion tag'.

Additionally, process transparency and security will be improved if the information of the cancellation is available as a link in the issued certificate Attribute data.

This would require an update in the issued certificate/GO schema that can be difficult to achieve without strong argument to drive the cost of this change. For example, changing the EECS GO or ERGaR schema would require extensive technical rework in all relevant registries as well as a common understanding by the national competent bodies.

Note: The calculation examples containing different cases of Attribute Inheritance can be found in the Annex 2 of this report.

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7 Conclusions and Recommendations

7.1 Cross-registry processes related to cancellation for Conversion Issuance

When looking into the different cross-registry processes related to cancellations for Conversion Issuance, this report assesses four different approaches (see chapter 5):

1. Ex Domain Cancellations
2. Ex Domain Cancellations with electronic cancellation statement transfer protocol
3. Import certificates to the Conversion Issuance registry for all Energy Carriers
4. Central cancellation database

Although for the same purpose, the alternatives are very different by technical design. They differ in their usability and efficiency as well as the needed implementation effort and design complexity. When assessing the different alternatives, the expected Conversion Issuance volume over time should be considered as the alternatives are not all fit for automation and thus not fit for scalable solutions.

For being informed of cancelled certificates as input for Conversion Issuance, importing the living certificates into the issuing registry is the most logical implementation (option 3).

It can however only be implemented where following conditions are met:

1. Agreed recognition framework: There is a framework of certificate recognition for import where liability allocation is taken care of and where import quality criteria are satisfied, and
2. IT-infrastructure: The importing registry can facilitate the data field structure, and
3. Issuing bodies agree on the boundaries of further transfer of certificates of one Energy Carrier that are imported in a registry of an issuing body who issues only for another Energy Carrier, unless their processes are not equipped for facilitating otherwise. They may restrict the further transfer of such certificates and allow the usage of such certificates only related to the input for Energy Carrier Conversion.
4. When certificates of one Energy Carrier enter a registry of an issuing body who does not issue certificates for that Energy Carrier, they may only be cancelled for the purpose of energy conversion. Cancellation for Disclosure towards an end-consumer should remain possible only in the registry of the issuing body for the relevant Energy Carrier.

This import-first option will have the best balance of needed implementation and maintenance effort as well as security against fraud and double counting. The main positive aspect of this option is that most of the infrastructure needed for information transfer is already available within certificate transfer protocols and thus the option would require the least effort on the transfer infrastructure (out of the automated alternatives).

Recognizing that not all registries would be able or want to import new types of living certificates for cancellation into their system, the alternative of using electronic cancellation statements is seen as the second-best option, on following conditions:

1. Agreed recognition: Certificates are only cancelled towards registries that have agreed to receive them. The participating registries agree on the acceptance and format of the electronic ex-Domain cancellation statement so that information immutability is guaranteed after the transfer of the electronic ex-Domain cancellation statement, and double counting of Attributes is prevented; and

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2. Integrations: A suitable integration is designed and implemented between registries/issuing bodies allowing for automated and robust cancellation information transfer. It is set up in a way that reception leads to qualitative processing of the cancelled certificates in relation to the measured energy Input into conversion; with required status and error handling operations in place; and
3. The competent authority for supervision of Disclosure of the origin of energy towards consumers is being informed of the certificates that are cancelled for energy consumption in its Domain. The involved issuing bodies agree on how to ensure this communication and reporting line is established and maintained.

A harmonized data format for the information exchange is essential when dealing with multiple issuing bodies. Such format can be similar to the data format for transfer of living certificates. This involves a need for alignment between issuing bodies on the transfer data format and implementation of new robust processes for correctly sending, receiving and handling the imported information of cancelled certificates. On a technical level, the sought workload saving compared to facilitating direct import of certificates of the other Energy Carrier, may even result in a higher overall workload.

The third option, establishing a central cancellation database, is seen as a viable alternative in the longer time perspective as the required implementation and administrative work would only be justified if the demand (volume) for the Conversion Issuance would be sufficiently high.

The option of using traditional ex-Domain cancellation statements is not recommended as it exposes the system to risks of fraud and double counting. Additionally, the needed manual work would be unacceptably high when the volume increases. The only scenario where this could be utilized is in the very beginning or testing phase of Conversion Issuance, as it is the only immediately available option for issuing bodies of GOs for only one Energy Carrier. It must be noted that also for low-volume handling, the amount of manual effort and supervision is already high.

7.2 Conveying information from cancelled certificates to newly issued certificates after conversion

Chapter 6 of this report looked into the different alternatives of conveying information from cancelled certificates for Input energy to newly issued certificates after conversion. Supporting the recommendations of REGATRACE report D4.3, the energy source information of the cancelled GO is the most obvious and technically feasible information to carry forward when considering Attribute Inheritance.

For other available Attributes of the cancelled certificates, that cumulate information of cancelled certificates and the Conversion Device, or that relate to pre-conversion info, there may be higher technical challenges, depending on the overall implementation.

In principle, current registry technologies are fully capable of handling the needed calculation and storage functions for facilitating Attribute Inheritance from cancelled certificates to certificates issued following Conversion Issuance. However, if the number of inherited Attributes increases or Attributes are inherited following a high number of case-specific scenarios, the overall complexity of the system and the effort to record the needed scenarios (system pre-defined rules that define how Attributes are inherited) increase rapidly for the system user. This becomes worse if the system is required to handle leftover residues with specific Attributes allocated to them.

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It is thus recommended to aim to keep the Attribute Inheritance as simple as possible and limited to as little Attributes as really needed. The energy source is the basis Attribute to convey from Input to the Output of Conversion, and hence from the cancelled certificates to the certificates created following Conversion Issuance. At least in the initial stages, system design benefits from only including new Attributes to inherit if there is a clear consumer signal indicating the need for that specific information. New data fields on post-Conversion certificates are defendable for a Conversion Tag, and probably also pre-conversion support information and a link to the cancellation data that proves the Attributes for this conversion.

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Glossary

Account	record on a registry relating to a particular Account Holder in which GOs are held.
Account Holder	Person or organisation in respect of whom an Account is held on a certificate registry.
Attribute	Data field on a GO specifying the characteristics of an energy unit produced by a Production Device in terms of the Input(s) used and/or the details (standing data) of that Production Device and production process.
Attribute Inheritance	Process of conveying Attribute values from cancelled GOs to issued GOs in the process of Conversion Issuance.
CEN Standard EN16325	The standard on guarantees of origin related to energy, developed as CEN/CENELEC EN16325. This standard is under revision at the time of drafting this report.
Conversion Issuance, or GO Conversion Issuance:	Issuance of a GO for Output resulted from Energy Carrier Conversion, and for which GOs representing the Attributes of the Input to that Production Device have been cancelled.
Conversion Device	a Production Device producing Output resulting from Energy Carrier Conversion for which Conversion Issuance is being performed or requested.
Disclosure	Provision of information to a final customer on the share or quantity of the energy supplied to them as having specific Attributes.
Domain	Geographic area containing Production Devices with respect to which an Issuing Body is responsible for issuing GOs for the relevant Energy Carrier.
Energy Carrier	Substance or phenomenon that can be used to produce mechanical work or heat or to operate chemical or physical processes and the means by which it is conveyed; used in this document to collectively refer to Electricity, Heating, Cooling, Energy Gas and Hydrogen.
Energy Carrier Conversion (or energy conversion):	Production of an Energy Carrier in a Production Device from one or more Inputs including at least one other Energy Carrier.
Ex-Domain Cancellations:	Cancellations that take place in one registry (usually in one country), for use of the relevant Attributes in another.
Guarantee of Origin (GO)	Electronic document relating to the Attributes for a specific amount of energy Issued by an Issuing Body under a Domain GO Scheme with the purpose of Disclosure.
Issuing Body	Competent Body or Competent Body Agent responsible for:

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- registering Production Devices and Account Holders in a Registration Database.
- collecting measured values from Authorised Measurement Bodies.
- issuing GOs; and
- enabling and registering transfers and cancellation of GOs.

Independent Criteria Scheme (ICS) or Label Scheme: A scheme whereby a unit of energy meets agreed criteria set by the ICS operator (such as Naturemade or TUV SUD), which are additional to those established for the GO and this assignment is recorded on the certificate.

Input amount of energy from a specific energy source or material goods consumed by a Production Device for the production of Output.

Input Energy Carrier: The Energy Carrier that is fed into a Production Device for Energy Carrier Conversion.

Issue process of creating, as a GO, a record in an Account in a Registration Database.

Label Attribute on a GO reflecting that the Output and/or Production Device and/or Input to which a GO relates, conforms to a specific set of qualities defined in a Label Scheme, following an agreement between the Issuing Body and the corresponding Label Scheme Operator, in addition to those established for the GO.

Non-Governmental Certificate a voluntary equivalent of a GO, which is not issued in the framework of a legislative certification scheme.

Production Device separately measured device or group of devices that yields one or more Outputs from one or more Inputs, with one specific Technology Type.

Purpose The purpose of certification, including the objective for which the certificate was issued.

Output amount of Net Energy Production of a specific Energy Carrier yielded by a Production Device and measured by an Authorised Measurement Body in MWh.

REDII Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources.

Registry (or Registration Database) database operated by an Issuing Body or its Agent, comprising:

a) Accounts and the GOs in those Accounts;
b) standing data of Production Devices and information provided to the Issuing Body or a third party on its behalf in connection with the registration of those Production Devices; and
c) standing data of GOs which have been transferred out of that Registration Database

Residual Mix the mix of energy sources for energy supplied without being backed by cancellation of GOs or other reliable tracking mechanisms.

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In the European energy market, a Residual Mix is energy-carrier specific. The concept of Residual Mix is an integral part of the GO system for preventing double counting in energy source Disclosure.

Public Support (or Support) "Support scheme" (as defined in Article 2, paragraph 5 of the Directive 2018/2001/EC), meaning any instrument, scheme or mechanism applied by a State, or a group of States, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased, including but not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and sliding or fixed premium payments;

Technology Type (of a Production Device) type of technology used by the Production Device in generating Output from Input.

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Annex 1: Results survey “Handling certificates in relation to Energy Carrier Conversion”

REPORT OF THE RESPONSES TO THE QUESTIONNAIRE ON “MAPPING CHALLENGES FOR HANDLING CERTIFICATION IN RELATION WITH ENERGY CARRIER CONVERSION”

This questionnaire was directed towards issuing bodies and registry operators of energy certificate systems. They have received the minutes, slides, and the recording of the presentations of the workshop on March 11th, 2021. This provides the background information regarding the questions in this questionnaire. 20 organisations from 16 countries replied to the survey and this way contributed to determining optimal ways for handling of certificates in relation to Energy Carrier Conversion! (http://www.REGATRACE.eu)

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1 Participants

The following organisations participated in the survey. They perform following other role(s) in the process of GO issuing or cancellation:

COUNTRY	ORGANISATION
Austria	AGCS Gas Clearing and Settlement AG
Belgium	BRUGEL - Brussels Regulator for Gas and Electricity Markets
Belgium	Hinicio
Belgium	VREG
Bulgaria	Sustainable Energy Development Agency
Denmark	Energinet
Estonia	Elering AS
Finland	Grexel Systems
France	GRDF
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)
Germany	UBA - Germany
Lithuania	Amber Grid
Luxembourg	ILR
Netherlands	CertiQ
Norway	Statnett
Slovakia	SPP - distribucia
Spain	Nedgia
Switzerland	Pronovo AG
Switzerland	VSG
United Kingdom	Green Gas Certification Scheme

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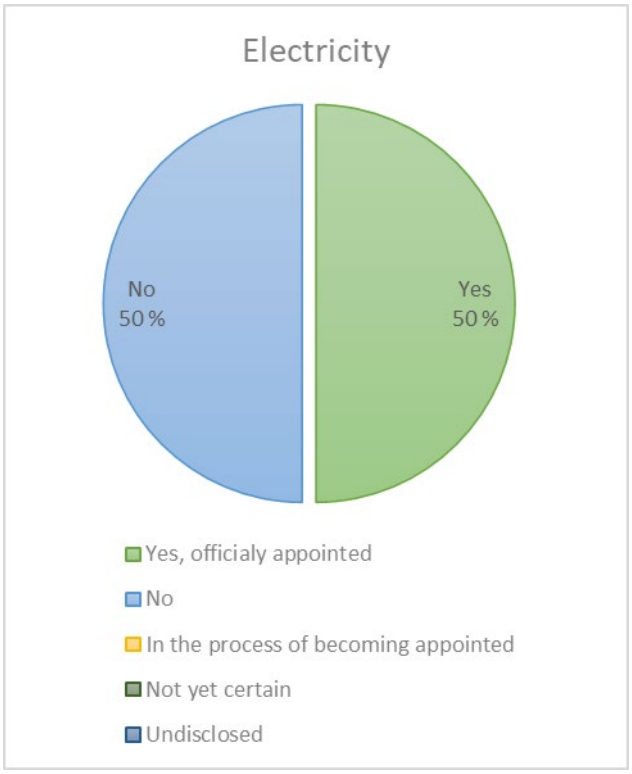
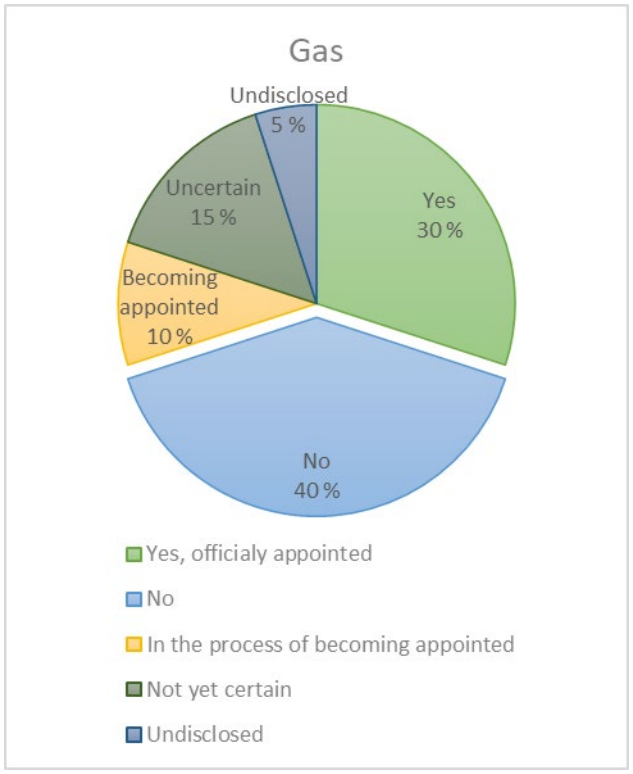
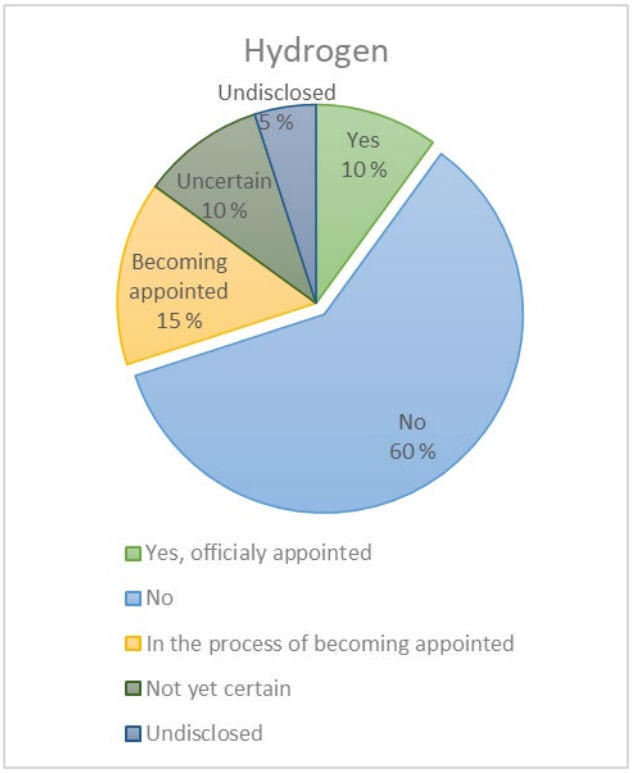
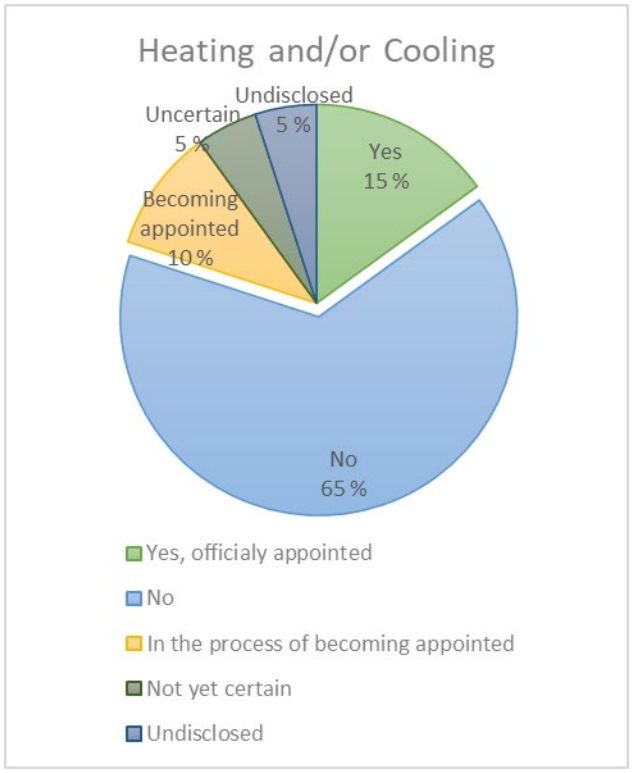
2 Information on the status and scope of your organisation regarding GO issuing

The following charts illustrate the organization's status and/or scope for being officially appointed by their government as Issuing Body for GOs concerning electricity, gas, hydrogen, and heating and/or cooling.









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Following organisations perform also another role in the process of GO issuing or cancellation:

COUNTRY	ORGANISATION	
Austria	AGCS Gas Clearing and Settlement AG	AGCS Gas Clearing and Settlement AG is the appointed operator of the Biomethane Registry Austria, issuing written proof of renewable gases injected into the Austrian natural gas grid. The original purpose of the certificates is their use as proof to receive the renewable power FiT. For other purposes of biomethane application, AGCS acts as production registry by providing the production/injection data to the respective authorised organisations, such as the Issuing Body for gas or the biofuels registry.
Belgium	Hinicio	"CertifHy provides an NGC scheme for hydrogen in Europe, together with two ICS (Labels) CertifHy Green and CertifHy Low Carbon. CertifHy currently pilots the CertifHy scheme by operating a Voluntary Issuing Body with Grexel. In the future, Hinicio will operate a EECS Compliant Voluntary Issuing Body for CertifHy NGC and CertifHy ICSs (Green & Low Carbon) under the CertifHy scheme. "
Belgium	VREG	"Disclosure to consumers, coordination between production registrars for different Energy Carriers Mind that in our legislation, hydrogen is viewed as a gas. There is no separate Issuing Body or GO Scheme for hydrogen in Flanders. "
Estonia	Elering AS	Elering is also the TSO of electricity and gas, national agency for subsidies of renewable electricity and gas, operator for metering data hubs of electricity and gas, operator of trading platform of transport sector certificates.
Finland	Grexel Systems	We are registry provider for all Energy Carriers, as well as participating in the development of certification of all Energy Carriers through our clients and projects.
France	GRDF	As of 2023, the Issuing Body appointed at the time (the current public service delegation being renewed in April 2023) will have to issue the GO, then organize auctions on the stock before cancelling the GOs.
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	We operate the German Biogas register that issues certificates for biomethane and biogas both on book & claim and mass-balancing systems. Users can transfer and cancel their certificates using our electronic registry. We are also capable of performing international transfers on a book & claim basis to other European countries, such as UK, Austria, and Denmark.
Spain	Nedgia	Nedgia is the Distribution System Operator leader in Spain
Switzerland	Pronovo AG	We are becoming appointed to issue also GHG and liquid Energy Carriers.
Switzerland	VSG	Renewable gas fed into the Swiss gas grid is tracked via Clearing set up by VSG at the direction of the federal authorities. Fuel taxes in the transport sector and domestic CO2-levy for heating purposes are waived for such energy quantities. This system will evolve in the coming years due to planned changes in federal legislation and may

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COUNTRY	ORGANISATION	
		lead to a unified national GO system for electricity, gas, hydrogen, and heating in the medium to longer term.
United Kingdom	Green Gas Certification Scheme	We are in a unique situation - currently the UK has no intention of appointing an Issuing Body for gas, H2 heating or cooling. that may change in 2022. For now, we are a market-based scheme issuing certificates for biomethane and bio propane

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3 Evaluating the existing rules for Conversion Issuance

3.1 Recap of the existing rules for Conversion Issuance

The slides from the workshop on 11 March 2021 provide for a recap of the existing rules for Conversion Issuance. Currently these are in the EECS Rules and in the CEN/CENELEC committee draft for the EN16325 standard on GOs. They imply that:

- 'Energy Carrier Conversion' refers to Energy Carrier Conversion, meaning the transfer of energy carried by one type of Energy Carrier into another type of Energy Carrier

- Conversion Issuance' refers to the issuance of a GO corresponding to Energy Carrier Conversion, and for which GOs representing input to that Production Device have been cancelled.

- For issuing of GOs following energy conversion, GOs of the Input Energy Carrier are to be cancelled. (Unless the Input energy is produced onsite and there are never GOs issued for it.

- An amount of GOs to be cancelled, corresponds to the measured amount of energy input into the Conversion Device. The maximum amount of GOs to be issued following conversion, relates to the measured amount of net Output from the Conversion Device.

- The newly issued GOs for the new Energy Carrier record at least the following data from the cancelled GOs for the original Energy Carrier, proportionally allocated from the input GOs to the Output GOs:
    - Energy source
    - Information on whether support was granted for the production or Production Device, and an indication on whether this was investment support, production support, both, none and unknown. This data is cumulated with information regarding support for the Conversion Device.
    - A Label may be carried forward if the Label scheme provider consents.
    - Carbon footprint information (which is optional information on a GO) may be carried forward.
    - The purpose (an input certificate for Disclosure enables issuing of an Output certificate that may be used for Disclosure).

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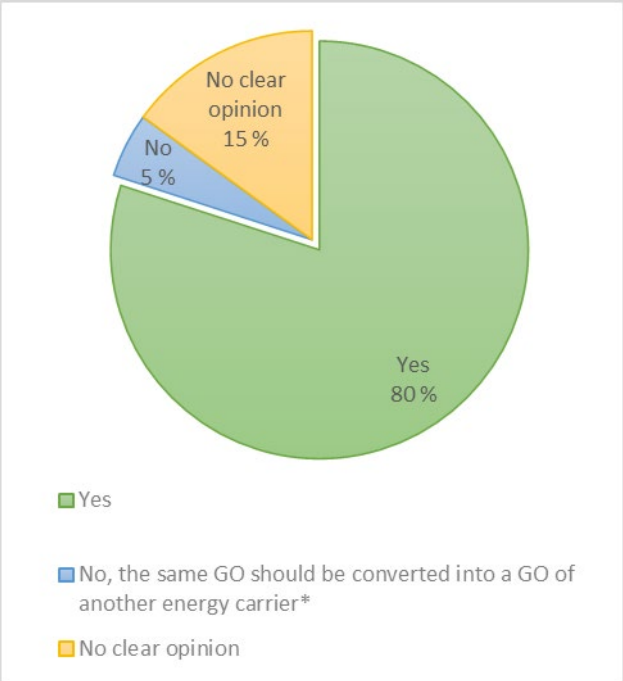
3.2 Do you agree that GOs of the Input Energy Carrier are to be cancelled and new GOs are to be issued? *(Note: the amount of Input energy can differ from the amount of Output energy from the conversion.)*



*Specification from Spain – Nedgia: Direct energy conversion, in terms of MWh.

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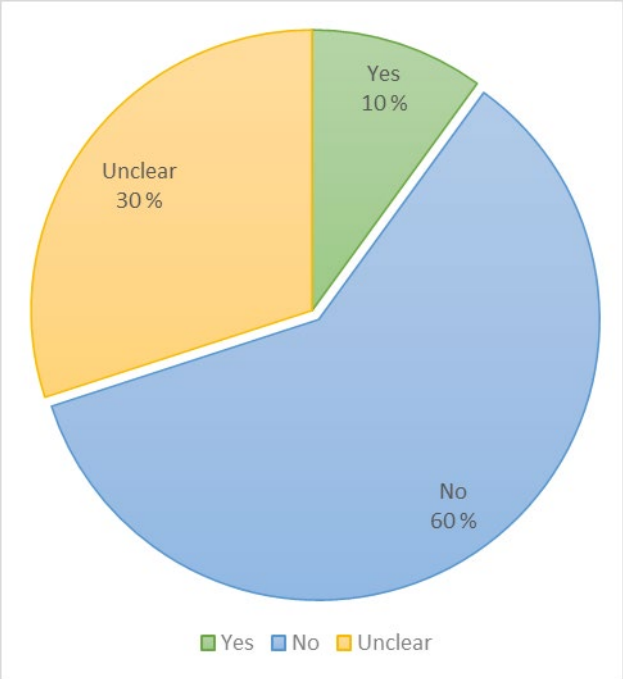
3.3 Are there specific procedures for handling GOs in relation with energy storage in your Country / Domain?



Those who have specific procedures for handling GOs, specified the high-level procedure for handling GOs in relation with storage as follows (e.g., What is the difference between energy storage and conversion according to your rules? Is storage considered as a Conversion Issuance process?):

COUNTRY	ORGANISATION	
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	In the Renewable Energy Ace (EEG), hydrogen is classified as “storage gas”. EEG provides state aid of reconverted storage gas in CHP plants according to the actual electricity source.
Switzerland	Pronovo AG	"It is only specified for electricity: Pump storage for hydro power plants. Procedures of energy storage for other Energy Carriers are in development (is unclear at the moment). "

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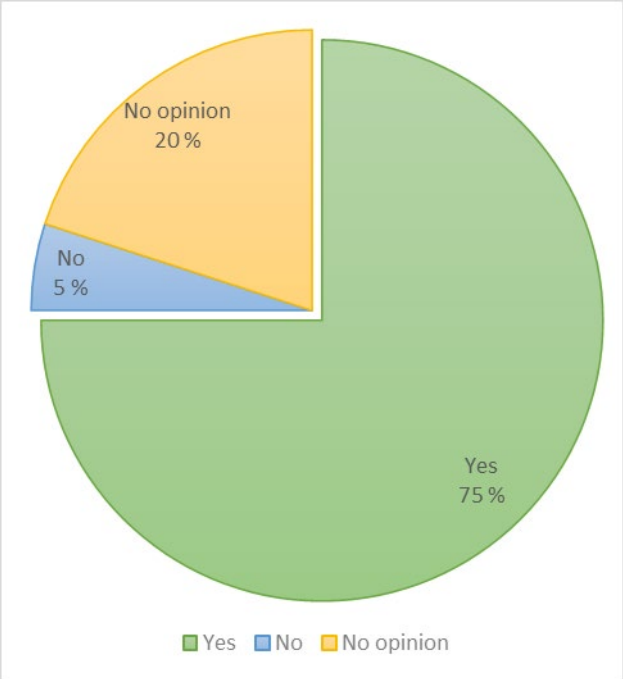
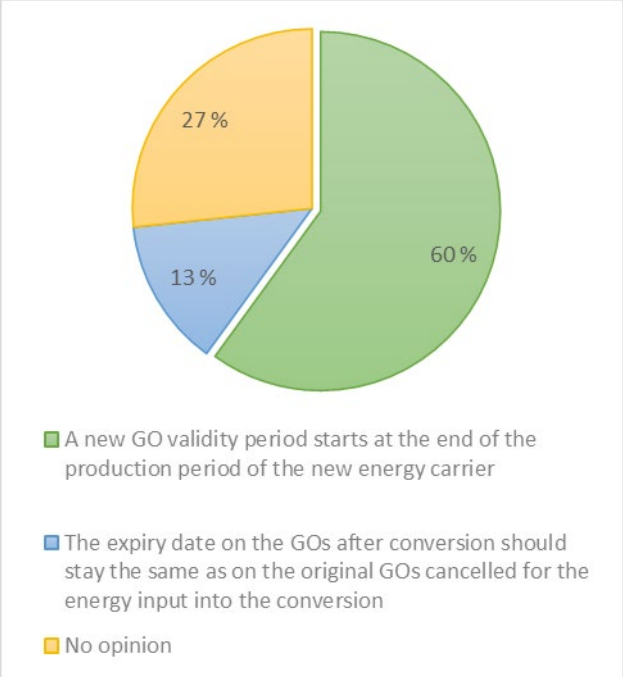
3.4 Should the expiry date for certificates issued after conversion be harmonized across Europe?



3.4.1 Resetting the production period

The organisations who answered 'yes', have following opinion on resetting the production period (and thus the expiry date) after Conversion Issuance:



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3.4.2 A new GO validity period

The organisations who answered *a new GO validity period starts at the end of the production period of the new Energy Carrier*, commented:

COUNTRY	ORGANISATION	
Austria	AGCS Gas Clearing and Settlement AG	Yes, any re-set should be harmonised among other application purposes to reduce "competition" between different application purposes (market segments)
Belgium	Hinicio	The CertifHy scheme, endorsed by the CertifHy Stakeholder platform, specifies that a CertifHy NGC expires 12 months after the end of the production period related to the H2 production batch.
Bulgaria	Sustainable Energy Development Agency	The approach should be the same as for guarantees without conversion and there is no reason to change the validity period.
Estonia	Elering AS	There's new primary energy, RED II rules apply. Suggestion to change the expiry of 18 months back to 12 months.
Finland	Grexel Systems	This is rather fundamental question on what kind of instrument we strive the GO to be. From my perspective the main quality of GO is to be an instrument for energy transition to renewables. Secondly, for this quality it empowers customer choice and funnels extra funding for producers. In this respect the main thing for Energy Carrier Conversion is to help the energy transition and channel money to best causes. For this, I consider limiting the lifetime to the original GO lifetime to be too restrictive for potential new solutions. The caveat of this production period extension is the possibility to play the system and for traders/speculators to hold their positions longer. Still, when physical conversion is required for GO conversion, I have hard time seeing it to be feasible to game the system.
Netherlands	CertiQ	An amount of energy has been consumed by the converting Production Device, and another amount of energy with new characteristics produced by the same device. It only makes sense to have the GO reflect the period of production of the converted energy.
Anonymous		It is the simplest and most robust solution that guarantees transparency and accuracy. In particular, it allows to take into account the fact that GOs with different expiry dates may be used, and that the new Energy Carrier might be stored (example: conversion of renewable electricity into hydrogen).

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3.4.3 The same expiration dates.

The two organisations who answered that *the expiry date on the GOs after conversion should stay the same as on the original GOs cancelled for the energy input into the conversion*, commented:

COUNTRY	ORGANISATION	
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	The expiry date should not be re-set after conversion of one Energy Carrier into another because that would allow the initial GO issued for a specific Energy Carrier to have almost indefinite lifetime as long as Energy Carrier Conversion processes can take place if the conversion losses are considered each time a conversion step takes place.
Spain	Nedgia	If it is only a GO conversion the period should stay the same.

If the expiry date on the GOs after conversion should stay the same, how to deal with the fact that the amount of input GOs and Output GOs differs, and that there may be a variety of production periods for input GOs? Which production period should count for the newly issued GOs after conversion?

COUNTRY	ORGANISATION	
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	The set of input GOs with the largest volume is determining the production period of the corresponding set of Output GOs.
Spain	Nedgia	Pro rata allocation of the production periods of the input GOs to the newly issued Output GOs.

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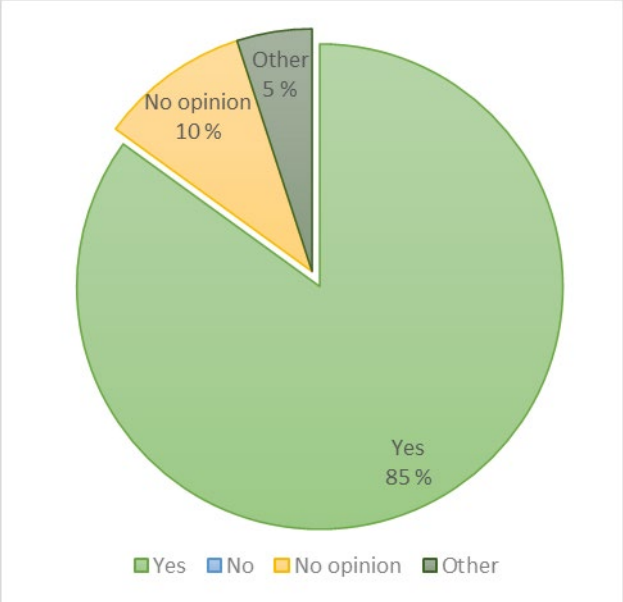
3.5 Dealing with losses: do you agree that the amount of energy input to the conversion process should be measured, and an according amount of GOs must be cancelled?



COUNTRY	ORGANISATION	COMMENT
Anonymous		All energy used, including losses and auto-consumption, should be measured, and accounted for. **Reasoning:** the easiest and most consistent way to do so is to measure both the input and the Output. This allows to precisely know the amount of losses and / or auto-consumption.
Austria	AGCS Gas Clearing and Settlement AG	Measured data and information should be used for certificates; nevertheless, dealing with losses should be addressed in an equal manner by different application purposes.
Belgium	Hinicio	In the CertifHy scheme, "The renewable origin of energy consumed in the form of electricity, gas or heat from the grid, or a district heating network shall be established by cancelling Guarantees of Origin." **Reasoning:** Measuring input is required to calculate and allocate CO2 emissions of a given H2 production batch.
Belgium	VREG	We believe that it is prudent to measure in order to objectify the amount of energy used.
Bulgaria	Sustainable Energy Development Agency	In connection with the answer to v.12, this happens automatically. Revocation of guarantees for energy used for conversion and issuance of new guarantees for the amount of energy produced automatically reduces the amount of new guarantees.
Estonia	Elering AS	By measuring the Output of the energy conversion process.
Finland	Grexel Systems	There is no good reason to disregard the physical reality. The renewable production is already moving on a such pace that there is no need to cut corners for increasing GO liquidity in this aspect.
Germany	German Energy Agency (Deutsche	In order to trace what the respective electricity GOs have been used for, electricity GOs should be cancelled according to the respective measured electricity input amounts.

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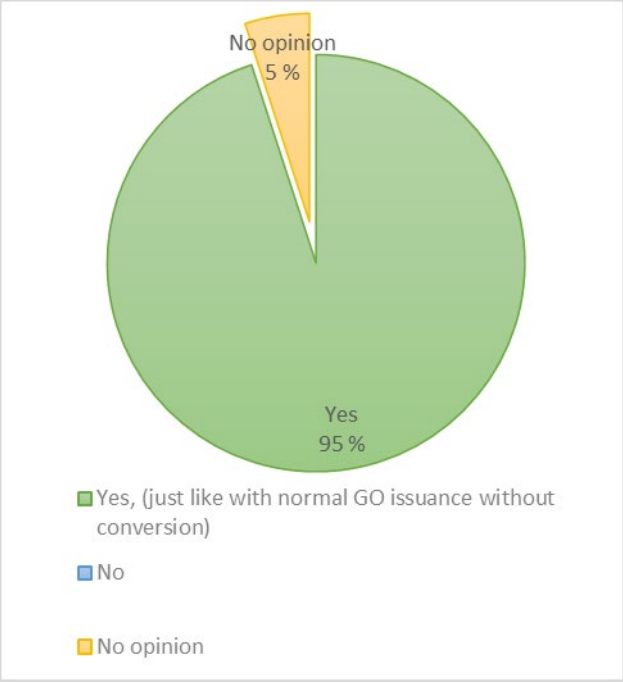
COUNTRY	ORGANISATION	COMMENT
	Energie-Agentur, dena)	**Reasoning:** In order to trace what the respective electricity GOs have been used for, electricity GOs should be cancelled according to the respective measured electricity input amounts.
Germany	UBA – Germany	Losses are losses and must be accepted as such. **Reasoning:** Increases credibility and ensures physical Energy flow
Netherlands	CertiQ	An amount of GOs cancelled should reflect the amount of energy consumed. and the amount of GOs issued should reflect the amount of energy produced by the converting Production Device. This is self-evident to us. **Reasoning:** Yes, input and Output should be measured.
Norway	Statnett	Not sure if I understand the question correctly - In my opinion the gross volume of energy that goes into the process must be measured and GOs from the Gross volume must be cancelled.
Spain	Nedgia	all the energy should be measured
United Kingdom	Green Gas Certification Scheme	important step - GO already benefit from not being required to deal with transmission losses and it is an area of weakness in the system.

3.6 Dealing with losses: do you agree that the amount of net energy Output from the conversion shall be measured, for an according amount of GOs to be issued?



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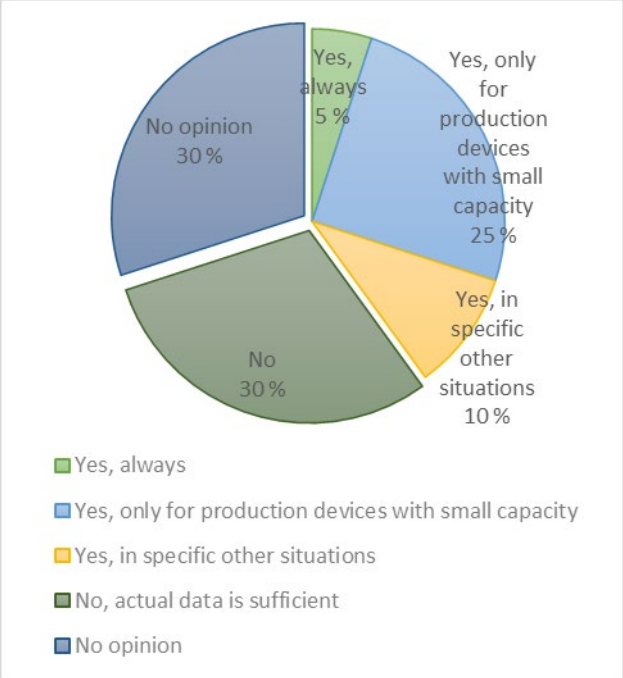
3.7 Would you allow for only measuring the Output energy, and estimate the Input energy based on a default value for the conversion?



3.7.1 Suggestions for composing a list of default conversion efficiencies. Which reference source to use?

COUNTRY	ORGANISATION	
Anonymous		Devices with a capacity equal or inferior to 5kW, devices with a stable and well-known conversion efficiency (such an electrolyser, for example).
Belgium	VREG	We have insufficient expertise to suggest a list of default conversion efficiencies. We would have to rely on motivated proposals of the relevant production registrar.
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	"Based on reputable literature e.g., JRC, scientific papers. E.g., https://www.oeko.de/fileadmin/oekodoc/E-Fuels-im-Verkehrssektor-Hintergrundbericht.pdf "
Spain	Nedgia	Standard default value for the conversion

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3.7.2 Why either or not allowing to work with a default conversion efficiency?

COUNTRY	ORGANISATION	
Anonymous		Because it is less precise, and it would require regular measurements to ensure that the conversion efficiency remains stable over time.
Anonymous		It is very simple. GOs are issued for net energy production placed on the market. GOs are cancelled for net energy delivered to plant. Conversion factors have no role to play. Plant conversion efficiency will determine resulting conversion factor. High efficiency plant will be rewarded. Example: Electricity GOs are issued for electricity placed on the market. If from a gas fired plant claiming renewable gas evidence must be provided that renewable gas has been used if electricity GOs based on renewable gas are issued. This evidence could involve renewable gas GOs for the used gas.
Austria	AGCS Gas Clearing and Settlement AG	A conversion factor may be prepared (audited information) for cases of outages of measuring devices. Generally, only measured data shall be used – where no measured data are available, an equivalent should be used such as auditor information.
Belgium	Hinicio	Not addressed in the current version of the CertifHy scheme, no default value is provided.
Belgium	VREG	Allow in the case where measurements would be cost-ineffective. This will probably be linked to the production capacity, but the threshold value may vary for different technologies and should be studied in depth.
Bulgaria	Sustainable Energy Development Agency	There is no reliable practice, and it is better to rely on objective measurement instead of coefficients. At a later stage, with accumulating of experience, the approach may be adopted if it proves to be reliable.
Estonia	Elering AS	Small Production Devices - always, large scale production - input shall be measured.
Finland	Grexel Systems	I do not have enough knowledge on these choices. How much error would there be if default value for conversion would be used and is it hard to get the input measurement?
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	We would stick to the capacity stated by Article 19 RED II that allows simplified information to be recorded on GOs from installation of less than 50 kW.
Netherlands	CertiQ	Some data might be calculated from other measurements. But the source data should always trace back to actual measurement. Estimations are not acceptable.
United Kingdom	Green Gas Certification Scheme	any Production Device that is converting one type of energy to another should be able to provide a detailed breakdown of inputs and Outputs - it is reasonable that they measure their inputs and allocated them to a set of Outputs - allowing default conversion is a weaker standard that could be abused by some operators. it also fails to reward more efficient operators.

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3.8 After conversion, which information to be mentioned on the newly issued GOs should be retained from the original GOs.

Note: for consideration are both the relevance of the information after conversion, and the implementation cost. Also note the presentation by CertiQ on the complexity for handling residues. beyond the MWh in case a lot of data is to be retained.

After conversion, which information to be mentioned on the newly issued GOs should be retained from the original GOs?

Energy source	14
Support information, relating to the type of support (production support, investment support, both, none or unknown)	7
Support information, limited to be either 'public support was granted somewhere over the lifetime of the Production Device(s) in the conversion chain before' or 'no support was granted throughout the value chain'	4
Label or any other independent criteria scheme to which the GO relates (if the Label scheme operator agrees)	4
Carbon footprint (if this optional information was included on the original GOs)	5
All information of the original GOs should be accessible from the newly issued GOs (Note the technical challenge that there are different quantities of input and Output GOs in relation with the conversion process)	4
The GO ID number of the original GOs should be documented on the new GOs (Note that the amount of input and Output GOs are likely to differ, which implies a challenge on allocating exact ID numbers unambiguously)	3
An indication that the GO has been obtained for energy Conversion Issuance, (i.e., the origin was proven with a GO from another Energy Carrier)	10
Other (specifications below)	2

The following graph visualises this same data in another way.

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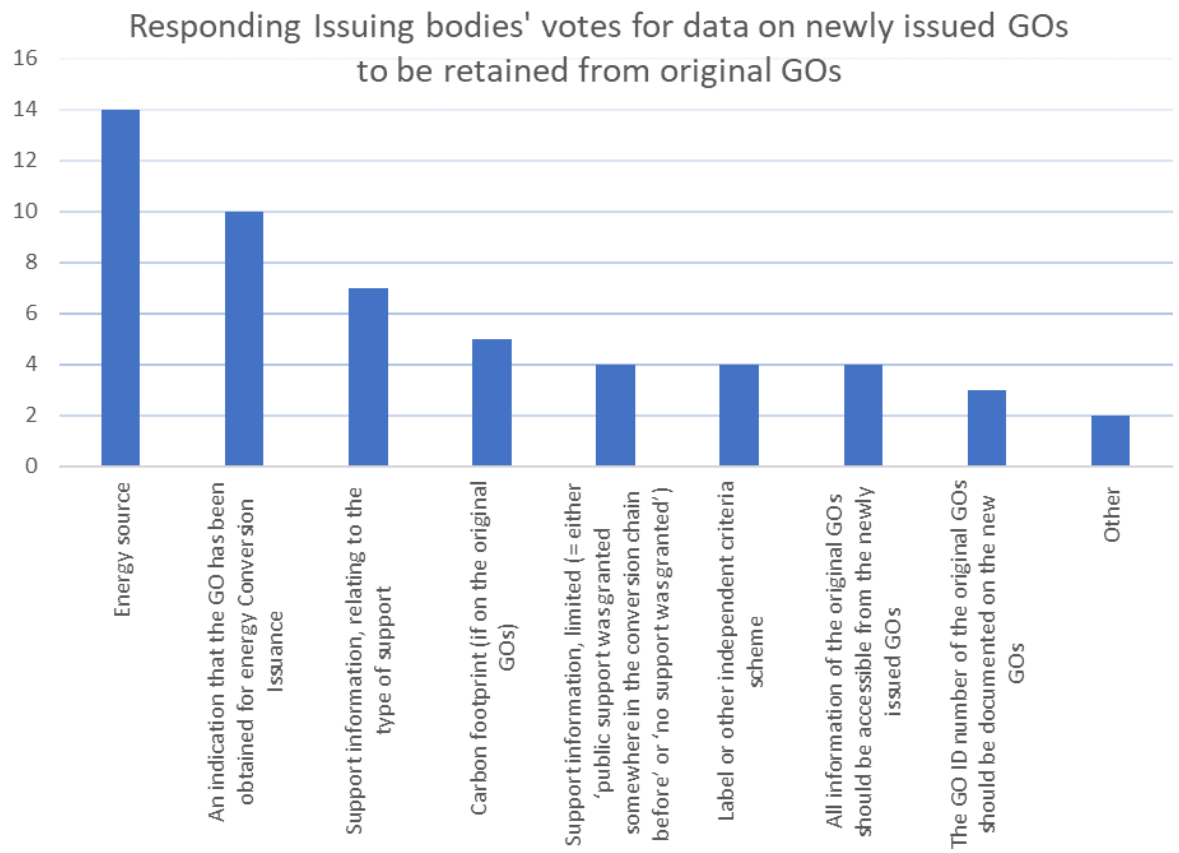

Comments

COUNTRY	ORGANISATION	OTHER (SPECIFICATION)
Belgium	Hinicio	Carbon footprint is recalculated upon issuance of a CertifHy NGC; hence the information is in fact carried but not directly from the original GO.
Bulgaria	Sustainable Energy Development Agency	We believe that this is the minimum necessary information that will not complicate the conversion process.
Finland	Grexel Systems	As per the CertiQ example, there is no use to make too complicated system. Original energy source is vital information. Other than that, everything is part of the normal issuing process of the Output GOs. For example, for carbon footprint what is important is the carbon footprint of the energy represented by the Output GO, not what was the original GOs used. For Label, the same thing, when requesting issuance in an Energy Carrier Conversion case it should be the producer requesting the Label (and meeting Label specific requirements) and not about specifically retaining the information from previous GOs. The current experience from Hydrogen is, that this Energy Carrier Conversion will be very much business as usual. Trust for the certification of the other Energy Carriers is essential and not trying to retain all information from GOs of the previous conversions (can be one or many).

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COUNTRY	ORGANISATION	OTHER (SPECIFICATION)
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	See the information included in the Deliverable 4.1 from the REGATRACE project
Germany	UBA – Germany	Tech Code should be added
Netherlands	CertiQ	The energy source is the only item that *must* be retained from the originating GO. This is because Disclosure (at the very least for electricity) typically requires identification of the source. It would therefore be inappropriate for the source to become lost upon conversion. Carrying forward support information is highly impractical and contradictory to the Directive. At most, this should be limited to 'no support has ever been granted'. Labels would have the same problem as support information - it would be too difficult to carry forward. For information on carbon to be retained, there would have to be consensus and harmonisation on a) how to calculate such for the originating GO, and b) how to re-calculate for energy conversion. Since GO IDs are unlikely to line up between input and Output of a Production Device, it would be unwieldy to retain, and neither would it be interesting to anyone using the GO. An indication that the GO resulted from conversion is something that can be added; since it is not a given on the originating GO, so it cannot be *retained*.
Spain	Nedgia	All information of the original GOs should be accessible
Switzerland	Pronovo AG	No final opinion yet. We are still in the process of evaluating.
United Kingdom	Green Gas Certification Scheme	as much information as is practical should be included. the Issuing Body will have the full cancellation statement for the GO of energy inputs it is just a question not technical ability to include information and presenting in a way that traders and consumer can understand. At a minimum, the consumer must be able to judge the geographical and temporal link between the input and Output. This can all be included in an expanded “energy source” Label as simplified information e.g., just the country and time of production not name address or producer. This is technically complicated but issuing GO for converted renewables should not be made so simple that the GO lack credibility. Energy source is clearing essential – we know the market demands information on types of biomasses used and it will also want to know solar vs wind vs hydro. Support - CertiQ highlight the problem of long chains of information about production and investment support – we should include as much information as possible with the option to revert to a simple statement that support of some kind was provided in the process. Carbon Footprint – a new GHG calculation should be done which uses the GHG information from the input GoO – I ‘m not sure if that would count as retaining the information? it may be that GHG information is not technically part of a GoO but with more conversations more energy is needed and it’s important that we don’t end up with energy that is renewable but has been through so many conversions the actual GHG impact is high and with very high losses. Indication that GO is from energy conversion based on GO tracked input – essential – consumers must

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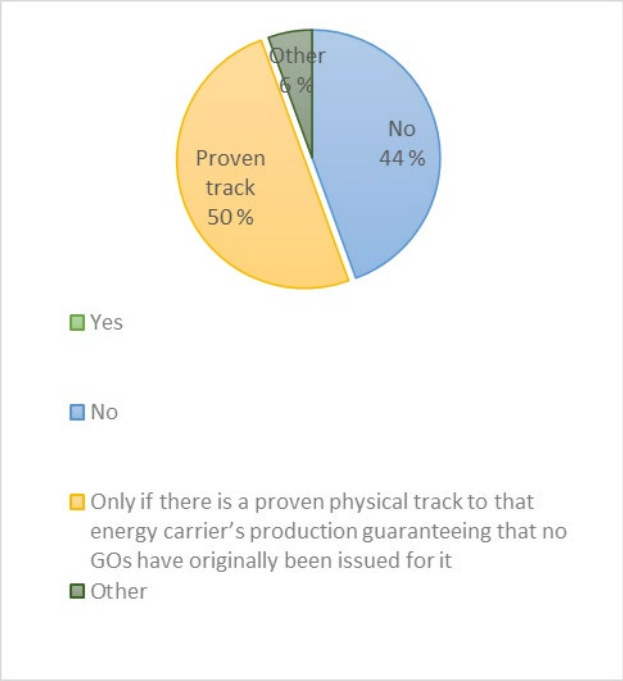
COUNTRY	ORGANISATION	OTHER (SPECIFICATION)
		be aware so they can form an opinion on if this is the "type" of renewables. E.g., Some will rightly feel that H2 produced with GO from hydro on the other side of Europe is a lower quality product than H2 with a direct connection to a renewable source.

3.9 Should it be allowed to issue GOs following conversion of another Energy Carrier if no GOs are cancelled for it?



Only 18 out of 20 organisations responded to this question.

COUNTRY	ORGANISATION	COMMENT
Belgium	Hinicio	Energy conversion should be allowed without GO cancelling where there is no GO scheme for the Input Energy Carrier (e.g., no full Disclosure or no GO scheme at all for a specific Energy Carrier).
Bulgaria	Sustainable Energy Development Agency	In Bulgaria, there is an opportunity to issue guarantees for all quantities of energy from renewable sources, regardless of whether they receive support from a support scheme.
Estonia	Elering AS	To avoid double-counting, renewable origin must be proved through GOs.
Finland	Grexel Systems	This is a good opportunity to bring the GO system a bit closer to physical reality. If cancelling GOs before Conversion Issuance is too difficult then the existing, GO systems must evolve into faster operations.
Spain	Nedgia	Energy Carrier's production must guarantee that no GOs have originally been issued for it

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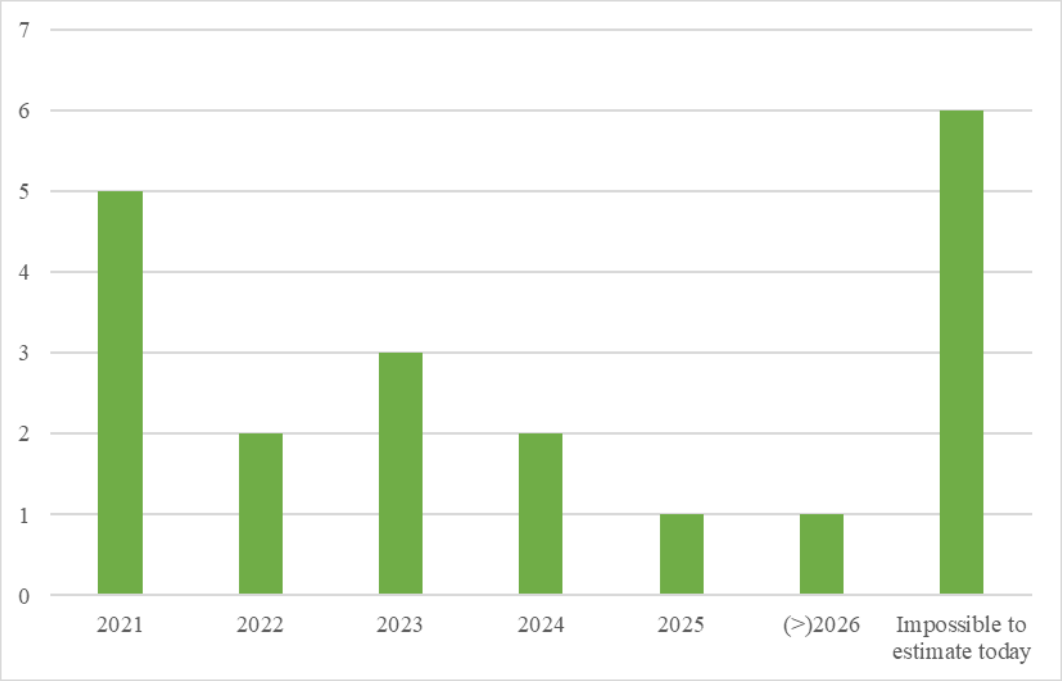
COUNTRY	ORGANISATION	COMMENT
United Kingdom	Green Gas Certification Scheme	Clearly, we must rule out that the Input energy is not double counted. if there is physical connection e.g., private wire, at the Issuing Body for the Output GO is given legal assurances that no GoO was issued then that would be suitable and no GoO would need to be cancelled.

3.10 Urgency estimation - By when do you expect the first demand for GO Conversion Issuance in your Domain?



There are multiple answers possible.

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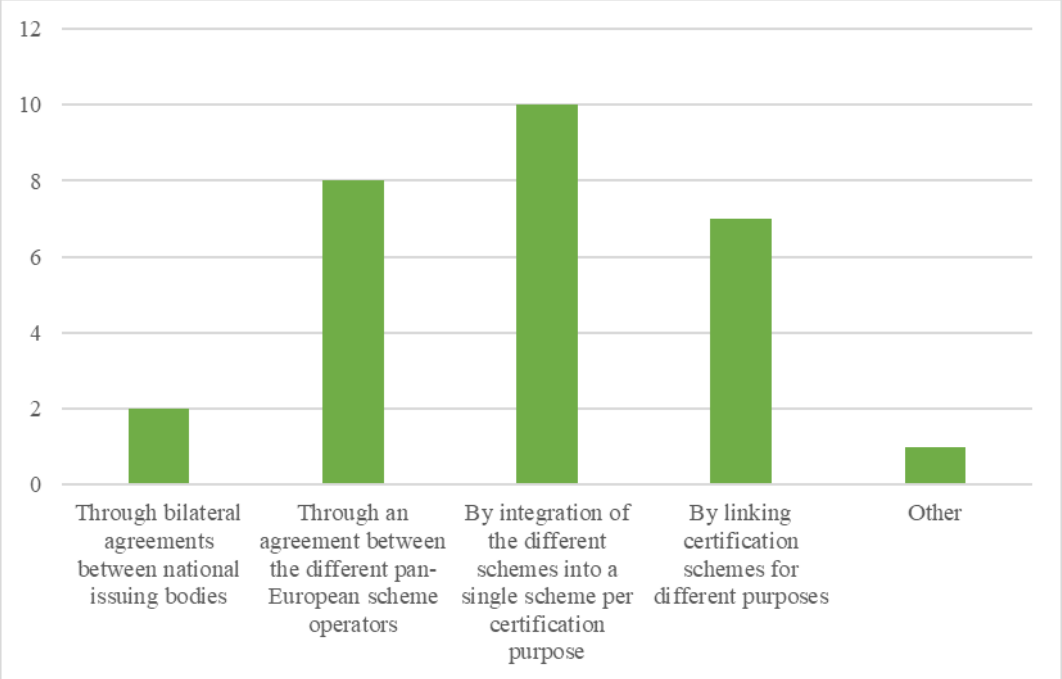
4 Dealing with various certification schemes

At the time of Q1 2021, there are various pan-European certification schemes for GOs for gaseous Energy Carriers. This is set out in the REGATRACE Report D4.2 which provides for a comparison between these schemes. AIB (EECS) and ERGaR both facilitate a GO scheme for gaseous Energy Carriers. The CertifHy scheme for hydrogen GOs is preparing for operation under EECS as a non-governmental certificate system.

If you are an Issuing Body for gas GOs, you may face market demand to import GOs that are issued under another pan-European scheme than the one you participate in.

If you are an Issuing Body for a single Energy Carrier in case a producer in your Domain asks for, GO Conversion Issuance, there will be demand for either importing a GO from another carrier, or for acknowledging its cancellation.

4.1 How would you prefer the international transfer of certificates issued under different schemes to be facilitated?



There are multiple answers possible.

COUNTRY	ORGANISATION	COMMENT
Austria	AGCS Gas Clearing and Settlement AG	Different European schemes are mainly driven by different national registry systems for different application purposes – therefore harmonized national documentation should be requested to be implemented in European legislation to develop towards a single scheme in the long-run.

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COUNTRY	ORGANISATION	COMMENT
		However, until that, maximum flexibility of communication interfaces between parties is required. Scheme rules should be harmonised for each application purpose at least for cross-border transactions.
Belgium	Hinicio	To date, CertifHy does not anticipate cross scheme transfers for h2 ngcs.
Belgium	VREG	Linking certification schemes might be an option too, but it seems reasonable to aim for integrated (but separate) scheme per purpose first.
Estonia	Elering AS	The preferential choice would be to have an easily manageable solution.
Finland	Grexel Systems	Harmonization and agreements. Directive says that GOs from other member states must be acknowledged. Let us work the standard, pan-European schemes, and industry agreements that good that nobody needs to question this.
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	We would work together with the German Issuing Body for electricity GOs and make sure they are cancelled before we issue gas GOs for hydrogen.
Netherlands	CertiQ	Ideally, the different schemes should be integrated, failing which an agreement being scheme operators would be best. Individual agreements will be a lot of 'paperwork'.
Spain	Nedgia	A single scheme per certification purpose is needed for sector market development
United Kingdom	Green Gas Certification Scheme	I see that within the PoS system ISCC and REDCert have mutual recognition of PoS issued under the other scheme. Something similar could be explored for ERGaR and AIB so that exchanges were possible between an ERGaR member and Gas EEEC scheme participant. I think for now we need to wait until all countries have adopted RED II and there is more standardisation for GoO for gas. another possibility is that as a national scheme I must join both schemes - not very efficient! but might be easier than full integration of schemes at the European level in the short term.

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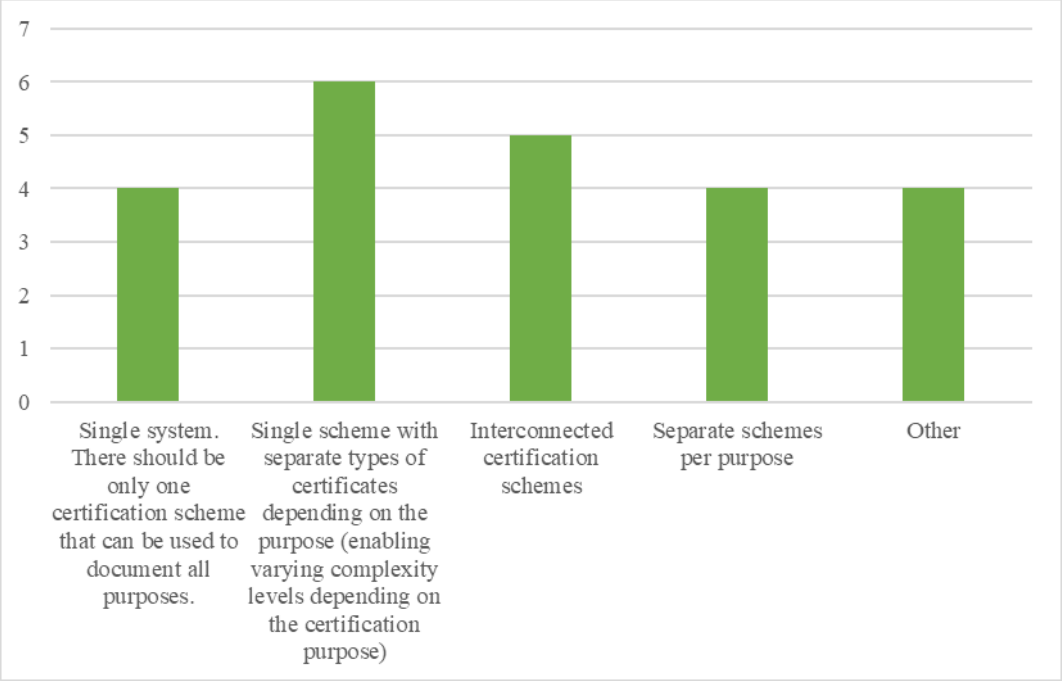
4.2 Regarding the extent of integration of certification mechanisms for various purposes in Europe, what do you deem to be beneficial?

In case there are separate certification schemes per purpose, the 'Cross purpose double counting risk' should be mitigated by not allowing to issue a certificate for Disclosure purpose where for instance a certificate for target accounting purpose is issued.



There are multiple answers possible.

COUNTRY	ORGANISATION	COMMENT
Austria	AGCS Gas Clearing and Settlement AG	The currently fragmented market requests a considered ramp up. An evolution from d, to c, to b, to a should be envisaged on European level and supported with corresponding legislation.
Belgium	Hinicio	For the sake of flexibility, there should be different schemes per purposes (e.g., H2 GOs and rfnbos supply certificates), though those schemes should be interconnected in a general architecture, therefore eliminating double counting.
Estonia	Elering AS	Depending on the usage of GOs, different certificates could be used (for instance, for transport sector, carbon footprint tracking, off-grid production etc.).
Finland	Grexel Systems	In principle, as unified and as simple system as possible is beneficial. In practice, the overlaps are not complete and for example the lifecycle scope of GO is different than for mass balancing of sustainability certification. This is issue is very much interconnected across RED II because of openness in the wording. I would like to see that questions like this are though from the very fundamentals of what goal of such instruments is, and then try to see that what would be the best solution for this overall goal.

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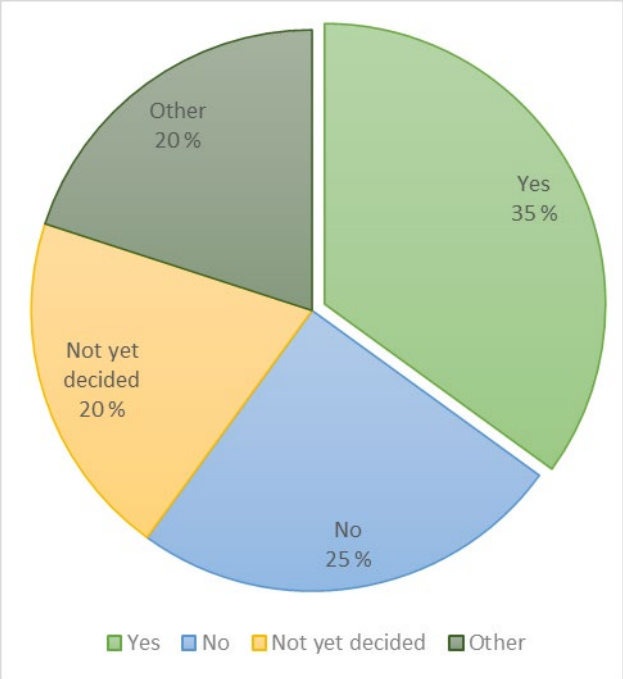
COUNTRY	ORGANISATION	COMMENT
Netherlands	CertiQ	It is impossible to answer this question without further information. For systems to be integrated into one, there would first have to be clarity on how such certificates will be issued, how they will be cancelled for each of their respective purposes, etc.
Spain	Nedgia	A single scheme is needed for sector market development
Switzerland	Pronovo AG	One standard with different schemes (the AIB approach)
Switzerland	VSG	Whatever leads to the fastest setting up of a European wide (or as many countries encompassing as possible) system.
United Kingdom	Green Gas Certification Scheme	I see separate systems for gas, electricity heating and cooling. conversions will take some effort on part of issuing bodies but no more than is already required in the Gas GoO sector to assess energy inputs.

4.3 Are there separate registries for electricity, gas, and hydrogen GOs in your country/Domain?



COUNTRY	ORGANISATION	OTHER (SPECIFICATION)
Belgium	Hinicio	CertifHy is an NGC scheme only for hydrogen, not linked to a specific country.
Estonia	Elering AS	There is one integrated system of registries for different Energy Carriers.
Germany	German Energy Agency (Deutsche	Electricity and gas are separated, but we still do not know if gas and hydrogen will also be separated or not.

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	Energie-Agentur, dena)	
Switzerland	VSG	Currently, yes, but may change in the future.

4.4 How difficult is it for your national IT system for gas certification to adapt to scheme design changes of the international certification scheme your system is/aims to be connected to?

COUNTRY	ORGANISATION	
Anonymous		We do not have yet a gas certification system in place.
Austria	AGCS Gas Clearing and Settlement AG	To be answered by the IB.
Belgium	Hinicio	Not difficult
Belgium	VREG	Question is not how difficult, but how expensive. Will depend on the amount of change needed
Bulgaria	Sustainable Energy Development Agency	This scheme has not yet been implemented into our legislation thus we are not able to assess at this stage.
Estonia	Elering AS	Changes can be implemented: registries are developed in-house and integrated with business processes.
Finland	Grexel Systems	Business as usual?
France	GRDF	Not decided yet
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	Not difficult. We have already adapted it to connect to the ERGaR CoO Scheme.
Lithuania	Amber Grid	So far, we have not joined any of these schemes.
Luxembourg	ILR	not known, IT system sub-contracted
Netherlands	CertiQ	We are in the process of doing this, so we have no definitive answer yet. So far, it seems challenging, but doable.
Slovakia	SPP - distribucia	Not relevant, we are in the process of establishing gas GOs registry.
Spain	Nedgia	It is too early for this approach
Switzerland	Pronovo AG	We have not implemented it yet.
Switzerland	VSG	Rather difficult. Technical and legal limitations need to be tackled.
United Kingdom	Green Gas Certification Scheme	quite simple because we are connecting manually. this is fine for low volumes/transaction numbers. challenge will come later with there are 1000's of transactions/year.

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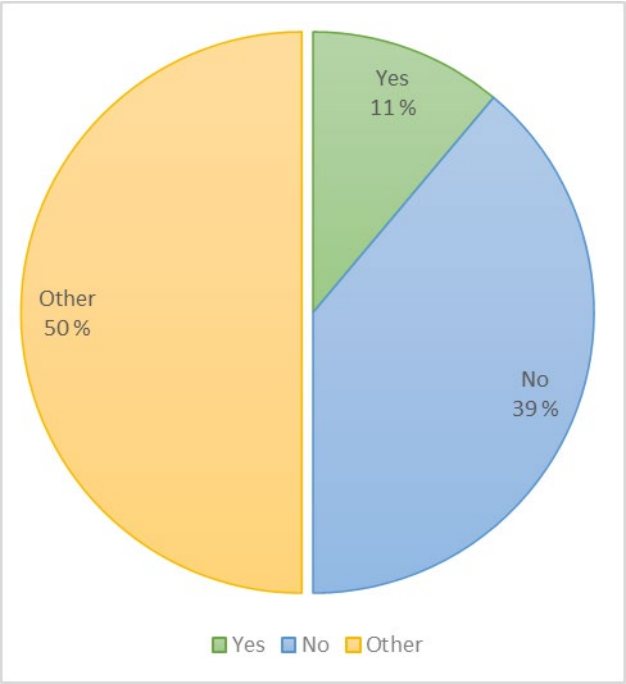
4.5 Are you as an Issuing Body in favour of joining various pan-European certification schemes and adjusting your registry mechanism to each of them?



Only 18 out of 20 organizations responded to this question.

COUNTRY	ORGANISATION	COMMENT
Anonymous		We would like to keep the certification system as simple and cost-effective as possible. We are also in favour of maximum harmonisation / uniformity between different Domains/countries and reasonable centralisation.
Austria	AGCS Gas Clearing and Settlement AG	To be answered by the IB.
Belgium	Hinicio	I do not think I did properly understand the question. However, CertifHy will develop several certification schemes for hydrogen in Europe and Hinicio will provide Issuing Body & Registry services for each scheme.
Belgium	VREG	We will only join scheme(s) that fulfils the purpose for which we are responsible, and that is guaranteeing the origin of energy and Disclosure.
Bulgaria	Sustainable Energy Development Agency	The Agency is an executive agency of the Ministry of Energy, therefore all such actions should be coordinated and specified with the Ministry.
Estonia	Elering AS	Preferential is to have one single nationally chosen EU scheme (following RED II).
Finland	Grexel Systems	Most of our clients are in favour of pan-European GO transfers, and for this purpose the pan-European certification schemes are important tools.

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COUNTRY	ORGANISATION	COMMENT
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	We do not know yet.
Netherlands	CertiQ	See our answer to question nos. 29 and 30.
Norway	Statnett	If/when conversion becomes a relevant issue in Norway
Spain	Nedgia	We are not an Issuing Body
United Kingdom	Green Gas Certification Scheme	could be a solution - seems likely that we will have to handle different certificate types in future - GoO, CoO, PoS, PoO - so being flexible and interacting with multiple schemes might be the best way forward if the chances of having "one scheme to rule them all" seem low unless the Union Database was imposed on everyone and expanded to include all Certificate types.

4.6 How agile is your certification system to conversion of GOs for other carriers?

COUNTRY	ORGANISATION	
Anonymous		We do not have yet a gas certification system in place.
Anonymous		We issue based on evidence of renewable production. We do not convert in our gas scheme.
Austria	AGCS Gas Clearing and Settlement AG	To be answered by the IB.
Belgium	Hinicio	The pilot Issuing Body operated under the CertifHy pilot projects is ready for energy conversion now.
Belgium	VREG	Still to be developed
Bulgaria	Sustainable Energy Development Agency	This is a matter of software upgrade and is achievable.
Estonia	Elering AS	Estonian system is very flexible and agile - all kind of changes can be implemented.
Finland	Grexel Systems	When Energy Carrier Conversion is handled through cancellation and issuances that is basically nothing different than what has been the state of play for many years already.
France	GRDF	Not considered yet.
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	It is agile for it. We currently list 200 biomethane plants, 3 ptX plants and are open to extend the system to further Energy Carriers which relate to the renewable gas sector.
Netherlands	CertiQ	Not very agile, yet. It was designed for electricity and heating/cooling. But it will obviously have to be adjusted.
Norway	Statnett	We do not know - but the basic infrastructure is modular and probably we will be able to adapt if needed.

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COUNTRY	ORGANISATION	
Slovakia	SPP - distribucia	Not relevant.
Spain	Nedgia	We are not an Issuing Body
Switzerland	Pronovo AG	The system is not implemented yet.
United Kingdom	Green Gas Certification Scheme	quite - we have a manual process for issuing which can be adapted.

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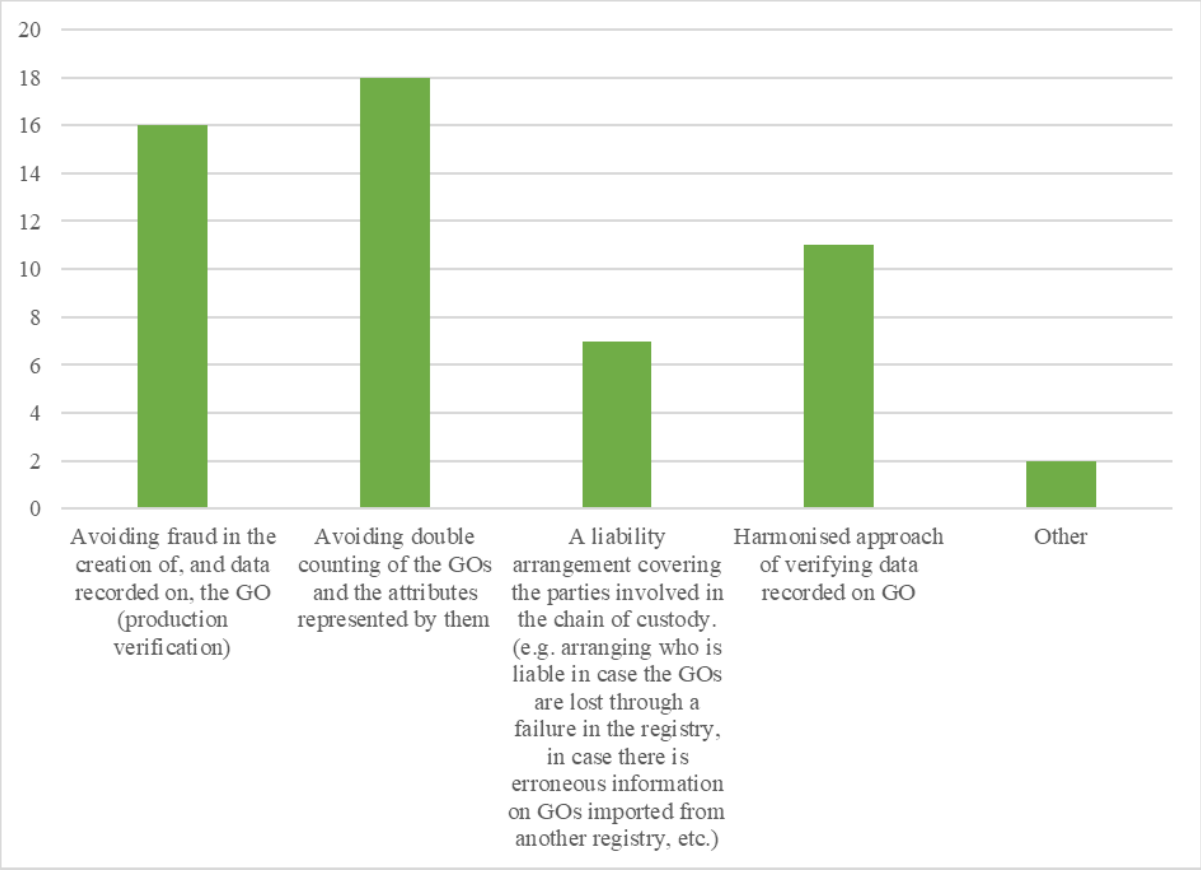
5 GO quality check

From the workshop on 11 March 2021, we learned that there is a substantial demand by issuing bodies that REGATRACE proposes criteria for a quality check of GOs that are cancelled for conversion.

5.1 Which principles do you consider essential for recognition of GOs from another Issuing Body?



There are multiple answers possible.

COUNTRY	ORGANISATION	COMMENT
Belgium	Hinicio	GO will have to comply with CEN EN16325 standard, therefore bringing trust for recognition.
Bulgaria	Sustainable Energy Development Agency	AIB's procedures and practices are largely in line with the harmonized approach to prevent double counting and fraud.
Estonia	Elering AS	Additionally, GOs must be transferred digitally.
Finland	Grexel Systems	The most important thing here is that CEN 16325 covers all the required aspects. Then the second question is just that who is checking the national GO schemes validity against CEN 16325? When

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COUNTRY	ORGANISATION	COMMENT
		national schemes are CEN 16325 compliant, then by RED II definitions no other validation should be needed.
Netherlands	CertiQ	It is difficult to judge whether a liability arrangement is essential before the system is up and running. After all, we have yet to experience these things. Also, how could such be enforced/verified?
United Kingdom	Green Gas Certification Scheme	As with issuing of any GoO you must be confident of the quality of the underlying data e.g., meter readings and recording of biomass inputs. EN 16325 offers some level of assurance, but I would like a mechanism to check the status of registry who issued the input GoO e.g., definitive list of who the issuing bodies are in each country and some details e.g., EECC Domain protocol docs that are publicly assessable. we do not need total harmonisation on verification of data recorded on GoO some will want post hoc other ex-ante auditing of meter readings - if there are balancing/correction measure in place that is suitable. we must recognise there is a certain level of risk in all input data.

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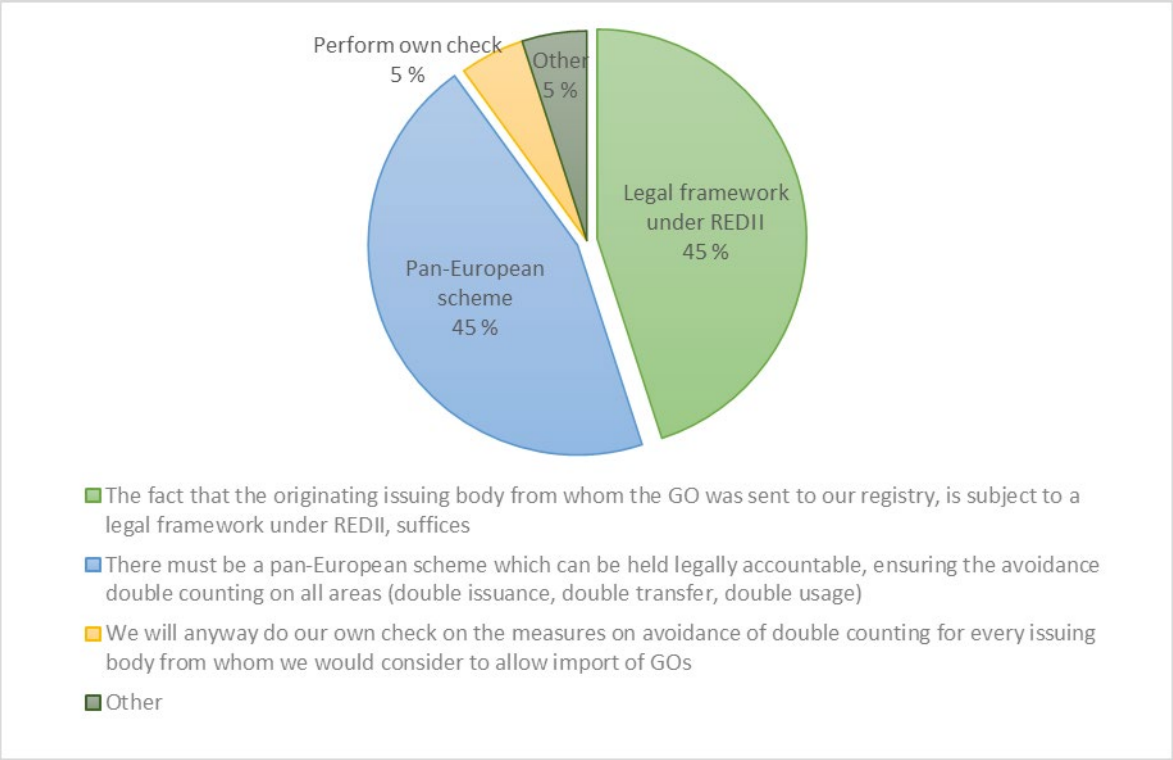
5.2 How should avoidance of double counting be ensured, for GOs that you accept as input for conversion?

Avoiding double counting, when working with (imported or cancelled) GOs that are issued outside the control of yourself as Issuing Body, this implies you needs to be able to have trust in : a) the processes for GO issuance (production registration, data flows, inspection and control mechanisms), b) the processes for GO transfer before the GO reached your registry (exclude the risk of duplication during transfer) and c) the processes for GO registration and guarding over its lifetime.



COUNTRY	ORGANISATION	COMMENT
Austria	AGCS Gas Clearing and Settlement AG	REDII clearly states the accountability of certificates and GO for a specific application purpose. This does not prevent the risk that the same energy amount may be counted for different application purposes, which is allowed according to REDII. Due to the number of participants and requirements on automated data processing, a harmonized approach is important on processes, data integrity and rules.
Belgium	Hinicio	To be further specified in the CertifHy scheme, currently handled case by case
Estonia	Elering AS	Each national GO issuing, and Disclosure body is responsible for the GOs issued (correct measuring etc.) and cancelled in their registry.
Finland	Grexel Systems	The RED II and CEN 16325 compliance should be enough. How the compliance is verified is another question though.

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COUNTRY	ORGANISATION	COMMENT
France	GRDF	For us, nb 1 is relying too much on the infallibility of the national registries, a European unique scheme with the relevant liability assurances should be implemented, as the avoidance of double counting is one of, if not the reason why GoOs exist.
Netherlands	CertiQ	Pan-European schemes are an efficient way of verifying the accuracy, reliability, and veracity of a GO. However, we *must* implement the Directive, which means that we are bound to recognising GOs issued in another MS, regardless of whether that MS has 'subscribed' to a particular scheme. Where it has not, we will for sure have to do our own check.
Spain	Nedgia	a pan European scheme is highly recommended
United Kingdom	Green Gas Certification Scheme	we should as far as possibly rely on the RED II framework - a lot of effort has gone into the EN16325 standard. what is not clear to me though is who which certification bodies can CertifHy a registry as meeting this standard - in any other area a registry would be able to publish a certificate from say SGS or DEKRA saying we meet ISO9001, or we are ISCC certified. should be same for EN 16325.

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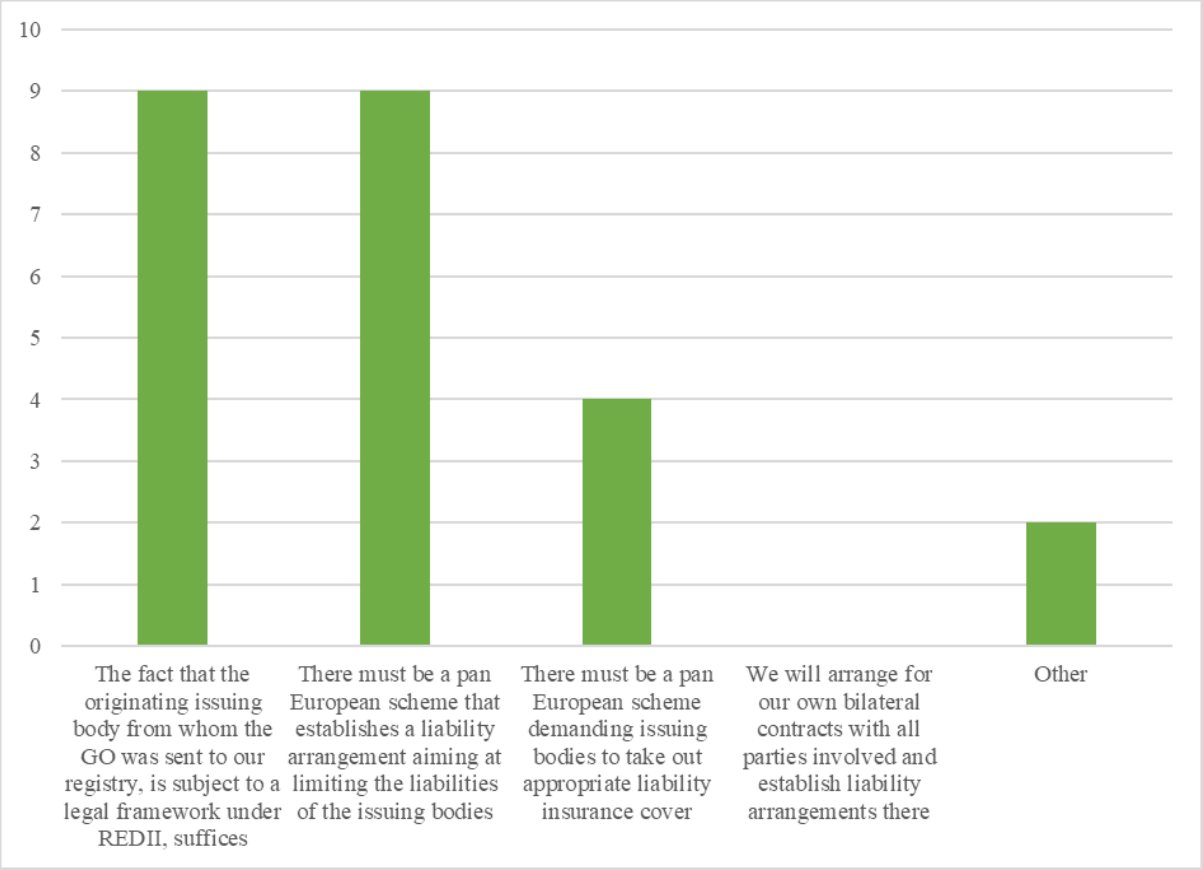
5.3When entering cross-registry transfers, how to make sure liability is covered?

Liability of the parties involved in the chain of custody: Significant financial value goes on in the GO market. This requires both technical data security mechanisms to be in place, as well as liability arrangements covering all parties involved. It requires an unambiguous liability arrangement of the Issuing Body and registry operator of the GOs but also and of the liability of the market participants that take part in registering production and in trading, cancelling, and using GOs. Allocating liability explicitly allows for your own organization to assess the risk for indemnity claims and limit liability to those processes in your own control reach.



There are multiple answers possible.

COUNTRY	ORGANISATION	COMMENT
Austria	AGCS Gas Clearing and Settlement AG	A pan European scheme should precisely define the technical processes to verify that the REDII requirements are properly applied.
Belgium	Hinicio	No cross-registry transfers foreseen to date
Bulgaria	Sustainable Energy Development Agency	If there is a pan-European approach, the responsibility on issuing authorities will be reduced and the rights of participants in the scheme will be guaranteed.
Estonia	Elering AS	Each national GO issuing, and Disclosure body is responsible for correctness of the data. Also, there are additional rules set be the pan European scheme.

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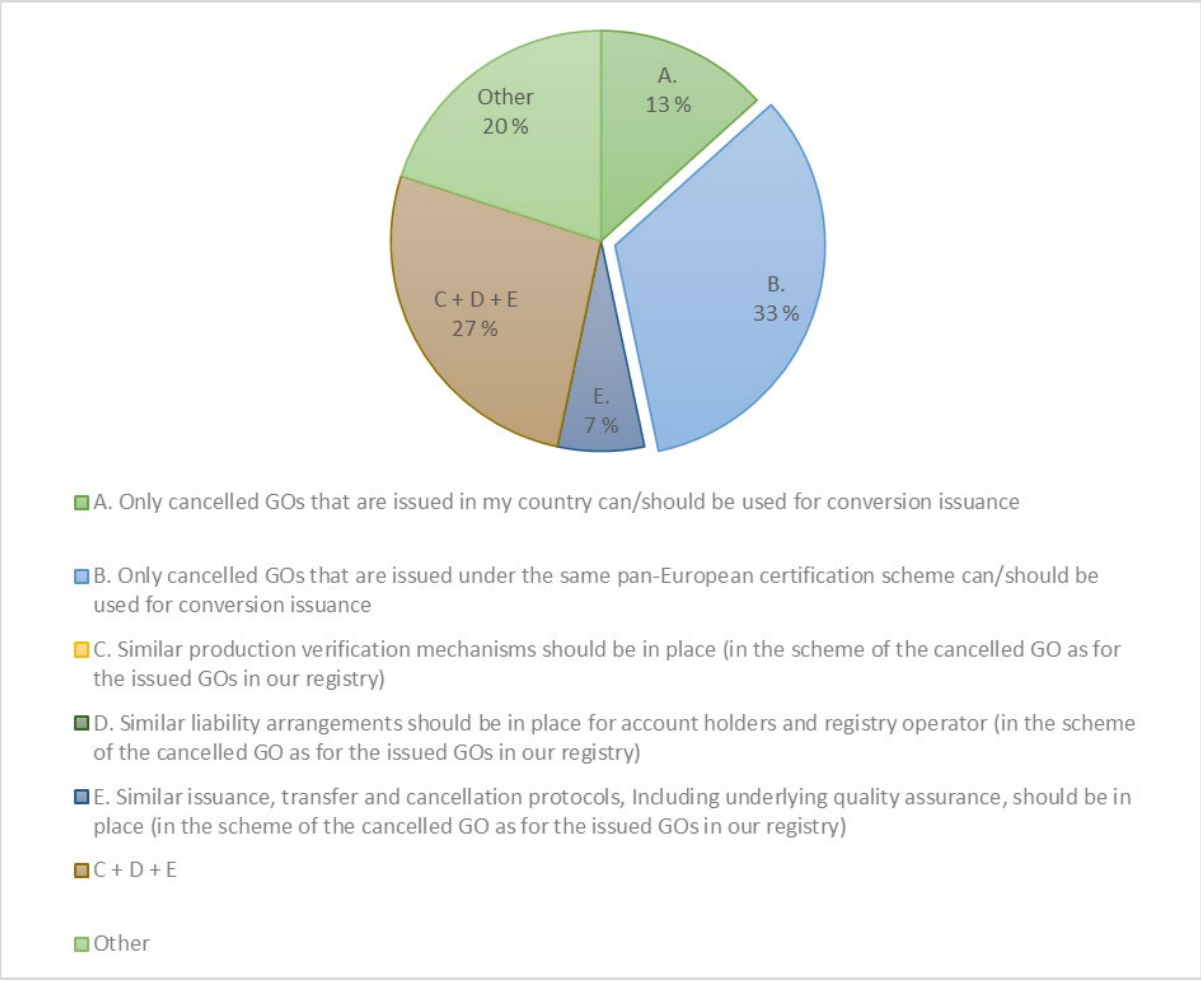
COUNTRY	ORGANISATION	COMMENT
Germany	UBA – Germany	We are subject to own liability rules as an authority
Netherlands	CertiQ	This is one for the lawyers. We will be happy to bring you into contact with ours.
Spain	Nedgia	a pan European scheme is highly recommended

5.4What type of criteria do you deem relevant for a quality check of a cancelled GO for Conversion Issuance in your registry?

Please answer for the time where your registry aims to have implemented conversion rules, regardless of whether that is in the short-term or mid-term future.



Only 15 out of 20 organizations responded to this question.

COUNTRY	ORGANISATION	COMMENT
Austria	AGCS Gas Clearing and Settlement AG	To be answered by the IB.
Estonia	Elering AS	The begin with, only a): Only cancelled GOs that are issued in my country can/should be used for Conversion Issuance. Additional solutions shall be determined in the future.

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COUNTRY	ORGANISATION	COMMENT
Finland	Grexel Systems	RED II compliant GOs. Other requirements only when specifically required by certain certification scheme.
Germany	UBA – Germany	No valid opinion so far
Lithuania	Amber Grid	No conversion rules in Lithuania
Netherlands	CertiQ	Again, liability is one for the lawyers. Regarding quality assurance: see our answer to question no. 41. For heating and cooling, specifically, we feel that GOs can only be cancelled to prove the origin of thermal energy supplied through the same network to which both producer and consumer are connected.
Norway	Statnett	Not sure if I understand the question fully: Cancellation related to conversion should happen at the same time and in the same place as the issuing of the conversion GO. Part of the process of issuing the conversion GOs must be to ensure that the sufficient amount of cancelled GOs is assigned for the conversion - Similar to the fuel declarations that needs to be in place before issuing electricity GOs for certain tech types.
Slovakia	SPP - distribucia	No opinion.
United Kingdom	Green Gas Certification Scheme	to be honest we have not considered this topic before, and it needs the input of our lawyers. for now, we would be happy with any GoO as long as we were aware of the status of the registry and had some assurances that they had a gov or market mandate and good processes in place. we would be happy to assess on case-by-case basis. medium term we would look for more structure and assurances.

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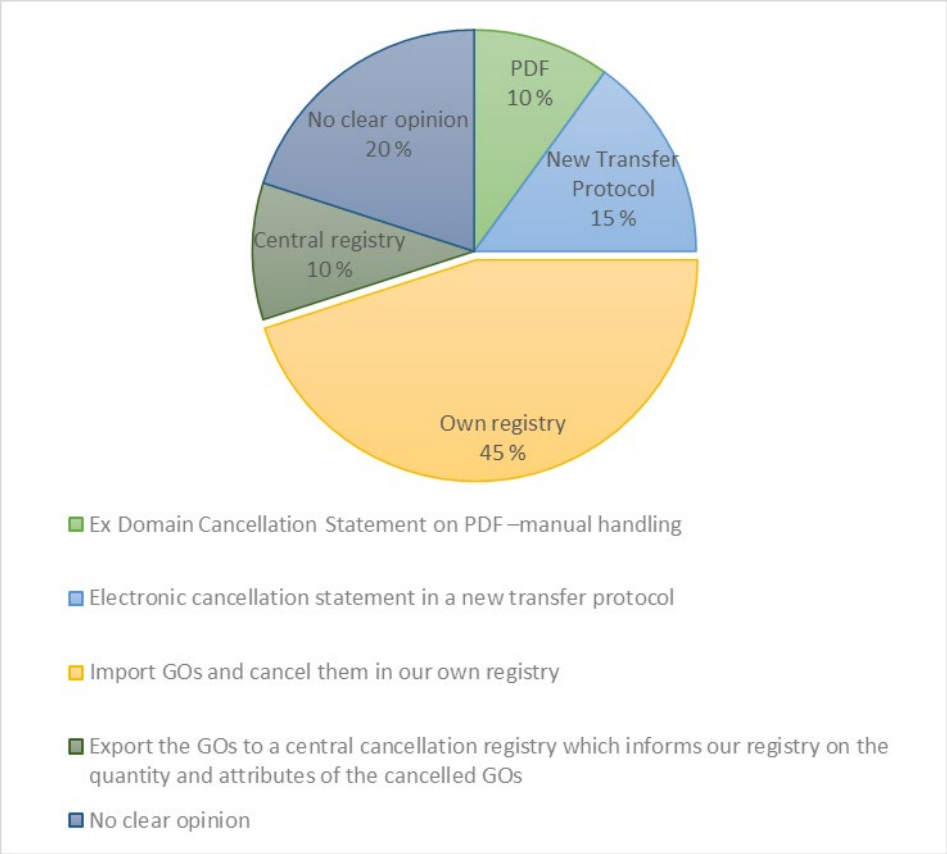
6 Importing GOs from another Energy Carrier, for Conversion Issuance

6.1 Cancellation process: When asked for import of a GO from another Energy Carrier for conversion, which pathway for cancellation of those GOs for conversion, originating from another registry, do you see optimal on the mid-term (3-5 years from now)



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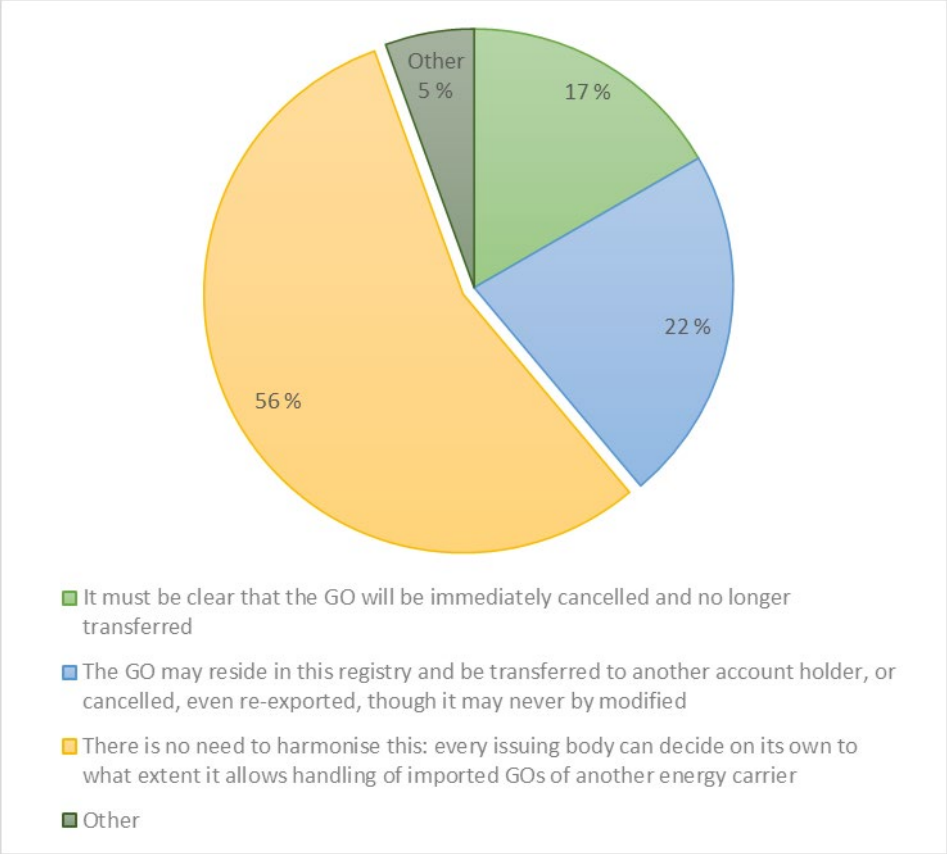
6.2 Cancellation process: In case of importing GOs of another Energy Carrier than the Energy Carrier for which the Issuing Body is appointed.



Only 18 out of 20 organizations responded to this question.

COUNTRY	ORGANISATION	COMMENT
Anonymous		Energinet will issue gas GOs based on renewable gas produced in Denmark.
Austria	AGCS Gas Clearing and Settlement AG	The consumption takes place at the production (conversion facility). Therefore, cancellation should be handled in the same country of the conversion. There should be an automated check during the transfer process whether the importing registry is operating for specific Energy Carriers. Such a list of registries and their responsibility should be publicly available for the avoidance of conflicts.
Belgium	Hinicio	Allowing transfer of GO for an Energy Carrier which is not handled by the registry within this registry could lead to data inconsistency / data loss
Belgium	VREG	Prefer a clear and uniform system, independent of country/Domain or carrier, to avoid confusion and the risk of mistakes.

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COUNTRY	ORGANISATION	COMMENT
Bulgaria	Sustainable Energy Development Agency	
Estonia	Elering AS	Each national registry can decide by itself (at least at the beginning). Solutions should be harmonised if concerned with Residual Mix calculations.
Finland	Grexel Systems	Alive GOs should be imported only to the Issuing Body registries which are for the specific Energy Carrier. If import is required as part of the Energy Carrier Conversion process, the GOs should be cancelled in the exporting registry, or if this is not possible due to Disclosure rules, then the GOs should be exported to the target country but to the registry of the same Energy Carrier, and then when needed cancelled for the purpose of Energy Carrier Conversion.
France	GRDF	Once the GO is reissued, it should be GO fully equal to those in the registry
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	Each Issuing Body should be able to decide how to handle imported GOs of an Energy Carrier different to the one it was officially appointed for because it would give more flexibility to it in case it is allowed in the future to handle GOs of other Energy Carriers.
Netherlands	CertiQ	
Norway	Statnett	If a manual process is chosen (handling of PDFs) it would go against everything we stand for regarding credibility. Such a process would be riddled with human errors and should be avoided at all costs. Not to mention how expensive it would be - Each process would easily amount to hundreds of Euros in fees.
Slovakia	SPP - distribucia	
Spain	Nedgia	
Switzerland	Pronovo AG	
United Kingdom	Green Gas Certification Scheme	if the registry is able to handle GoO for other Energy Carriers and the conversion process was cancelled then they could be transferred onwards and used for any purpose - this would be up to the two-registry involved - e.g., the sending registry must have option to choose if it is sending a GoO that is only for conversion or if it is for conversion or further use.

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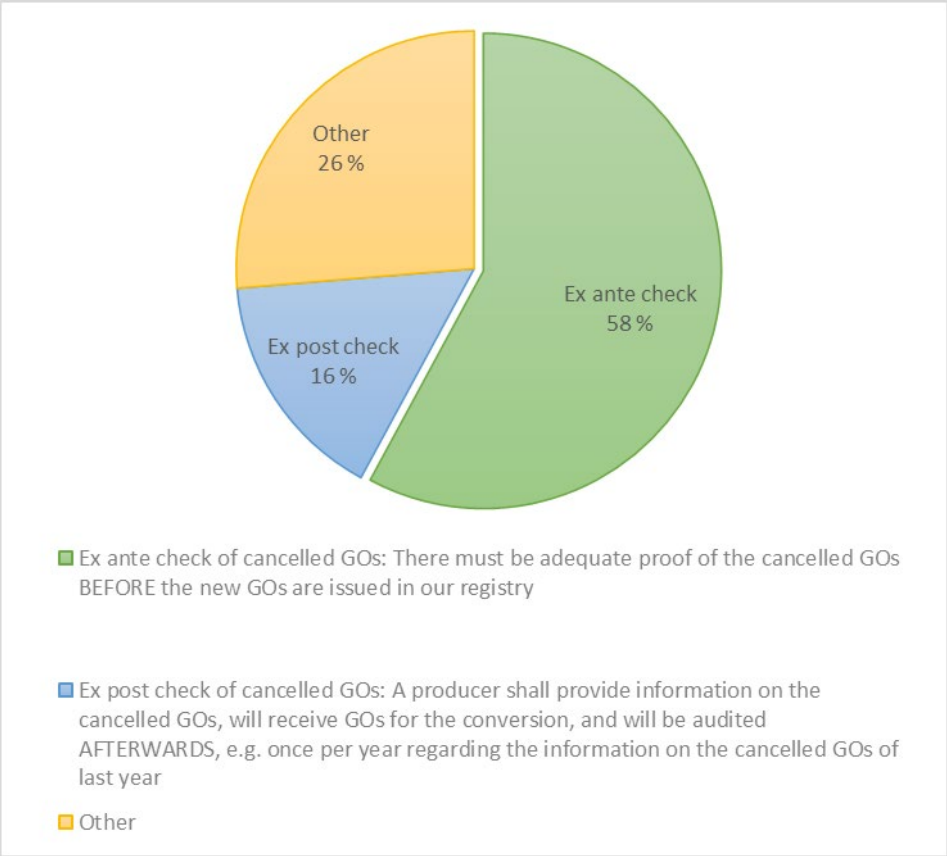
6.3 Consumption matching for conversion: What do you deem feasible in the processes in your registry, for checking the quantity and Attributes of the cancelled GOs with the measured input to the Conversion Device:



Only 19 out of 20 organizations responded to this question.

COUNTRY	ORGANISATION	OTHER (SPECIFICATION)
Austria	AGCS Gas Clearing and Settlement AG	To be answered by the IB for the purpose of GO.
Belgium	Hinicio	Both can be considered, based on whether the audit of a production batch is required or not in the short term.
Norway	Statnett	Simultaneous - The GOs that are to be converted are cancelled as a part of the process of issuing the converted GOs.

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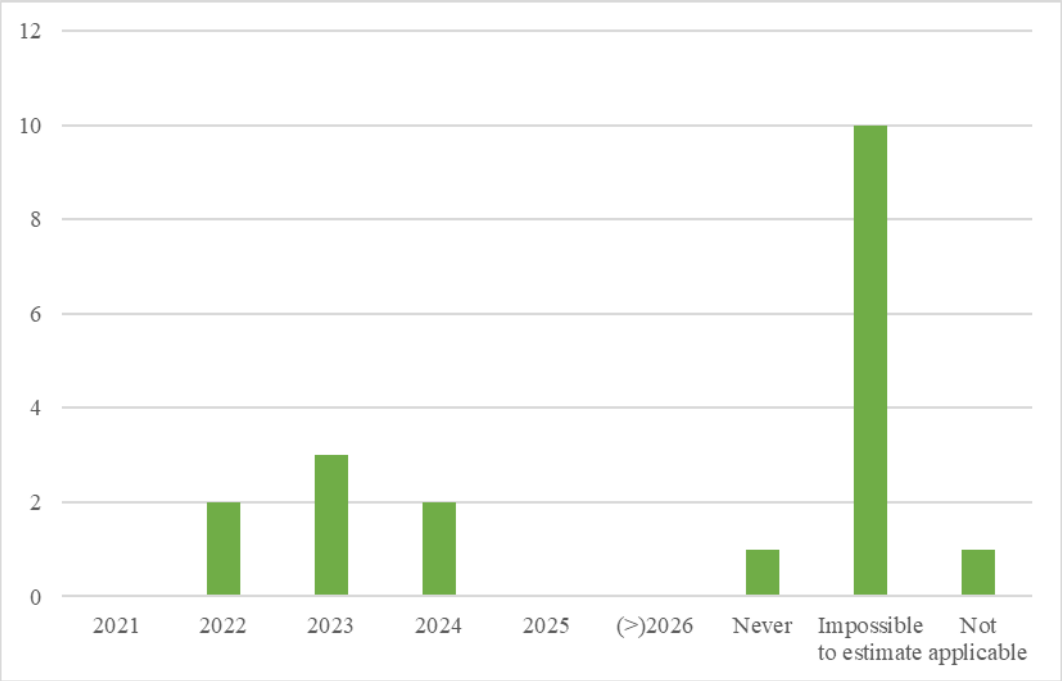
6.4Conversion Issuance: In your (rough) estimation, when will your registry start preparing for automated inserting of data from cancelled GOs on the GOs you will issue after conversion?



Only 19 out of 20 organizations responded to this question.

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7 What do you hope this project helps you with, in the field of handling certificates for energy conversion?

COUNTRY	ORGANISATION	
Anonymous		We do not have a gas registry yet, and as we will need to implement one in the near future, we need to have at least a few general guidelines and rules.
Austria	AGCS Gas Clearing and Settlement AG	To get a mutual understanding of the conversion process, the complexity and consequently provide guidelines how to overcome these challenges in order to provide existing and future Issuing Bodies a fundamental documentation. Not invent wheel again but build on existing experience and harmonise established systems.
Belgium	Hinicio	Providing clear guidance on 1/ how to store information on in Cancelled energy inputs and 2/ how to ensure smooth operations between national GO IB and NGC IB.
Belgium	VREG	Establishing clear and harmonised principles to follow. Sharing/suggesting best practices for implementation of conversion processes in GO platform.
Bulgaria	Sustainable Energy Development Agency	Finding a common approach to be applied by all issuing authorities.
Estonia	Elering AS	To have an overview of solutions of other countries to move towards developing a harmonised, reliable, and transparent approach.
Finland	Grexel Systems	Harmonization of rules.
France	GRDF	Thinking of all the questions we might have missed beforehand.
Germany	German Energy Agency (Deutsche Energie-Agentur, dena)	We hope it helps us to have a better understanding on how to deal with GO conversion, especially when it comes to storage and how to deal with GOs issued after the storage stage.
Netherlands	CertiQ	
Norway	Statnett	This issue is not on the agenda in Norway yet - so we hope a sensible mechanism and a well-functioning standard will be waiting for us to implement the day we need it ;) For this to be of any potential market value at all it is vital that the processes are automized. The market is moving towards higher time granularity - Consider having manual processes to match input and out for hourly/15-minute resolution... Part of the value in conversion and storage lies in the possibility to switch the time of day of production of renewable energy - So it must me expected that hight time granularity will be a requirement.
Slovakia	SPP - distribucia	More harmonisation.
Spain	Nedgia	key tool for helping the sector development
Switzerland	Pronovo AG	Finding an optimal solution and guidelines for creating our new registry.

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COUNTRY	ORGANISATION	
Switzerland	VSG	Finding common ground on rules to facilitate Europe-wide cross-border trading of renewable energy, and government recognition thereof.
United Kingdom	Green Gas Certification Scheme	start exploring the challenges of conversion and work up a position for the GGCS late in 2021 - from a process perspective and technical challenges.

Annex 2: Calculation examples: Proportional allocation of Attributes

Energy Carrier Conversion usually comes with energy loss. The number of Conversion GOs is therefore lower than the number of Cancelled GOs for proving the Input into conversion: the number of Conversion GOs issued, proportionally relates to the number of cancelled GOs for Input, multiplied by the conversion efficiency.

 # Conversion GOs Issued = (cancelled GOs / Input measurement) x Output measurement

The following chapter presents a set of example cases of Attribute Inheritance. It aims to illustrate how the proportional allocation of Attributes takes place.

Notice that a 20% energy loss is assumed due to conversion process inefficiencies.

The calculation uses the concept of Batch, which refers to a set of GOs with identical values for Attributes that are inherited from Input energy cancellation to Conversion Issuance. In practice, if cancellation is done for GOs that have two different values for the same Attribute, in the below examples they would be referred to as Batch 1 and Batch 2.

Directly copied Attribute value cases

The examples of this chapter present cases where energy source information is conveyed from cancellation to Conversion Issuance.

Case 1:

All Input energy is covered with similar GOs.

Input measurement value	100	→	Output measurement value	80
Cancelled GOs (Batch 1)	100		Issued GOs (Batch 1)	80
Energy source	Wind		Energy source	Wind

Case 2:

All Input energy is covered with similar GOs. Residue volume after conversion issuing.

Input measurement value	100	→	Output measurement value	80,5
Cancelled GOs (Batch 1)	100		Issued GOs (Batch 1)	80
Energy source	Wind		Energy source	Wind
			Residue (Batch 1)	0,5
			Energy source	Wind

Case 3:

Input energy is only partially covered by cancellations

Input measurement value	100	→	Output measurement value	80

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Cancelled GOs (Batch 1)	80
Energy source	Wind

Issued GOs (Batch 1)	64
Energy source	Wind

Case 4:

Input energy is covered with cancellations of GOs with multiple different Attribute values.

Input measurement value	100
Cancelled GOs (Batch 1)	50
Energy source	Wind
Cancelled GOs (Batch 2)	50
Energy source	Solar

→

Output measurement value	80
Issued GOs (Batch 1)	40
Energy source	Wind
Issued GOs (Batch 2)	40
Energy source	Solar

Case 5:

Input energy is only partially covered by cancellations with different Attributes and batch sizes. Residue volumes after conversion issuing.

In the below case, it is important to notice that also the residue part is only partially covered by the Input energy cancellations and is thus smaller than in previous cases.

Input measurement value	100
Cancelled GOs (Batch 1)	40
Energy source	Wind
Cancelled GOs (Batch 2)	20
Energy source	Solar

→

Output measurement value	80,5
Issued GOs (Batch 1)	32
Energy source	Wind
Issued GOs (Batch 2)	16
Energy source	Solar
Residue (Batch 1)	0,2
Energy source	Wind
Residue (Batch 2)	0,1
Energy source	Solar

Cumulating single Attribute value cases

Here, an example of carbon emissions calculation is used where the assumed emissions from conversion process are 100 [units]CO2e / [unit of production volume].

Case 1:

Input energy emissions and conversion process emissions are summed together.

Input measurement value	100

→

Output measurement value	80

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Cancelled GOs (Batch 1)	100
Carbon emissions	100

Issued GOs (Batch 1)	80
Carbon emissions	200

Case 2:

Input energy emissions and conversion process emissions are summed together. The same logic is applied to the residue

Input measurement value	100
Cancelled GOs (Batch 1)	100
Carbon emissions	100

→

Output measurement value	80,5
Issued GOs (Batch 1)	80
Carbon emissions	200
Residue (Batch 1)	0,5
Carbon emissions	200

Case 3:

Input energy emissions and conversion process emissions are summed together even when only part of the Input energy is cancelled using GOs and only part of Output is thus issued.

Input measurement value	100
Cancelled GOs (Batch 1)	80
Carbon emissions	100

→

Output measurement value	80
Issued GOs (Batch 1)	64
Carbon emissions	200

Case 4:

Input energy GO batches can have different carbon emission factors which are reflected in proportion in the issued GO batches. Conversion process carbon emission factor is 100.

Input measurement value	100
Cancelled GOs (Batch 1)	50
Carbon emissions	80
Cancelled GOs (Batch 2)	50
Carbon emissions	50

→

Output measurement value	80
Issued GOs (Batch 1)	40
Carbon emissions	180
Issued GOs (Batch 2)	40
Carbon emissions	150

Case 5:

Input energy GO batches can have different carbon emission factors which are reflected in proportion in the issued GO batches as well as the remaining residues.

Input measurement value	100
Cancelled GOs (Batch 1)	40
Carbon emissions	80

→

Output measurement value	80,5
Issued GOs (Batch 1)	32
Carbon emissions	180

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Cancelled GOs (Batch 2)	20
Carbon emissions	50

Issued GOs (Batch 2)	16
Carbon emissions	150
Residue (Batch 1)	0,2
Carbon emissions	180
Residue (Batch 2)	0,1
Carbon emissions	150

Additional Attribute value cases

In the following cases, the Attribute values of issued certificates are determined by the agreed logic. The cases differ from the previous two alternatives by having a higher likeliness of different interpretations and rules between registries and issuing bodies.

Case 1:

Input energy cancellation support information is inherited. Conversion Device receives no support.

Input measurement value	100	→	Output measurement value	80
Cancelled GOs (Batch 1)	100		Issued GOs (Batch 1)	80
Support	Investment support		Support	Investment support

Case 2:

Input energy cancellation support information is inherited. Conversion Device receives production support. Residue leftover.

Input measurement value	100	→	Output measurement value	80,5
Cancelled GOs (Batch 1)	100		Issued GOs (Batch 1)	80
Support	Investment support		Support	Investment and production support
			Residue (Batch 1)	0,5
			Support	Investment and production support

The case could also be considered a separate cumulating Attributes case. However, instead of value calculation, the Attribute value for issued certificates has to be determined by predefined logic.

Case 3:

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Input energy cancellation support information is inherited. Conversion Device receives production support. All support prior to energy conversion is considered production support. Residue leftover.

Input measurement	
value	100
Cancelled GOs (Batch 1)	100
Support	Investment support

→

Output measurement	
value	80,5
Issued GOs (Batch 1)	80
Support	Production support
Residue (Batch 1)	0,5
Support	Production support

Case 4:

Input energy batches have received different public support. Support information is inherited as is. Conversion Device has received production support. Leftover residue.

Input measurement	
value	100
Cancelled GOs (Batch 1)	40
Support	Investment support
Cancelled GOs (Batch 2)	20
Support	Production support

→

Output measurement	
value	80,5
Issued GOs (Batch 1)	32
Support	Investment and production support
Issued GOs (Batch 2)	16
Support	Production support
Residue (Batch 1)	0,2
Support	Investment and production support
Residue (Batch 2)	0,1
Support	Production support

Case 5:

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Input energy batches have received different public support – investment support and no support. Support information is inherited as is. The Conversion Device has received no support. Leftover residue.

Input measurement value	100	→	Output measurement value	80,5
Cancelled GOs (Batch 1)	40		Issued GOs (Batch 1)	32
Support	Investment support		Support	Investment support
Cancelled GOs (Batch 2)	20		Issued GOs (Batch 2)	16
Support	No support		Support	No support
			Residue (Batch 1)	0,2
			Support	Investment support
			Residue (Batch 2)	0,1
			Support	No support

Handling of leftover residue

The complexity of residue handling can drive Issuing Bodies to limit pre-conversion information on the GOs they issue for Conversion. It is expected that in many cases, the complexity and amount of the stored information and the need to match a high number of different cases together is actually due to the leftover residue of different Batches. If an issuing body / registry is considering conveying multiple Attributes from cancellation to Conversion Issuance, the effects of different residue handling should be considered.

Residue handling is still likely feasible if the only inherited Attribute to consider is the energy source. The more Attributes are inherited (and should be stored in residues) the more complex the process is. If, for example, residues should record energy source, support earmark, Label and CO2, a separate "residue batch" would have to be created for every combination. This "residue batch" would only be released when the next batch of exactly similar GOs is cancelled for the same Conversion Plant. The number of different residue combinations could rise exponentially and require heavy logic from the registries.

The simple methods to overcome the complexity could be to:

- Only consider energy source in residues
    - In relation to support this would e.g., mean that the residue would inherit the support information of the following cancellation batch with that energy source.
- Skip inheritance of Attributes in residues
    - This would mean that the total residue of the previous issuance (which could be >1MWh if there are multiple different batches issued) would inherit the Attributes of the following cancellation batches.

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- Neglect residues in Conversion Issuance
    - For example, if Conversion Issuance is made for 3 different cancellation batches for 100MWh of Output (in proportion after efficiency losses: 70,6; 20,8 and 8,6) then 70+20+8 GOs will be issues and 2MWh are dropped.

All alternatives (even the most complex one of including all residue information) should be considered balancing the benefits of the system with technical effort and complexity.

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