



REGATRACE

Renewable Gas Trade Centre in Europe

D2.8 Techno-economic feasibility study on a harmonized system for cross border title-transfer of the renewable character of gas in Europe

Deliverable:	D2.8 Techno-economic feasibility study on a harmonized system for cross border title-transfer of the renewable character of gas in Europe
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Table of Contents

1	REGATRACE in a Nutshell	3
2	Introduction.....	4
3	Key challenges	6
3.1	Regulatory framework.....	6
3.1.1	Renewable Energy Directive	6
3.1.2	Union Database	6
3.2	European Systems	7
3.2.1	IT system options for harmonized cross border transfers	9
4	IT-options for facilitating cross-border transfers	11
4.1	Introduction.....	11
4.2	Requirements for cross-border transfers of gas GOs	12
4.3	Options for cross-border transfers of gas GOs between both European Schemes.....	12
4.3.1	Exchange of gas GOs between Issuing Bodies.....	12
4.3.2	Issuing Bodies are connected to both schemes	13
4.3.3	Interface between IT-solutions of both European Schemes	13
4.3.4	Connection or Integration of Schemes.....	14
5	Assessment of options	19
5.1	Comparison of IT-related Rules and Specifications of AIB EECS Scheme and ERGaR CoO Scheme	19
5.1.1	Transfer processes for exchange of gas GOs.....	19
5.1.2	Transfer protocols	20
5.1.3	Principle of how registries interface with AIB Hub and respectively ExtraVert platform	23
5.1.4	Comparison content and format of data.....	23
6	Assessment of options	26
6.1	Technical assessment	26
6.1.1	Transfer Architecture	26
6.1.2	Technical adjustments in existing systems to implement the assessed IT solutions	28
6.1.3	Design criteria on implementing business processes.....	32
6.1.4	Flexibility of IT solution	35
6.2	Economic assessment.....	37
7	Actions required for implementation of the various options	39
7.1	Technical level (linking IT systems).....	39
7.2	Transfer Process Level	41
7.3	Quality assurance level (which processes and manual steps have to be adapted, up to registration and auditing requirements of market participants of the national organisations).....	42
7.4	Organizational level (decision making, governance of Schemes and Organisation, ..).....	43
7.5	Legal level (referring back to the legal framework, CEN, etc.)	45
8	Conclusions.....	47
	Glossary.....	50
	Literature	55
	Annex: Questionnaire: IT-related costs for setting-up and operating an interface with IT-systems of AIB and ERGaR.....	56
	Introduction	56
	Aim of survey	56
	Cost categories	56
	Background information	56
	Description of Issuing Body/registry.....	56
	Description AIB and ERGaR IT-Systems	57
	Cost estimates.....	58

1 REGATRACE in a Nutshell

REGATRACE (REnewable GAs TRAdE Centre in Europe) aims to create an efficient trade system based on issuing and trading biomethane/renewable gas certificates/Guarantees of Origin (GO) with exclusion of double sale.

This objective will be achieved through the following founding pillars:

- European biomethane/renewable gases GO system
- Set-up of national GO issuing bodies
- Integration of GO 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

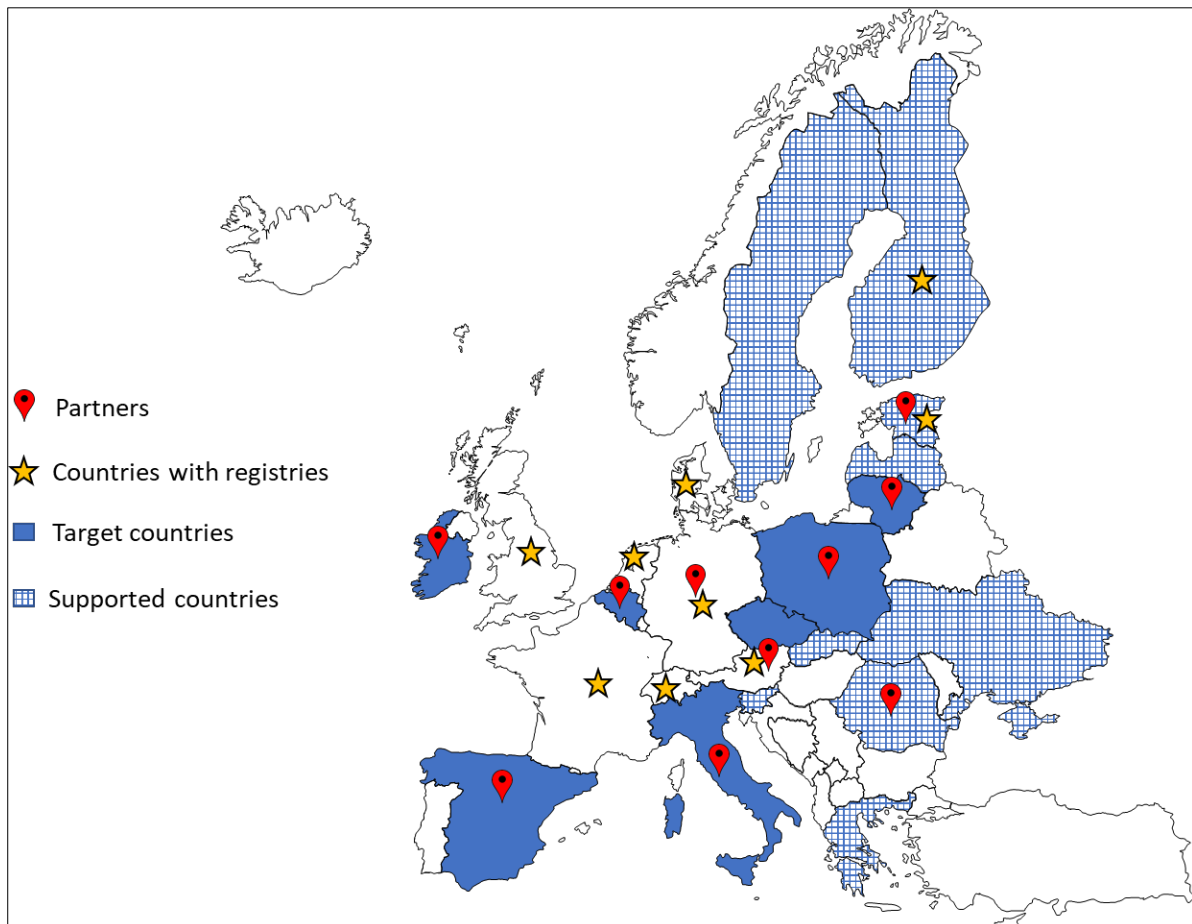


Figure 1: REGATRACE countries and partners

2 Introduction

The overall production of renewable gases and the issued volume of corresponding certificates has achieved around 30 TWh in Europe in 2020.¹ The REPowerEU initiative of the European Commission aims at increasing the biomethane production up to 350 bcm (approx. 350 TWh) biomethane in 2030 in Europe. Delivering on this target will very likely accelerate the demand for importing and exporting biomethane in Europe.

With regards to cross-border transfers, assuming that the data provided by dena for 2020² provide an almost complete picture of all European cross-border transfers, approximately 10% or 3 TWh of the biomethane production is exported to another European country. The report further shows that only a few countries and national registries are involved in cross-border transfers of renewable gas certificates. The statistics neither indicate which types of certificates are exchanged, nor the purpose of the transfer. However, the majority of transfers is performed between national registries of which at least one does not have a governmental mandate for the issuance of gas GOs. Although the assessment of this report focuses on IT-options for the exchange of gas GOs, other types of certificates and the issuing national registry will play a role in the future set up for certifying, documenting, and tracing back renewable gases.

At the time of the finalisation of this report, the authors of the report know that at least the following 16 countries have officially appointed Issuing Bodies for gas GOs: Austria (E-Control), Belgium Brussels (Brugel), Belgium Flanders (VREG), Belgium Wallonia (SPW), Denmark (Energinet), Estonia (Elering), Finland (Gasgrid Finland), Italy (GSE), Latvia (Conexus Baltic Grid), Lithuania (Amber Grid), The Netherlands (Vertogas), Portugal (REN), Slovakia (SPP Distribucia), Slovenia (AGEN-RS), Switzerland (Pronovo), and Spain (Enagas). Only 5 Issuing Bodies (Estonia, Belgium-Flanders, Belgium-Wallonia, The Netherlands, Denmark) are already operating an IT-system for the issuance of gas GOs.

In addition to the above-mentioned Issuing Bodies, biomethane registries are in operation in Austria (AGCS), Germany (dena), France (GRdF), Ireland (GNI), United Kingdom (GGCS) and Switzerland (VSG).

Mapping out the countries with the largest volumes of biomethane production and the countries with already operational Issuing Bodies indicates that only a minor share of biomethane production will be covered by Issuing Bodies on short notice. Some member states do not have any biomethane production installation yet and the corresponding demand for the issuance of gas GOs will be zero for the years to come. It shows that the development of biomethane production and the underlying documentation systems is unevenly distributed across Europe. From this it can be expected that the future demand for cross-border transfers will develop at different speeds.

Regardless of the magnitude of the demand for cross-border transfers in each country, Article 19 paragraph 9 of Directive (EU) 2018/2001 (RED2) requires Member States to accept gas GOs from other Issuing Bodies. They can only refuse them if they have doubts about the accuracy, reliability and

¹ <https://www.europeanbiogas.eu/eba-statistical-report-2021/>

² [Dena 2021: Branchenbarometer Biomethan 2021.](#)

veracity of the gas GO. Therefore, the development of a reliable, efficient, and trustworthy IT-solution for cross-border transfers of gas GOs is key to comply with this requirement.

The Association of Issuing Bodies (AIB) and the European Renewable Gas Registry (ERGaR) operate Schemes and IT-options that serve the purpose of transferring gas GOs between the IT-systems of national/regional Issuing Bodies and biomethane registries.

AIB is a non-profit association with only certificate issuing bodies in its member base, operating a voluntary standard for energy certificates like guarantees of origin, the European Energy Certificate System (EECS) and a decision-making structure that enables regular updating this standard in accordance with market needs and policy evolutions. AIB members use an IT Hub that facilitate automated transfers of EECS certificates between account holders in registries of different issuing bodies (700,000 GWh of electricity GOs transferred in 2021 over the AIB Hub). AIB extended in 2019 its EECS Standard with a Gas Scheme, which facilitates issuing bodies to issue EECS Gas GOs and transfer them over the AIB Hub. At the time of finalisation of this report, several AIB members are preparing their national processes for connection to the AIB Hub for cross-registry gas GO transfer (AIB, 2022).

ERGaR launched its ERGaR CoO Scheme in June 2021 facilitating cross-border transfers of gas GOs and other types of renewables gas certificates between connected Issuing Bodies and biomethane registries. At the time of finalisation of this report, four System Participants were connected to the ExtraVert platform of the Scheme, with five more ERGaR members being appointed as issuing body for gas or being in the process of being appointed. In the first year of its operation, the Scheme had facilitated more than 300 cross-border transfers of gas renewable gas certificates with a cumulated volume of more than 600 GWh (ERGaR, 2022).

The IT-option for facilitating the cross-border transfers of gas GOs will be assessed with the aim of establishing a functional, reliable, and efficient European market for renewable gases. Given the current situation with two European Schemes for cross-border transfer, the options for linking and integrating their IT-systems is a central question of this assessment. Since such an integration will take some time, bilateral and individual solutions for facilitating cross-border transfers of gas GOs between Issuing Bodies will too be explored.

The technical assessment of the different IT-options compares key features of the identified IT-options (Bilateral Agreement, Interfaces to 2 Schemes, AIB-ERGaR interface, Integration of Schemes). In this regard, the report will complement some already published REGATRACE reports, namely report D4.2 Report on Technical and Operational Comparison of the Biomethane/Renewable Gas Systems and the Electricity System and report D2.4 (Investigative Study of IT system options for harmonized European cross-border title-transfer of biomethane/renewable gas certificates), by comparing the transfer protocol as well as the specifications for the format, content and structure of the exchanged files (GOs) of both European schemes.

The economic assessment complements the technical assessment of IT-options. It considers the different starting points of Issuing Bodies for establishing an interface to one of the European Schemes and provides cost estimates for the creation and maintenance of these interfaces.

In the last chapter, the report describes for each IT-option the major hurdles and potential actions to overcome these hurdles.

3 Key challenges

3.1 Regulatory framework

3.1.1 Renewable Energy Directive

Paragraph 6 of Article 19 RED II states that “Member States or the designated competent bodies shall put in place appropriate mechanisms to ensure that guarantees of origin are issued, transferred and cancelled electronically and are accurate, reliable and fraud resistant. Member States and designated competent bodies shall ensure that the requirements they impose comply with the standard CEN - EN 16325.” In paragraph 9, it is further required that Member States recognise GOs issued by other Member States.

In this sense, the revision of the aforementioned standard started on February 2019 to include the energy carriers’ gas and hydrogen as well as heating and cooling. Originally, the Standard EN 16325 only regulated Guarantees of Origin for electricity. There are already registries in Europe for issuing gas certificates following the book & claim principle. Transfers of gas certificates was enabled between some of these registries based on bilateral cooperation agreements. This means that a new cooperation is needed for each time an account holder of a registry wants to transfer gas certificates to a foreign registry. Part of the administrative burden of such bilateral agreements is the harmonization of technology codes, issuance and cancellation rules that allow the recognition of such certificates by the registries involved in the transfer. In this regard, the rulings included in the Standard EN 16325 will allow for the harmonization of the aforementioned elements in order to pave the way for an efficient market for GOs of the energy carriers included in RED II (electricity, gas, hydrogen, heating and cooling).

Given the fact that AIB comprises Issuing Bodies for electricity GOs (some of which will or have already been designated as Issuing Bodies for gas GOs) and some of ERGaR’s members will or have already been designated as Issuing Bodies for gas GOs, then there is a potential for synergy. In this regard, harmonization according to the Standard EN16325 is essential for synchronization of both platforms. The standardization procedure (and hence harmonization) is not an easy task, especially when the interests and opinions of the various participants (gas associations, hydrogen associations, industry, research institutions, governmental energy agencies, etc.) are at play. Consensus based on the best options for an efficient GO market in Europe is therefore needed. This means that the rulings included in the revised Standard EN 16325 will most likely seek to serve the market in such a way that the issuance, transfer, and cancellation of GOs in Europe can be completed in an increasingly effortless manner. From an administrative and technical perspective, the gas Issuing Bodies will have to adapt their processes and IT solutions in order to comply with the Standard EN 16325. This also applies for the administration and operation of the AIB Hub and the ERGaR CoO Scheme, which will have to be modified accordingly.

At the time of finalisation of this report, the revision of the Standard EN 16325 was ongoing. The draft version EN 16325 2022-06-24 (CEN, 2022) is considered to be in a very advanced status which aims to be finally accepted in the course of 2023, yet this timeline is subject to various dynamics outside of the control of the drafters of this report.

3.1.2 Union Database

RED II foresees the implementation of a Union Database (UDB), which registers the production, trade and consumption of sustainable gaseous and liquid fuels. With regards to gaseous fuels, only the injection and withdrawal from the gas grid shall be recorded with the UDB. The latter will be connected

to the national databases of the Member States, allowing data entry from operators of National and Voluntary Schemes. It is also currently being discussed whether national schemes (third-party databases) should be mirrored in the UDB, even if they are not officially recognized by the European Commission.³ If a Member State has no national database for PoS in place, the UDB will offer direct user accounts for fuel producers.⁴ It is planned for the UDB to begin its operation by the end of 2022.

In their draft of the recast of Directive 2018/2001, the European Commission proposes a link between gas GOs and the UDB. The proposal states that Member States should ensure that gas GOs are cancelled before the corresponding renewable gas consignments are registered with the UDB. At the time of finalisation of this report, the potential interaction between gas GOs and the registration of PoS for the same consignment of the gaseous fuel in the UDB was still unclear. For this reason, any potential interaction between the European Systems, Issuing Bodies for gas and the UDB will not be assessed in this report.

3.2 European Systems

European legislation encourages Member States to facilitate the Europe-wide cross-border exchange of renewable gas consignments. In order to track the movement of renewable gases within a gas blend (within the gas grid) in a secure, trustworthy and transparent manner, the market requires a European system for cross-border transfer and exchange of renewable gas certificates.

Key stakeholders, including the already established national biomethane registries, along with designated Issuing Bodies for either gas or power, who are members of either ERGaR or AIB, are expected to provide solutions as soon as possible.

A tracking system for the renewable value of energy carriers must be based on two main pillars: the organisational structure (Scheme / scheme rules / market rules) and the technical infrastructure (IT-system), which are illustrated in Figure 1.

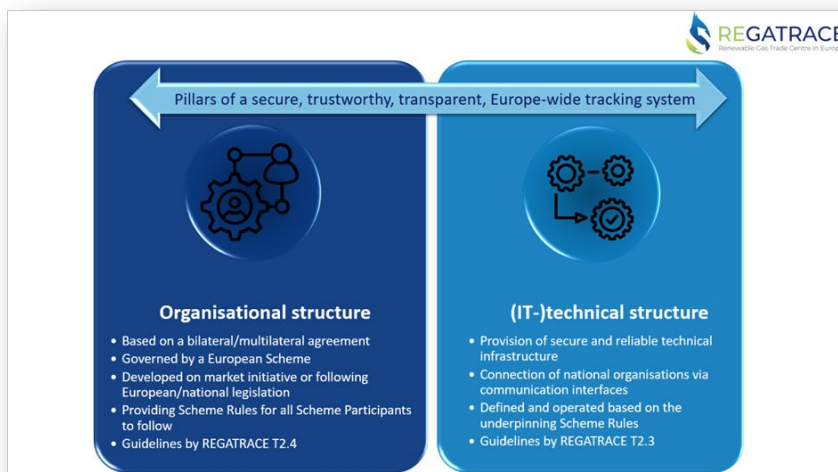


Figure 2: Pillars of a secure, trustworthy, transparent, Europe-wide tracking system (REGATRACE D2.5, 2020)

The organisational structure is usually governed by the Scheme Operator. Its rules are either developed by market initiative or based on national and/or European legislation. REGATRACE task 2.4

³ Sailer & Reinholz, dena, 2022

⁴ Guidehouse, 2020

describes the organisational structure of such a European Scheme. Such Scheme Rules are usually underpinning the operation of the necessary (IT-)technical structure, for which REGATRACE Task 2.3 “Prepare for the IT systems to facilitate reliable and efficient cross border title-transfer of European biomethane/renewable gas certificates” provides insights.

European schemes, based on the necessary organisational and IT-structure, have been in operation or are currently under development (see Figure 2) for different energy carriers and different application purposes.

The complexity of the future renewable gas market derives from the fact that at least four different organisations are ready to operate Schemes with a (partly) overlapping scope (see figure 2). AIB operates the European Energy Certificate System (EECS®), being a voluntary standard that enables reliable and efficient cross border transfer of energy certificates. ERGaR has launched the ERGaR Certificate of Origin (CoO) scheme in June 2021 to connect established national registries and facilitate cross-border transfers of renewable gas certificates. The European Commission will start the operation of the Union Database for sustainable gaseous and liquid fuels (EU-Biofuels). The CertifHy project consortium aims at establishing a Europe-wide Certification Scheme for hydrogen. While the above-mentioned European Schemes provide solutions for the documentation of renewable gas certificates, the scope and background, rules and requirements are different. This increases the risk of multiple counting and claiming and, if not harmonized well, hampers the interoperability of the IT-systems of the connected Issuing Bodies. Therefore, any cooperation and alignment between the Schemes could improve the efficiency of transferring renewable gas certificates across Europe and prevent the multiple counting of the renewable value.

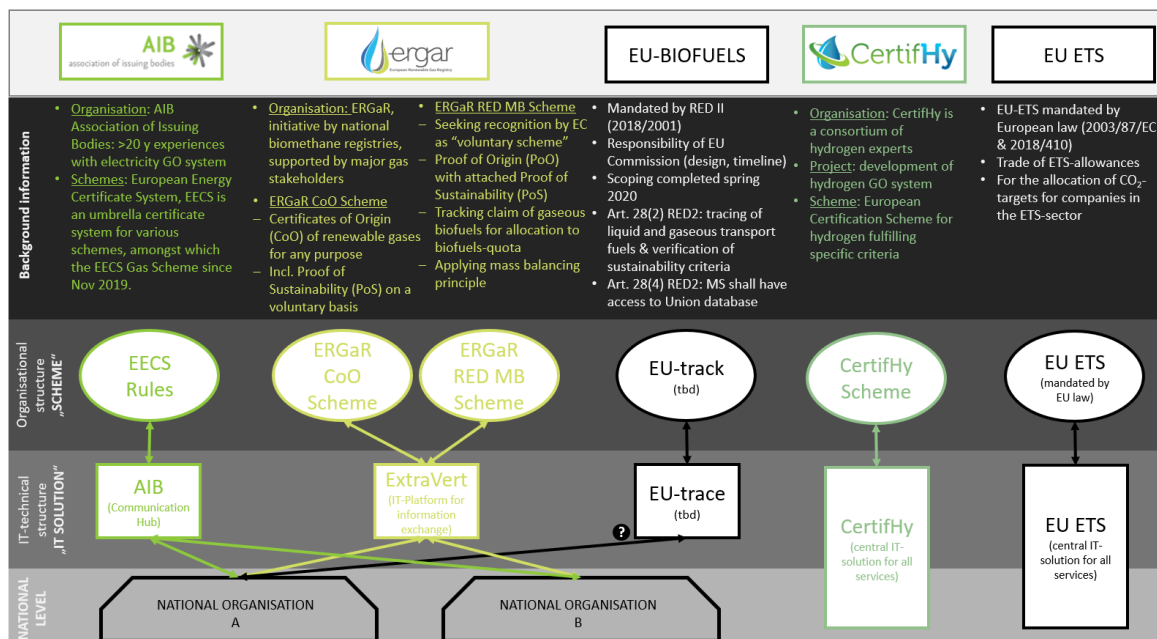


Figure 3: Existing Schemes and related IT-solutions (REGATRACE D4.2, 2021)

REGATRACE Deliverable 2.4 provides an investigative study of IT system options for harmonized European cross border title-transfer of biomethane/renewable gas certificates. REGATRACE D4.2 provides a technical and operational comparison of the biomethane/renewable gas GO system and the electricity GO system and identified the following working areas:

- Data integrity and quality assurance frameworks of the European Schemes are different,

- Data recorded on certificates, its verification requirements and format of this data is not fully synchronized,
- The IT-systems and the transfer protocols of AIB, ERGaR and CertifHy are not synchronized,
- The liability coverage framework is not levelized among the different schemes.

In some countries, more than one national organisation is responsible for the issuance of renewable energy certificates. Although the purpose of renewable gas certification might be different, a renewable gas production device could be participating in several schemes. In relation to European Schemes, this could even increase the complexity and the risk of double counting. There is no single approach to prevent the risk from multiple counting that derives from a set-up with different organisations being responsible for issuing and documenting renewable gas certificates in one country. This is left out of the scope of this report, as it is assumed that this is handled on national level without any impact on the operation of European Schemes.

3.2.1 IT system options for harmonized cross border transfers

Deliverable 2.4 provides an investigative study of IT system options for harmonized European cross border title-transfer of biomethane/renewable gas certificates. The report offers a description of six possible IT-options for the connection of National Organisations (national biomethane registries, Issuing Bodies and biofuels registries/databases) for harmonised and secure data exchange:

- Standardised data exchange without dedicated database (option 1)
- Standardised data exchange with simplified database (option 2)
- Bolt-on module (option 3)
- Platform for information exchange (option 4)
- Centralised communication hub (option 5)
- Central IT-solution for all services (option 6)

Based on the maturity of the renewable gas market, different options have been drawn up, in consideration of the future development of the market. Here, the short-term solution for limited renewable gas volumes is envisaged differently for those first-mover national organisations which are already established and equipped with robust and developed IT-solutions compared to the long-term solution. The latter, more future-oriented variation is based on large renewable gas volumes, as well as the set-up of national gas Issuing Bodies in all European Member States. The recommendations elaborated in D2.4 reflect the timeline and maturity levels of market development:

Short-term IT-solution for a European Scheme

IT options 1 to 3, which are based on already existing IT-infrastructures, could provide a short-term, temporary approach because they pose low requirements on the IT-systems of Scheme Participants and the handling of business processes is rather simple. However, a high number of transactions and Scheme Participants will require more automated business processes. Hence, IT-options 4 and 5 seem suitable when advanced national IT-systems and know-how of Scheme Participants are available.

Medium-term IT-solution for a European Scheme

For those Member States who are in the early developments of their renewable gas market, a Central IT-solution (option 6) could be beneficial for an initial kick-off. In order to address the different situations in Member States, a Hybrid IT-solution could be suitable, combining well-advanced and tailor-made national IT-systems with a Central IT-solution. However, without standardisation across Europe, country-specific circumstances will be prevalent, decreasing the efficiency of the Central IT-option. It might pose high costs for development and maintenance and is mainly suitable for markets with a high number of market participants and transactions.

Long-term IT-solution for a European Scheme

A Central IT-solution (option 6) for all services in Europe will be a suitable long-term solution from IT-perspective since it pushes harmonisation and standardisation across Europe and simultaneously avoids duplication of organisational efforts. The level of centralisation is open for investigation, several business processes might still be performed on national level, e.g., the registration of production plants. However, the development phase of such an IT-solution is highly complex. Especially during a transition phase, the synchronisation of the Central IT-solution with IT-systems of National Organisations, where already established, will pose complexity and possibly additional costs. Experiences with a similar IT-solution in the EU ETS sector has shown that development might take years or up to decades. For countries with no system and market established yet, the connection to a Central IT-solution will provide guidance and support, overcoming the challenge of developing a tailor-made national IT-solution.

For more detailed information on the individual solutions and subsequent comparison visit the deliverable published on the REGATRACE project website <https://www.regatrace.eu>.

From a business point of view, different options are feasible (see following chapters) to connect the IT-solutions of existing Schemes. The status quo in each country does vary significantly as it is based on the development of the national market and the integration of European legislation into national acts and regulation. The national framework and set-up do have a high impact on the time frame, costs, and efforts to connect to European Schemes.

Based on current IT-systems of national organisations there is a clear trend towards the establishment of a dedicated, national IT-system with individually developed interfaces to a European Scheme allowing for individual registry business processes to handle imports and exports of renewable gas certificates. Whether the imports and exports via a European Scheme are operated manually is in the sole responsibility/decision power of national organisations. With currently limited numbers of registries and small renewable gas volumes in Europe, those manual processes might be kept for the time being. However, existing IT-solutions might allow for future upgrading towards increased automation of renewable gas certificate transfers. This offers the chance to draw up a comprehensive solution of European Scheme cooperation considering the levels of national IT-solution development.

The following chapters are based on the hypothesis that all participating national organisations of a European Scheme are equipped with an IT-solution able to connect to a European Scheme and are able to fulfil future automation requirements to cope with a high number of transfers across borders and subsequently via the European Scheme with other national organisations IT-systems. Therefore, option 1 to 3 from the REGATRACE D2.4 are very unlikely to be considered for European Scheme cooperation. Furthermore, option 6 (central IT-solution) may require more time to establish due to the different European Schemes to connect, which would require that a central IT-solution at least covers all European Schemes or that the Schemes directly integrate with each other.

Consequently, IT-option 4 “Platform for information exchange” and option 5 “Centralised communication hub” represent suitable IT-system set-ups for connecting either national organisations but also allow for the connection and/or integration of IT-systems of European schemes. The AIB hub operated by AIB may be considered in the category “Centralised communication hub” (option 5) and the ExtraVert Platform operated by ERGaR fits category “Platform for information exchange” (option 4). The present report thus further develops on these circumstances and focuses on IT-systems of AIB and ERGaR for connecting national organisations with each other, or via European schemes.

4 IT-options for facilitating cross-border transfers

4.1 Introduction

The transfer of gas GOs between national/regional Issuing Bodies can be facilitated in many different ways. The governance, the scheme rules, and the IT-solutions of the two European schemes lay down the starting point of how a harmonised system for cross-border transfers of biomethane and gas GOs could be established. It therefore is obvious that a harmonised system requires collaboration between the scheme operators AIB and ERGaR. In contrast to such a coordinated approach, national/regional Issuing Bodies may decide to set-up individual bilateral or multilateral IT-solutions for cross-border transfers of gas GOs. Due to the historical lack of European solutions, dena on the one side and AGCS, ENERGINET and REAL on the other side, established bilateral agreements for the exchange of renewable gas certificates. In the meantime, these bilateral exchange solutions have been replaced by the ERGaR CoO Scheme, which harmonizes the transfer processes between its system participants.

The authors have identified several options based on their market know-how and brainstorming approach with involved stakeholders. Although those options follow different approaches and scenarios, they all describe concepts for the transfer of gas GOs between Issuing Bodies:

- 1 Exchange of certificates between Issuing Bodies (“Bilateral Agreements”)
- 2 Issuing Bodies are connected to both European Schemes (“Interfaces to 2 Schemes”)
- 3 Interface between the IT-solutions of both European Schemes (“AIB-ERGaR interface”)
- 4 Integration of Schemes (“Integration of Schemes”)
 - 4.1 Integration of ERGaR Schemes into EECS Schemes
 - 4.2 Integration of EECS Gas Scheme into ERGaR CoO Scheme

Options 1) and 2) are based on individual decision of Issuing Bodies, while options 3) and 4) involve collaboration between the operators of the two European Schemes. The IT-options are characterised by several key elements and the way these elements interact with each other:

European Scheme: AIB’s EECS Gas or Electricity Scheme or ERGaR’s CoO Scheme or RED MB Scheme.

EXISTING INTERFACE between European Scheme and issuing body / national registry: Interface which connects the IT-solution of the European Scheme with the IT of its Scheme Participants.

Issuing body / national registry: Organisation responsible for issuing gas and/or electricity GOs or other types of renewable gas certificates either on a governmental mandate or on a voluntary basis.

IT solution linking European Schemes / facilitating GO transfers between Issuing Bodies: The IT solution, which enables the electronic transfer of GOs between the databases of Issuing Bodies. It can either be a new or an existing IT-solution.

IT-solution of European Scheme: The IT solutions handling the GO transfers between Scheme Participants of either AIB Schemes or ERGaR Schemes. ERGaR’s IT solution is called ExtraVert. AIB’s solution is called AIB hub.

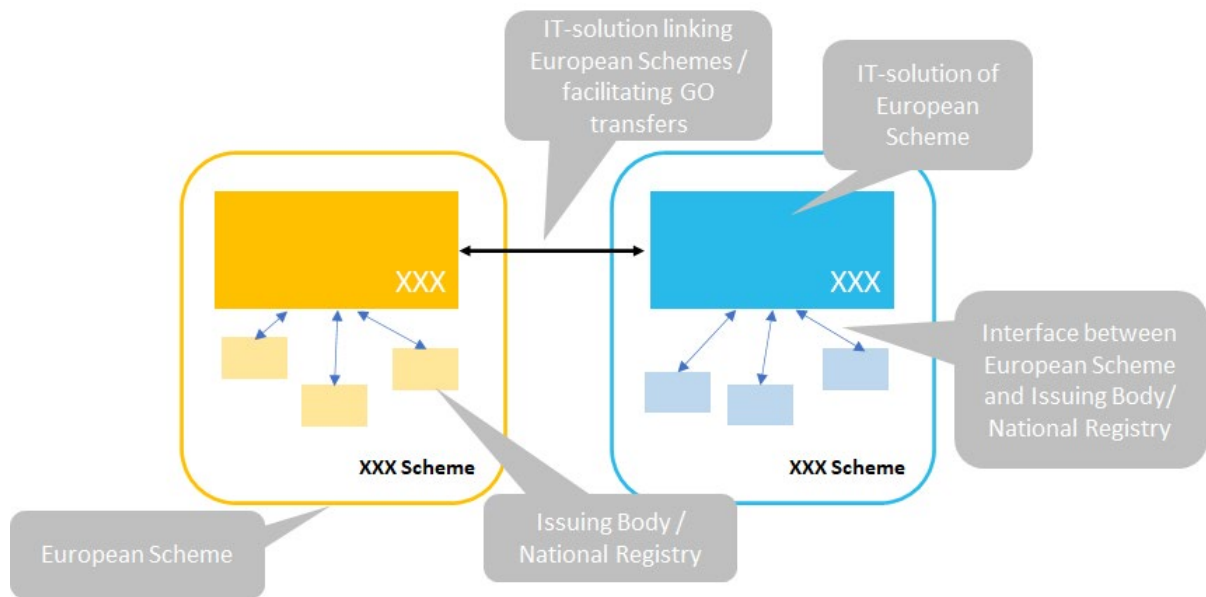


Figure 4: Key elements characterising IT-options

4.2 Requirements for cross-border transfers of gas GOs

Looking at the framework for Issuing Bodies' operation for cross-border transfers of gas GOs, and its impact on IT systems, the RED2 provides relevant guidance.

Art. 19.9: "Member States may refuse to recognise a GO only where it has well-founded doubts about its *accuracy, reliability or veracity*." Interpretation of these three criteria is left up to the Member States.

The IT system for cross-border exchange has a relevant contribution to each of these criteria, though each of these criteria in itself is impacted by frameworks wider than only the IT system. The difference in national auditing requirements for the renewable gas production and the Issuing Bodies is one key aspect in this regard. Also, *efficiency* of data exchange and quality verification are pivotal criteria. Lacking efficiency in cross-border transfer of gas GOs risks to result in low market-uptake due to hurdles in time consuming and resource-intensive processes. Particularly, here the IT system has a major role. The processual, administrative, technical and organisational requirements in relation to cross-border transfers are described in REGATRACE report D2.4 and will not be repeated here.

4.3 Options for cross-border transfers of gas GOs between both European Schemes

4.3.1 Exchange of gas GOs between Issuing Bodies

Before European Schemes started their operation, direct bilateral transfers were performed. Especially in the renewable gas sector, renewable gas certificates were transferred between Issuing Bodies and national biomethane registries, respectively, based on bilateral cooperation agreements. The ERGaR CoO Scheme was a first remedy to replace such bilateral agreements, however there are no restrictions for the establishment of further bilateral agreements. Without collaboration between AIB and ERGaR on gas GOs, AIB and ERGaR affiliated Issuing Bodies could aim at establishing a direct exchange between their IT systems via bilateral agreements. In such a scenario, no coordinated and harmonized single IT solution would facilitate the transfers between AIB and ERGaR affiliated Issuing Bodies. The Issuing Bodies willing to exchange gas GOs with each other would have to define the specifications for the establishment and operation of their connecting interface on a bilateral basis.

Although no direct interface between the IT-systems of AIB and ERGaR would be established, the operators of the European Schemes would have to decide whether imported GOs from another scheme would be eligible for transfer over their IT systems. Such a solution is prone to the risk of modifications of the European Schemes.

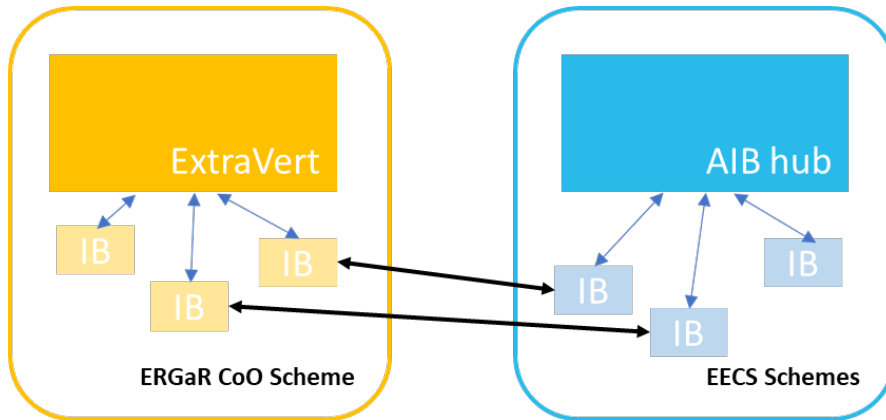


Figure 5: IT-option exchange of gas GOs between Issuing Bodies

4.3.2 Issuing Bodies are connected to both schemes

Another scenario is that Issuing Bodies join both European schemes and exchange gas GOs with all Issuing Bodies, which are connected to both ExtraVert platform and AIB hub. An issuing body joining both European Schemes would have to establish two interfaces; one interface to the ExtraVert platform and one to the AIB Hub. Issuing Bodies which would exclusively join one of the two schemes, would not be able to exchange certificates with Issuing Bodies, which are operating under the scheme rules of the other European scheme.

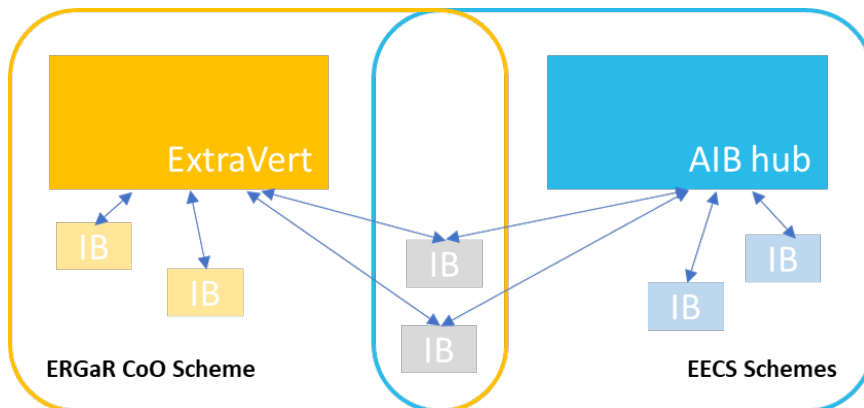


Figure 6: IT-option Issuing Bodies are connected to two European Schemes

4.3.3 Interface between IT-solutions of both European Schemes

Directly connecting the ExtraVert platform and the AIB Hub with an IT-interface would enable cross-border transfer of gas GOs between Issuing Bodies affiliated with both European Schemes. The advantage is that national organisations would need to establish one interface instead of several interfaces. It would not be relevant to which European Scheme the national organisation was connected to as the interface between the European system would forward transfers. A gas GO from an Issuing Body, which is connected to the ExtraVert platform, could then be transferred to an Issuing Body connected to the AIB hub, or vice versa. All gas Issuing Bodies connected to either ExtraVert platform or AIB Hub could apply this interface and send and/or receive gas GOs from Issuing Bodies that are participating in the EECS gas scheme and the ERGaR CoO Scheme. With a view to the

increasing demand for energy carrier conversion, the collaboration on gas GOs could be further extended to the mutual recognition of gas and electricity GOs respectively.

The exchange of gas GOs via a technical interface requires a collaboration between scheme operators ERGaR and AIB, which involves the mutual recognition of gas GOs (including their attributes and specifications), the joint development and operation of a technical interface and a harmonisation and adaptation of governance and liability. Further, it requires a framework for:

- 1) dealing with updates in either scheme, regarding the format and/or content of data that is required to be exchanged between Schemes and regarding its format. It should be clarified how any upgrading and improvement in one system would not hamper the feasibility of data exchange between the ExtraVert platform and the AIB Hub;
- 2) allocating liability for the case any damage is claimed by any party involved in the value chain. Certificates are electronic documents with monetary value: if any data is lost, duplicated or unjustly modified, market parties, Issuing Bodies or scheme operators may suffer damage and risk allegation;
- 3) upgrading and adaptation of the interface according to external influences on European and national level such as adaptation of Renewable Energy Directive.
- 4) quality assurance to the same level as the intra-Scheme quality assurance. Examples are the frequency and content of audits on the Scheme Participants and/or the renewable gas production installations.

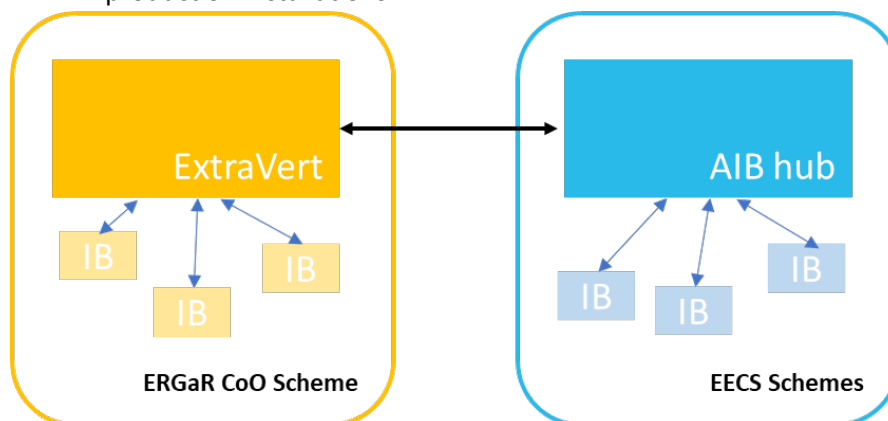


Figure 7: IT-option interface between ExtraVert and AIB hub

4.3.4 Connection or Integration of Schemes

4.3.4.1 Integration of ERGaR Schemes into EECS Gas Scheme as Independent Criteria Scheme (ICS)

The integration of ERGaR schemes into EECS schemes follows the scenario that all gas Issuing Bodies will join EECS Gas Scheme and connect to the AIB hub, while the special rules and attributes of the ERGaR schemes maintain to exist as an Independent Certification Scheme (ICS) (for more information see 4.3.4.2). This configuration has the option to maintain the operation of the ERGaR Schemes at the same organisation as where it is operated now, or alternatively, integrate this into AIB operation. The advantage is that between the engaged Issuing Bodies, the acknowledged certificates can be exchanged over the AIB Hub. For transfer over the AIB Hub, official appointment of the Issuing Body under a legislative framework is not a prerequisite. What is important is that the connected issuing body engages into the liability framework and uses the agreed standardised transfer protocol.

Acknowledgement as an ICS under EECS in AIB allows that System Participants of ERGaR Schemes can continue to issue certificates according to the ERGaR Scheme Rules while at the same time complying with EECS rules. There are two types of Independent Criteria Schemes: Legislative Certificate Schemes and Non-Governmental Certificates Schemes. In terms of IT, this can be implemented in two options:

Dual transfer protocol option

For the option of a partial integration of ERGaR Scheme into EECS gas scheme with dual transfer option, Issuing Bodies participating in ERGaR Schemes may additionally opt to perform cross-border certificate transactions with the ExtraVert platform, while they may also do so over the AIB Hub.

The option implies that no new IT-solution has to be established for cross-border transfers of gas GOs, but all cross-border transfers of gas GOs can be executed via the AIB hub. ERGaR System Participants joining the EECS Gas Scheme have to set up a new transfer protocol and develop an interface to the AIB hub, just like other Issuing Bodies that are connected to the AIB Hub. As their business processes are currently oriented towards the functionality of the Extravert Platform, furthermore, they have to modify their business processes or add functionalities to them.

In EECS there is a principle that an EECS Certificate loses its EECS status when transferred outside of the EECS area, and that it can only enter the AIB Hub if it has been issued as an EECS Certificate. This therefore implies that the ERGaR System Participants would also have to implement warranties to not import non-EECS Certificates over the AIB Hub.

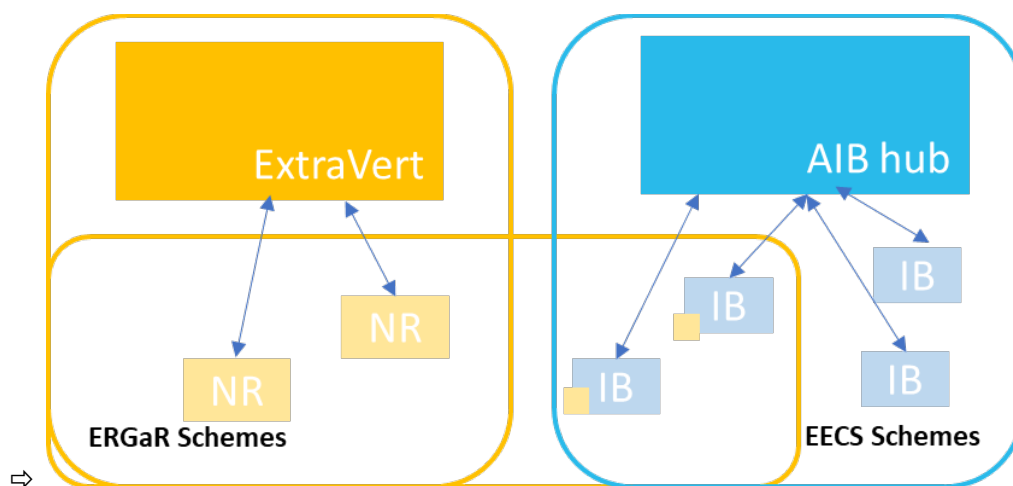


Figure 8: IT-option integration of ERGaR Scheme into EECS – dual transfer protocol

Single transfer protocol option

Further developing this scenario would result in the full integration of ERGaR Schemes into the EECS Gas Scheme and the AIB hub as the single IT solution for the exchange of gas GOs and other renewable gas certificates between Issuing Bodies. EECS facilitates a structure that can be used for both Issuing Bodies with a governmental mandate and national non-governmental registries.

It may require adaptations to the AIB Hub to integrate the ERGaR Scheme Rules. This is especially the case, if the ERGaR CoO Scheme further elaborates its mass balancing function.

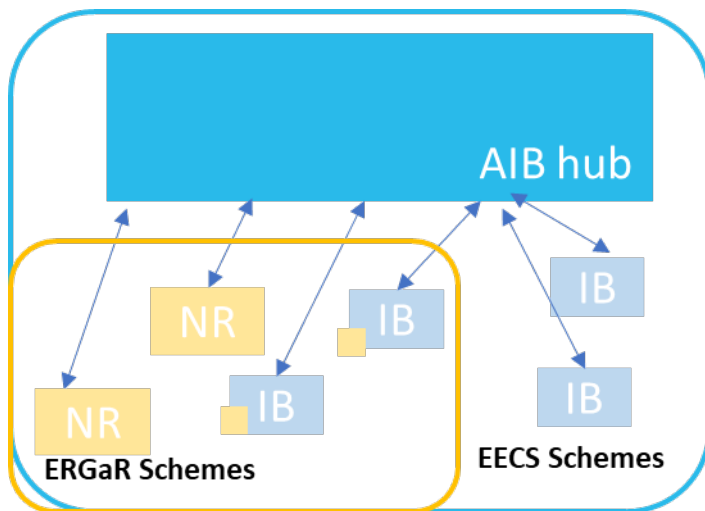


Figure 9: IT-option full integration of ERGaR Schemes into EECS – single transfer protocol

Options for allocating the role of Scheme operator(s)

The term ‘integration’ so far mainly relates to the IT system and does not cover the task of scheme operation, which is a separate decision to be made. Besides IT system integration, the following options are available regarding to whom to allocate the role of scheme operation:

Option C1: It is possible to maintain ERGaR Scheme operation in a separate legal entity, where the Scheme Rules of these ERGaR Schemes are determined. In this case, an agreement is to be set up between AIB and ERGaR regarding the operation and compatibility of the ERGaR schemes with the EECS Rules. ERGaR independently determines its scheme rules and ensures the quality of the implementation by its system participants. This option C1 can accommodate both options A and B above.

Option C2: Alternatively, it is also possible to integrate ERGaR scheme operation in the same legal entity as that which operates the other EECS Schemes, being AIB. Here AIB becomes responsible for quality assurance not only on the implementation of the existing EECS Rules, but also on integrating in EECS any additional rules currently set out in the ERGaR Schemes. This option C2 can only be implemented in above option B.

Framework for connecting schemes with EECS

a) Issuing Body level

While small differences between the certificate schemes of AIB and ERGaR are inherent to the operational conditions of the two associations and their schemes (REGATRACE D4.2.), it deserves the consideration of the possibility for a national Domain Scheme to comply with the certification schemes of both international associations. This requires the characteristics of the ERGaR and AIB schemes to be checked to the detail.

This chapter explores what it is needed for this to be established, from the perspective of operating in the framework of the European Energy Certificate System (EECS) Rules.

Doing so acknowledges that the EECS Rules consist not only of harmonisation of operational certificate administration rules, but also of a framework for cooperation, decision making, admission, compliance follow-up, quality guarantee, role definition, change handling and liability allocation between Issuing Bodies, their Agents and their Account Holders. This chapter thus explores opening the full EECS Framework to System Participants of the ERGaR Schemes.

An Issuing Body wanting to make use of the EECS framework, thus needs to comply with this full framework of engagements by becoming a member of the association. Once an Issuing Body has passed through the full assessment of this framework, it has access to all related services. This implies that its Domain Scheme's quality is guaranteed to all members of the AIB, and automated transfer of its certificates can be facilitated over the AIB hub.

Where it comes down to the operation of the certificate scheme rules, if operating under the EECS umbrella, the EECS and ERGaR schemes can operate either in parallel or in a cumulative way.

There are ways to establish such statuses by either operating the ERGaR Scheme outside AIB (option 3.3.4.1.01 above) or inside the AIB (option 3.3.4.1.02 above). To establish more understanding about this, first some properties of the EECS Certificate system are being elaborated, before applying these properties to both options.

b) Certificate Products under EECS

The current framework of the EECS Rules facilitates three product types: Guarantees of Origin, Support Certificates and Non-Governmental Certificates. Each product type on its turn can have various sub-products. A data field on the EECS Certificate indicates the type of product. An Issuing Body can apply for EECS Scheme membership in relation to one or more Certificate Products.

A Guarantee of Origin (GO), by its legal definition, is issued by a Competent Authority or its agent, under the laws of a state as a guarantee of the nature and origin of energy for the purpose of providing proof to the final consumer of energy of the energy source, technology or other attributes to which the guarantee relates.

A Non-governmental Certificate is defined as the voluntary equivalent to a GO, which is not issued in the framework of a Legislative Certification Scheme.

If desired by ERGaR and AIB, additional Products for the ERGaR Certificate Products could be defined in EECS, if the current Product Types in EECS do not suffice to cover the ERGaR certificate products.

c) Additional qualities documented on an EECS Certificate

A data field on the EECS Certificate enables to add the information of compliance with an Independent Criteria Scheme.

It is possible to identify the ERGaR Scheme(s) as Independent Criteria Schemes. The benefit of this is that this informs about compliance with additional criteria on top of the basic criteria of the Certificate Product. This way, a GO that complies with ERGaR criteria, can still be identified as such a GO issued under a legislative scheme while having additional qualities that lead back to ERGaR's criteria.

4.3.4.2 Integration of EECS Gas Scheme into ERGaR CoO Scheme

The integration of EECS gas rules into the ERGaR CoO scheme is another option of establishing a common, harmonised European system. As long as the AIB hub is not operational for gas issuing bodies, this would be an option to facilitate cross-border transfers of gas GOs between already established issuing bodies. In such a scenario, all gas Issuing Bodies would adhere to the ERGaR CoO scheme rules. The wider cooperation and harmonisation engagement of the EECS rules would not apply for Issuing Bodies who issue only certificates for gaseous energy carriers. However, this engagement to EECS would need to be integrated when handling certificates in relation with energy carrier conversion, to cooperate with Issuing Bodies operating under AIB's electricity scheme.

In a first step, only one IT solution is required to facilitate cross-border transfers of gas GOs between national/regional Issuing Bodies. Taking into account the increasing demand for energy carrier

conversion, the question arises, how the transfer of gas and electricity GOs is facilitated between the corresponding Issuing Bodies both, within a country/domain and between countries. When this report was finalised, the regulatory framework for Renewable Fuels of Non-Biological Origin (RFNBO) with regards to article 27 (3) of RED 2 and the complementary rules for energy conversion in the standard EN 16325 were still being discussed. Still, an interface and cooperation between the Schemes and related IT-solutions are of importance to fulfil the demand for energy carrier conversion independent which direction and requirements from the regulatory framework and the standard EN 16325, respectively. How the energy conversion could be integrated into the ERGaR CoO Scheme needs to be elaborated based on the outcome of the before mentioned initiatives.

Overlapping functions and requirements such as security, operation, and other major similarities should still be implemented in parallel. Individual requirements to the energy carrier are kept separately and provide for flexible adaptation.

Whereas EECS provides a wider engagement framework for Issuing Bodies' mutual cooperation, the ERGaR governance does not differentiate between issuing bodies with governmental mandate and such registries that do not have a governmental mandate. With regards to the mutual recognition of gas GOs, the System Participants may reject GOs and other types of renewable gas certificates from other System Participants only, if they violate national legislation or ERGaR rules. 3.3.4.1

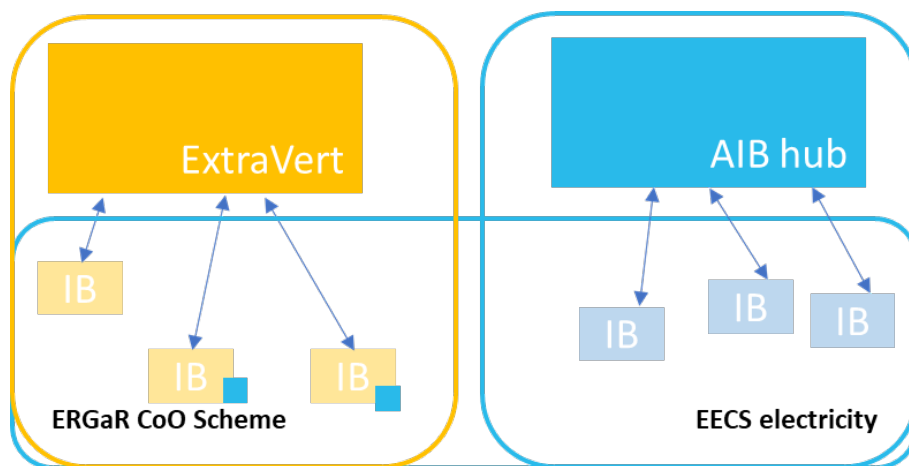


Figure 10: IT-option integration of EECS Gas Scheme into ERGaR Schemes – single transfer protocol

5 Assessment of options

5.1 Comparison of IT-related Rules and Specifications of AIB EECS Scheme and ERGaR CoO Scheme

With regards to the technical and economical assessment, the current rules and specifications of the AIB EECS Scheme and the ERGaR CoO Scheme have to be considered. From an IT perspective, the cross-border transfers of gas GOs involve four major challenges:

- a clarification of the various **roles** (scheme operator versus IT system operator versus system participants versus account holders) and the interaction between them,
- the harmonisation of **business processes** for individual Issuing Bodies and registry operators,
- harmonisation of transfer protocols into a definition of the **technical exchange specifications**, and
- an agreement on which **content and data** will be exchanged between the respective systems.

The economics of the technical implementation of the identified IT-options depend on how much modifications and human resources are required for the establishment, maintenance, and operation of each option.

5.1.1 Transfer processes for exchange of gas GOs

5.1.1.1 AIB business processes

The business processes for the exchange of certificates are available in Subsidiary Document 03 to the EECS Rules, called 'EECS Registration Databases – Hub User Compliance Document (in short 'HubCom')'. It is available here: <https://www.aib-net.org/eecs/subsidiary-documents>.

It sets out obligations of both the AIB and the Issuing Bodies whose registries are connected to the AIB Hub. They relate to transfer protocols, type, and format of the data to be exchanged, test protocols, maintenance, error handling, security, liability, performance, 3-yearly IT- technical audits, etc.

The AIB contracts a so-called Superuser (subject to regular tender) who follows up smooth transfer handling, facilitates any dispute resolution and collects and balances the needs of the AIB members towards the IT provider of the AIB Hub. AIB members maintain a Code of Conduct for handling errors.

An Account Holders Database is maintained to ensure that transfer messages are only sent to existing accounts in other registries. This avoids loss of certificates during transfer, or time spent in resolving errors related to non-existent account numbers.

The AIB Hub in its transfer validation process checks for double counting. This is based on the ID of every transferred certificate and the registry it has lastly been sent to.

It has checks on format and content of the transferred Certificates and throws error messages in accordance with standardised error codes to enable the involved registries to efficiently resolve issues in relation with any failed transfer.

Updates to the IT specifications, transfer protocol, message mechanism, message format are agreed in AIB's Information Systems Unit, updates to the business rules and certificate content principles are agreed on in AIB's EECS Unit. Decisions in both organs of the association are made by all members

that are connected to an AIB Scheme. Scheme specific rules and scheme specific certificate content are decided respectively in the Electricity Scheme Group and the Gas Scheme Group.

5.1.1.2 ERGaR business processes

The Participation Agreement and the ERGaR CoO Scheme Rules set out the obligations of ERGaR as operator of the CoO Scheme and the System Participant as account holder of the ExtraVert platform. While the System Participants Working Group is entitled to suggest proposals for new functions and rules, it is the ERGaR Executive Board that decides on the amendment of the Participation Agreement and the ERGaR CoO Scheme Rules.

The Participation Agreement contains the obligations for the System Participants and ERGaR as the operator of the ERGaR CoO Scheme. These include the qualification process, information requirements, risk management, liability of involved parties, documentation, etc.

In the event that a System Participant fails to satisfy the requirements and obligations set out in the Participation Agreement or in the Scheme Rules, a Control and Sanction Committee conducts an investigation of the case and could suggest a sanction to the System Participant.

The ExtraVert platform validates all uploaded data packages against the format and rejects GOs which do not have a unique transfer ID (double transfer). Transfers that have been rejected or cancelled will be recorded on the platform, but the GOs will only be reactivated in the source registry.

5.1.2 Transfer protocols

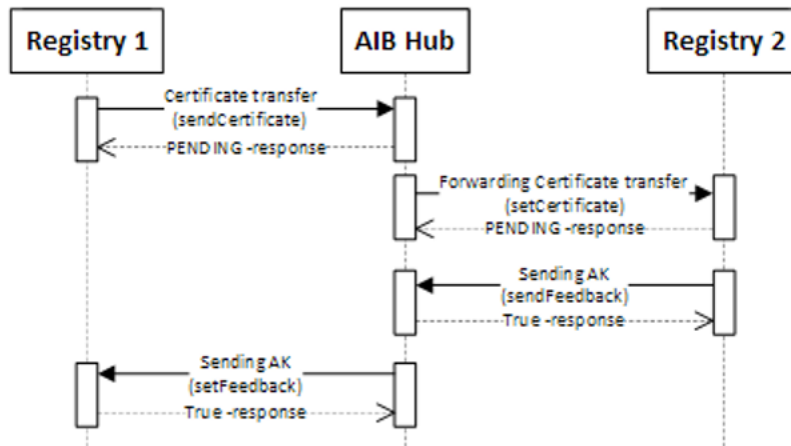
5.1.2.1 AIB Transfer Protocol

The AIB Transfer Protocol is publicly available [in Subsidiary Document 03](#) to the EECS Rules (HubCom). It sets out the basic data transmission protocol, the responsibilities of the sending registry, the AIB Hub, the receiving registry, the sending account holder, the receiving account holder.

AIB has transfer protocols for Certificate transfers, for updating the Account Holder Database, for the Statistics which AIB aggregates from the national Issuing Bodies to compile them on its website. For simplicity, this analysis limits itself to the protocol for certificate transfers, as it is operational in 2022, for more than a decade.

Case 1) Successful transfer:

Upon initiation of a transfer of selected certificates by a sending Account Holder, a registry sends a transfer message to the AIB Hub, which contains the information of these certificates in a standardised format. Correspondingly, in the sending registry the certificates are 'blocked': they are not further transferrable nor cancellable, they are marked as being 'in transfer'. At the AIB Hub a first validation takes place, both on format and on content alignment with the agreed rules. Upon approval, the message is forwarded to the receiving registry, which validates the message on its turn, both on content and format in relation with the rules of the national scheme. Some receiving registries in addition maintain a handshake procedure, where the receiving Account Holder has to formally accept the transfer. Some registries send an immediate response (synchronous set-up), others first send a response stating that the transfer is 'pending', as a notification of well receipt. After validations, the 'pending' message is followed up with a final message- Upon acceptance of a transfer in the receiving registry, the certificates are introduced in the account of the receiving Account Holder in the receiving registry and an AK (acknowledgement) message is sent by the receiving registry to the AIB Hub and automatically passed on to the sending registry. Upon receipt of this AK message, in the sending registry the respective certificates are formally removed.

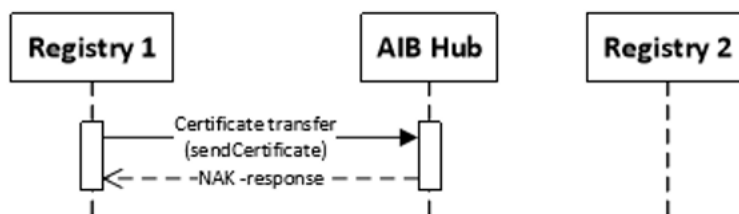


Case 2) Transfer message containing invalid data:

Where, upon initiation of a transfer by an Account Holder, the registry sends a transfer message to the AIB Hub that doesn't comply with the acceptance rules programmed at the Hub, the AIB Hub does not forward the message to the receiving registry but sends back a NAK response to the sending registry.

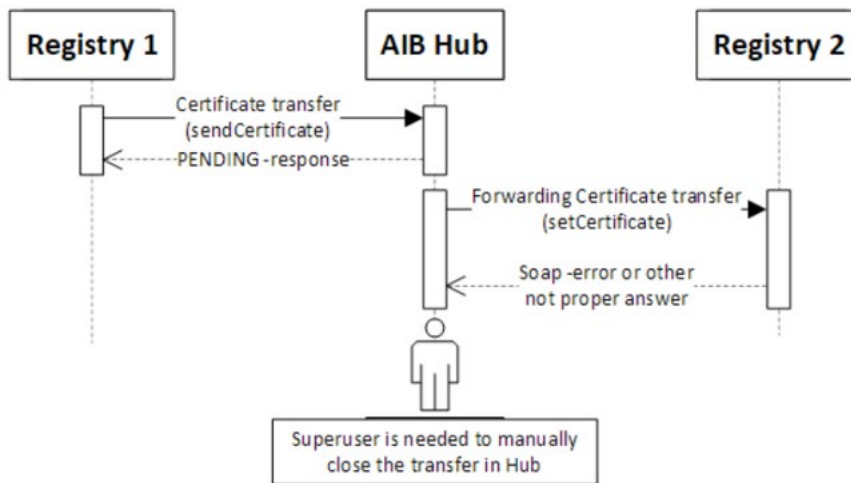
The same is the case where the transfer message is found OK by the Hub but blocked by the receiving registry. The latter can occur e.g., where the legislation in the receiving domain is not allowing import of such type of GOs, or if the expiry rules in the receiving domain determine that the certificates are no longer valid after import.

Upon receipt of a NAK response, the sending registry, unlocks the blocked certificates that were subject of this 'failed' transfer and releases them for a new transfer or cancellation action.



3) Lacking response of receiving registry

To avoid that occasionally un-answered messages by registries lead to certificate expiry and value loss at the involved Account Holder, the AIB SuperUser follows up whether there are transfers taking beyond the agreed transfer time and conducts the relevant communication with the national registry operators to ensure successful finalisation of every transfer. Registries here follow their jointly agreed Code of Conduct.



5.1.2.2 ERGaR Transfer Protocol

The ERGaR transfer protocol is described in the ExtraVert User Manual.

Trader sends transfer request to Issuing Body (source registry)

An account holder in the source registry requests a transfer of a GO (or any other type of renewable gas certificate to which the term Certificate or Origin CoO is applied) to an account holder in the target registry. This request is made according to the internal processes and guidance of the source registry, but the request has to include the details necessary to process the transfer i.e., the name, ID and address of a target trader and information on the content of the GO.

Source registry examines request and uploads a data package (XML-file) to the ExtraVert platform

The source registry examines the request, temporarily deactivates the data referring to the GO in its IT-system, creates an XML-file according to the ExtraVert transaction protocol and uploads it to the ExtraVert platform. The ExtraVert platform validates whether the uploaded XML-file meets the requirements of the transfer protocol and if the GO is unique (avoidance of double transfers).

The target registry validates feasibility and forwards the request to the target trader

After the sending registries has forwarded the request to the account of the target registry, the receiving registry validates the feasibility of the transfer and forwards the request to the target trader. To do this, the XML-file is downloaded and transferred to the IT-system of the receiving registry. Then the target registry informs the source registry whether the transfer is accepted or rejected.

Subject to acceptance, the data of the GO are permanently deactivated in the source registry

Upon acceptance of the requested transfer by the target trader, the data referring to the GO are permanently deactivated in the source registry. The deactivation is confirmed to the target registry. If for any reasons the GOs are not accepted by the target registry, the source registry will be informed and the blocked GOs will be reactivated in the source registry. The information is created automatically, but the reactivation of the blocked GOs usually requires manual intervention of the source registry.

The data of the GOs are activated in the account of the target trader

The data of the GOs are then transferred to the account of the target trader where they are available for further transactions and final cancellation.

5.1.3 Principle of how registries interface with AIB Hub and respectively ExtraVert platform

5.1.3.1 AIB Interface

AIB maintains a webservice interface for receiving and sending messages from the connected registries. It has protocols for both synchronous and asynchronous handling of messages. Only registries that have successfully passed the connection testing can connect with the AIB hub for certificate transfer.

In the early years AIB also facilitated a mailbox system where it was possible to upload and download information by sending e-mails from and towards the AIB Hub, this was called the 'Mailbox Service' interface mechanism. For harmonisation, security, and efficiency reasons, AIB left behind the mailbox service a couple of years ago.

Transfer Message format is in XML.

5.1.3.2 ERGaR Interface

ExtraVert platform is an account-based IT-web-solution, accessible for pre-registered user accounts applying highly secure multi-factor authentication only. It enables the standardised information exchange between the accounts of ERGaR System Participants. Each System Participant receives a dedicated account with personalized users. The information on ERGaR Certificates of Origin (CoO) is conveyed in form of standardised data packages in XML-data format which can be uploaded to and downloaded from the platform only by respective account holders. A unified validation engine secures the conformity of data format and consistency with the ERGaR CoO standard. The data packages and their processing are recorded on the System Participants' accounts and are consequently accessible for account users. The accounts record both imports and exports with additional status information to process the exchanges between involved ERGaR system participants.

5.1.4 Comparison content and format of data

An alignment on the content and format of the exchanged data is required for enabling cross-border transfers of gas GOs.

A key requirement for the exchange of gas GOs between national Issuing Bodies and European Schemes requires the harmonisation of the exchanged information and the underlying format and type of information. Since the file transfer to and from the AIB hub and the ExtraVert platform is based on the XML-format, the key questions are which information is mandatory and which format requirements are defined for each data field of the XML-file. The XML-files include transfer-related information enabling the identification of the involved sending and receiving registry and the account holder as well as the XML-file itself. Apart from this transfer related data, information on the production device and the attributes of the energy are transferred by the XML-files that, in a further step, will then be conveyed to the certificate (GO). The types of the data fields are standardised (such as date, text fields, integer, enumeration or Boolean) with specified patterns and clearly defined towards the users of the Schemes.

The comparison of the XML-file specifications of both European Schemes shows that, despite the fact that the content of the conveyed information is very similar, there are many differences in the details of what type, format and pre-coding of the information need to be applied. AIB's transfer protocol is

described in the EECS-SD03 Hub User Compliance Document (Hubcom). ERGaR's specifications for the XML-file are included in the ERGaR CoO Scheme User Manual Version 1.2.

Type of data fields:

- In most cases, the type of information conveyed in the data fields of the transfer messages of ERGaR and AIB is the same or similar.
- Mandatory information - content:
 - Both XML-file specifications include mandatory information which is not conveyed by the other scheme. For example, the metering point of the biomethane injection or the type of installation
 - but also information on the purpose (disclosure or support) or the type of delivery (grid or other).
 - Further there is information, which is conveyed in a different process, like ERGaR transferring more detailed contact data in the transfer message whereas AIB maintains an Account Holder Database with such info.

Structuring information:

- both European Schemes have defined IDs for different entities, which are mandatory.
- A crucial difference between the content of both transfer messages is how the information on the amount of energy is transferred. ExtraVert dedicates a data field to the amount of energy in MWh and the XML-specifications of the AIB hub define data fields for the first and the last certificate of the block of certificates.
- Referenced or pre-defined codes for technologies or Issuing Bodies/Issuing Bodies or other data fields will be one of the hurdles, which derive from different types of data fields. For example, the data field for information on production and investment support is defined as Boolean by the ExtraVert XML and AIB hub allows a free text description besides a code that refers to the category of the support type.

Format:

- The format of the data between the message content for the ExtraVert and the AIB Hub is different for almost every data field.
- For several data items, referenced codes are used to standardise or downsize the exchanged data. Also here, the structure and format are usually different between AIB and ERGaR transfer message definitions. This, for example, is true for IDs that are applied to the message/exchange ID of the transferred files.

Immutability principle

Following the principle of immutability, information must neither be deleted nor modified from the received GO.

In AIB, immutability is defined in such way that certificate information cannot be modified over the certificate lifetime. One potential evolution of implementing the immutability principle, for consideration when adopting mass balancing schemes, is to allow adding data to a certificate (still not modifying nor deleting info from a certificate). This, however, requires the connected registries to update their domestic registry at architectural level and at user interface level, which incurs costs as data maintained in EECS registries is highly standardised.

In ERGaR Schemes, it is up to the receiving registry whether it wants to convey non-mandatory information to its national database. For example, this applies to biomass information which, in most

cases, is not harmonised amongst connected System Participants and the biomass definitions in national laws and regulations. However, the information of the original certificate will be stored and accessible on the ExtraVert platform. At least for Issuing Bodies with a governmental mandate, the revision of the CEN standard 16325 will introduce a harmonized biomass coding and will "force" these System Participants to follow the immutability principle in the future.

Processability

As the type and/or the format and structure of the data field are different, the transfer messages of AIB and ERGaR cannot be processed by the other one's IT-system without modifications. Major programming efforts would be needed to handle different formats and data types, requiring agreement on updated message format specification by all the involved registries.

6 Assessment of options

6.1 Technical assessment

6.1.1 Transfer Architecture

Although the IT-options described in chapter 4, all serve the purpose of transferring gas GOs from one Issuing Body's IT registry to another Issuing Body's IT registry, there are substantial differences between the connection options for Issuing Bodies to these various possible solutions. This is directly linked to the number of interfaces that would have to be established in order to exchange gas GOs with all European gas Issuing Bodies.

- In the event where two European Schemes do not cooperate with each other, a high number of interfaces (throughout Europe) would have to be created. Given the legislative imperative to facilitate GO import and export between all EU countries, this quickly becomes un-manageable. It also risks hampering further evolutions of the certification system as an upgrade in one registry could render the interface solution with the connected registries unusable.
- Operating a bilateral IT-solution with an Issuing Body which is connected to another European Scheme, bears the risk of uncoordinated modifications of the scheme rules of one of the underlying European Schemes. In the worst case, the established bilateral IT-option becomes useless, because the updated Scheme Rules are not consistent anymore.
- If Issuing Bodies wish to exchange other types of gas certificates in addition to gas GOs, the transfer architecture could become more complex, depending on the set-up. In the scenario of a dual transfer protocol option, Issuing Bodies would have to set up and maintain two transfer protocols. The options of full integration of European Schemes with a single transfer protocol overcome this challenge.

The assessment of the transfer architecture addresses the questions:

- Does the IT-solution facilitate transfers with all Issuing Bodies?
- How many interfaces need to be established from the IT system of one Issuing Body?
- Which risks of modifications exists?

	1) Bilateral Agreements	2) Connection to two Schemes
Transfers with all gas Issuing Bodies are feasible	<ul style="list-style-type: none"> • No, only the Issuing Bodies with which an agreement was concluded will be covered by the IT-option 	<ul style="list-style-type: none"> • Yes, transfers with all Issuing Bodies that are connected to one of the two European Schemes
Number of interfaces	<ul style="list-style-type: none"> • As many interfaces are required, as registries that need to be connected, if gas GO transfers with more than one issuing body of the other European scheme shall be executed 	<ul style="list-style-type: none"> • From issuing body point of view: Two interfaces, namely one interface for each of the two European Schemes is required
Risk of modifications of	<ul style="list-style-type: none"> • From issuing body point of view: High risk of uncoordinated modifications, because no 	<ul style="list-style-type: none"> • From issuing body point of view: High risk of uncoordinated modifications, because no

the underlying schemes	collaboration of the European Schemes is involved	collaboration of the European Schemes is involved
	3) Interface AIB-ERGaR	4a) Partial Integration of ERGaR with dual transfer protocol
Transfers with all gas Issuing Bodies are feasible	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • Yes, but transfers with national registries that do not issue GO under governmental mandate have to be performed through ExtraVert Platform
Number of interfaces	<ul style="list-style-type: none"> • from Issuing Body point of view: no interfaces additional to the interface with the scheme they are connected with • Between European Schemes: One interface between IT-solutions of European Schemes 	<ul style="list-style-type: none"> • From Issuing Body point of view, it depends: 1) if exchange of CoO is envisaged, two interfaces and transfer protocols have to be established and maintained, 2) if the Issuing Body is System Participant of ERGaR CoO Scheme, a new transfer protocol and interface are required • Between European Schemes: none
Risk of modifications of the underlying schemes	<ul style="list-style-type: none"> • From issuing body point of view: Issuing Bodies may feel discouraged to request improvements to either scheme, as updates risk to invalidate the interface. • An update to one of the schemes would require updates to the interface. Both schemes have to cooperate on finding solutions for updates of their individual schemes. 	<ul style="list-style-type: none"> • From Issuing Body point of view: no risk, if the transfer protocols of both European Schemes are implemented independently from each other.
	4b) Full Integration/recognition of ERGaR Schemes in EECS - single transfer protocol	4c) Full Integration/recognition of EECS Gas Scheme in ERGaR – single transfer protocol
Transfers with all gas Issuing Bodies are feasible	<ul style="list-style-type: none"> • yes 	<ul style="list-style-type: none"> • Yes • Separate solution for energy conversion electricity GOs is needed
Number of interfaces	<ul style="list-style-type: none"> • From Issuing Body point of view: a new or second interface is required, if Issuing Body is connected to ExtraVert platform and/or wants to exchange CoO with ERGaR System Participants unless all ERGaR System 	<ul style="list-style-type: none"> • From Issuing Body point of view: a new interface is required, if the Issuing Body is connected to AIB hub. • However, a solution would be required for the GO exchange with Issuing Bodies for electricity GOs: Same assessment and

	Participants connect to the AIB Hub <ul style="list-style-type: none"> • Between European Schemes: n/a 	number of interfaces as with options 1, 2 and 3. <ul style="list-style-type: none"> • Between European Schemes: n/a
Risk of modifications of the underlying schemes	<ul style="list-style-type: none"> • None 	<ul style="list-style-type: none"> • In relation with GO exchange for electricity certificates, same assessment as with options 1, 2 and 3.

6.1.2 Technical adjustments in existing systems to implement the assessed IT solutions

Developing either of the involved IT solutions requires overcoming differences in the exchange process, the file format and the content of the exchanged information and the interface specifications. The assessment describes if and which technical adjustments would have to be implemented by the Issuing Bodies to facilitate the gas GO transfer for each of the identified IT solutions.

- The exchange process is related to the flow of communication between Issuing Bodies. It can involve communication between machines only or a combination of machine and human communication. Such communication involves sending, validation, forwarding, declining, error handling, etc. If human communication is involved, this might avoid or reduce adjustment of the existing IT-solutions, but it will increase the involvement of manual processes, and will bring with it potential disadvantages of the involvement of human resources and hampers scaling up the transfer volume.
- The file format and the content of the exchanged information is defined in the transfer protocol. AIB and ERGaR both apply XML as file format, however with differences in content and format of the data (see 4.1).

Depending on the type of the IT-options facilitating the exchange of information (see also REGATRACE deliverable D2.4), different types of interfaces are applicable to enable the data exchange. With regards to the IT-options described in chapter 4, the following interfaces are relevant and will be considered for the assessment:

- For bilaterally exchanging gas GOs between two registries, multiple interfacing options could be exploited, going from a simple e-mail exchange, over a cloud solution to a file exchange server, e.g., FTP. Both the ERGaR and AIB transfer messages can be exchanged in a bilateral setting, as they are set up in XML files.
- In the case of the ExtraVert platform, the upload/download-function serves as the interface for the exchange of data. Access is enabled to pre-registered account holders only by applying secure multi-factor authentication so to ensure data security and limited access to System Participants only. An automated validation mechanism of the ExtraVert platform ensures the conformity of data format at data entry, the uniqueness of the transferred GO and the consistency with the ERGaR CoO standard.
- The AIB hub applies a web service that requires the registration via a client certificate which ensures data security and interaction limitation to trusted parties, provides validation services that exclude error, double counting, loss of certificates during transfer, overdue transfers and fraud detection services. In a bilateral connection setting such services need to be organised for each individual bilateral connection.

The reasons, which are considered to result in major adjustments of the involved IT-systems, are as follows:

- Interface specifications
- Exchange process modifications
- Content and format of exchanged files

Reason for adjustment	1) Bilateral Agreements
Interface specifications	<p>The same XML files can be exchanged, for which various options are conceivable:</p> <ul style="list-style-type: none"> • e-mail exchange could be integrated into existing mail server • FTP or similar file exchange server requires a download/upload function for the files, that shall be exchanged, if no automatic transfers shall be facilitated.
Exchange process modification	<p>Depends on the interface specifications and individual agreements between Issuing Bodies, and the processing mechanisms in the relevant registries:</p> <p>Neither e-mail exchange nor FTP or similar file exchange server would per se involve modifications to the existing IT-application of the Issuing Bodies, because the exchange process will be mainly performed by human resources. However, in some registries automated processing from e-mails is implemented already.</p> <p>FTP or similar file exchange server does not per se require modifications to the existing IT-applications of the Issuing Bodies. It depends on the level of automation, whether the exchange process needs to be modified.</p>
Content and format of exchanged files	<p>When the received data is formatted differently than in the set-up of the receiving registry, substantial work is to be done for mapping the info. New data fields have to be added to the IT-systems on both ends. In some cases, additional information also has to be provided by the Account Holders which might require a change of the Issuing Body's scheme rules or even national stipulations. The differences in the format and type of the data could be solved by major programming efforts enabling an automatic differentiation between ERGaR and AIB XML-files.</p> <p>Substantial manual work and customisation efforts per additional bilateral connection, which grow with the number of bilateral registry connections.</p>

Reason for adjustment	2) Connection to two Schemes
Interface specifications	<p>The Issuing Bodies have to follow the different interface specifications of the AIB hub and the ExtraVert platform, which are as follows:</p> <ul style="list-style-type: none"> • AIB hub: web service: see Appendix C2 of EECS Subsidiary Document 03 HubCom 'EECS Registration Databases'

	<ul style="list-style-type: none"> ExtraVert: XML upload and download function that fulfils the specifications of the XML data package. Specifications provided in ExtraVert User Manual and respective attachments.
Exchange process modification	The Issuing Bodies have to follow the exchange process as defined by each European Scheme. The different levels of automation of the AIB Hub and the ExtraVert platform will result in different exchange processes for each European Scheme.
Content and format of exchanged files	<p>The sending of GOs requires the implementation of rules that adjust the outgoing XML to the specifications of the format and datatype of the two European Schemes. For incoming XML-files, additional rules have to be implemented for the processing of XML-files with different format and type. Differences in content could be solved by adding new data fields or adjusting the specifications of existing data fields.</p> <p>Considering the principle of immutability, the forwarding of GOs from an issuing body of one European Scheme to an issuing body of the other European Scheme might not be possible due to different kind of information being conveyed with the XML.</p>

Reason for adjustment		3) Interface AIB-ERGaR
Interface specifications		Given the current set-up of both IT systems, an account in the ExtraVert Platform has to be established for AIB and ExtraVert has to be connected through the webservice with the AIB hub. This can only work if the message content and format would comply with the relevant transfer protocol, and if the liability framework would ensure the same quality guarantees as in the relevant scheme governing the respective IT solution.
Exchange process modification		<p>If an AIB-account is established in the ExtraVert platform, the transfer protocol of the ExtraVert platform could be adjusted to the AIB transfer protocol by removing the final validation of the deactivated and the transferred certificate. In addition to this, an administrator in AIB staff has to be appointed who is responsible for the AIB account in the ExtraVert platform and manages the transfer messages between AIB hub and ExtraVert platform. For AIB registries, the exchange process with ERGaR connected registries would require major changes, as most of the AIB registries internally handle GOs in the same standardised data format as defined in HubCom. ERGaR Issuing Bodies might face major changes in their IT-systems as well.</p> <p>National Organisations would therefore have to make a mapping for the data fields' format and specifications between AIB and ERGaR's transfer protocol, in order to be able to process the content of the messages. They might have to deploy more staff for the increased manual workload in interface adaptation or even per transfer.</p>

Content and format of exchanged files	<p>The differences of the format and data type can be solved by harmonising the format and data type. Where all the relevant data content is readily available, this can be done in the sending registry, or in an automated message format translation at either AIB-Hub or ExtraVert Platform, before the XML-file is transferred to the receiving Hub/Platform that forwards it to the Issuing Body. If possible, it could also be solved by harmonising format and type of data fields, which in turn would imply modifications of all involved IT-systems.</p> <p>The same applies to the transfer of additional information which requires new data fields in the XML-files and the processing IT-systems.</p>
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Reason for modification	4) Integration of Schemes
Interface specifications	<p>The integration of one European Scheme into the other forces Issuing Bodies, which are connected to one of the schemes to be integrated into the other scheme. This may require creating a file upload/download function that is compatible with the ExtraVert platform specifications or to establish a connection to the AIB hub webservice.</p> <p>In addition, with a view to the increasing demand for energy carrier conversion, the option of integrating EECS gas scheme into ERGaR Schemes would require a solution for the exchange of gas and electricity GOs between the Issuing Bodies connected to the ERGaR Schemes and the EECS Electricity Scheme.</p>
Exchange process modification	<p>For AIB Issuing Bodies, integrating into the ERGaR transfer protocol, would imply reducing the level of automation. ERGaR made this choice for reasons of a less mature market development of renewable gases in Europe and simpler design of transfer processes, enabling the start-up of national markets and registries to be less complex.</p> <p>Nevertheless, it would require higher manual processing capacity by AIB registries, not only for the manual actions, but also for the message quality validations. While cross-registry transfer volumes are low, this could be considered until the market has developed to a level which allow for more or full automation. Particularly for Issuing Bodies that are responsible for both electricity and gas GOs, inconsistencies in the process documentation could occur.</p> <p>For ERGaR Issuing Bodies, the implementation of the AIB transfer protocol would require a re-design of their business processes and their IT-systems, because the higher automation is only achieved with adequate IT-systems on their ends.</p>
Content and format of exchanged files	<p>Issuing Bodies, which are integrated to another scheme, would have to adopt their registry to the transfer protocol of the new scheme. It is also conceivable that the integrating scheme takes over data fields from the scheme being integrated.</p>

The IT-option, which follows the scenario of integrating ERGaR schemes into EECS Gas Scheme, would require a modification of the transfer protocol of the AIB hub to enable the transfer of certificates of origin and their specifications, e.g., with regards to the expiry date and mass balancing. Issuing Bodies defining an updated transfer protocol to accommodate this, goes beyond the scope of this assessment.

6.1.3 Design criteria on implementing business processes

The exchange of gas GOs requires many business processes. These can be organised and implemented in different ways. Depending on the IT-option, automation of business processes might not be included and have to be performed by manual actions. The following assessment provides a comparison on the implementation of business with regards to the criteria:

- Level of automation
- Manual actions
- Complexity of Business Processes

These three criteria are interlinked: the level of automation influences the number of manual actions/steps for performing a business process. The complexity of business processes is of course difficult to measure and depends on the applied perspective. Application of manual actions might add complexity to the daily business of Issuing Bodies.

The effects on the level of automation can be generally estimated as:

Lower degree of automation:

The application of more manual steps is prone to the risk of human errors and requires the involvement of human resources. On the other hand, the implementation and IT-development will be cheaper and quicker. Applying manual processes allows the responsible persons/organisations to follow their own learning curve while it should be avoided that each country has to “reinvent the wheel. A lower degree of automation enables an easier implementation in countries with no market yet or start-up of markets and enables easier/more flexible market development.

Higher degree of automation:

More advanced and secure are systems with a higher degree of automation. They are usually available in countries with high transaction volumes and well-established business processes (having already undergone their own individual learning curve). Thus, for countries with no market yet, it might be more difficult to implement systems with high degree of automation as they immediately have to adhere to strict specifications and rules which might force them to skip their own individual learning curve. A higher degree of automation comes with significantly higher costs for IT-development and maintenance than for less automated IT-systems. This could be challenging to defend to the taxpayer. Staffing costs for the Issuing Body will be lower, but costs for the design and establishment of the IT will be higher at the beginning.

The way business processes are designed effects the level auf automation, number of manual actions and complexity. Of course, these criteria also effect the cost for development, implementation, maintenance as well as the operation of IT-systems. Chapter 5.2 will further detail on the cost factors.

Option		1) Bilateral Agreements
Level of automation	of	<ul style="list-style-type: none"> • Depends on the established interface and business processes • Transfer processes, including validation steps and similar, may be partly automated. • Harmonisation of transfer files, attributes and process specifications has to be found between the two parties of the bilateral agreement while harmonisation beyond the two parties may not be given.
Manual actions		<ul style="list-style-type: none"> • Depends on both parties. Indirect connection via a cloud service or direct connection via an interface feasible. • In case of indirect connection: Upload to and download from the established cloud-solution, the verification of files and the communication require manual actions each. • Fully automated interface also bilaterally feasible but probably too costly for connecting only two parties and currently not applied in European renewable gas market.
Complexity of business processes	of	<ul style="list-style-type: none"> • Avoidance of human errors requires double checking and adds complexity on validation processes. • Highly automated processes are highly complex in development and implementation but may reduce administrative burdens in daily business. • Different IT-solutions are involved in bilateral systems which makes harmonisation complex.

Option		2) Connection to two Schemes
Level of automation	of	<ul style="list-style-type: none"> • Depends on the interfaces and business processes of the European Schemes. • Aim of schemes is to substitute bilateral agreements and to reach higher level of automation than between two parties. Depending on maturity level of national markets and national systems, the level of automation should be chosen wisely to fit the market demands. • AIB hub facilitates a higher level of automation since Issuing Bodies for electricity GOs are historically (~20 years of experience) further automated than ERGaR system. Thus, interface to AIB hub more automated. On registry side there is the option to implement the connection in a fully automated way but also the option to implement the connection with more manual processing, as some of the smaller registry's use. • ERGaR's system (ExtraVert platform) is much younger and was developed as bottom-up approach to harmonise existing, national systems of the renewable gas market while not requiring major changes in existing systems. Consequently, a lesser degree of automation was chosen.
Manual actions		<ul style="list-style-type: none"> • Relates to the arguments above: • AIB hub historically further automated and thus, once connected, less manual actions are required.

	<ul style="list-style-type: none"> The ExtraVert platform was developed to allow national system high flexibility in their own IT-system. Thus, manual actions for accessing the ExtraVert platform (login, upload/download of exchange file) are required.
Complexity of business processes	<ul style="list-style-type: none"> Number of business processes will increase for Issuing Bodies, since European Schemes have different transfer protocols and business processes which have to be applicable for the issuing body when applying this option.

Option		3) Interface AIB-ERGaR
Level of automation	of	Depends on the solution: <ul style="list-style-type: none"> Connecting ExtraVert with AIB's web interface enables a high level of automation. ExtraVert would have to increase its level of automation which effects the connected Issuing Bodies. Establishing an account for AIB in the ExtraVert Platform with an upload/download function would at least involve the manual downloading/ uploading of the data packages.
Manual actions		<ul style="list-style-type: none"> No additional manual actions expected for national Issuing Bodies.
Complexity and robustness of business processes	and of	<ul style="list-style-type: none"> Regardless of the applied solution, additional business processes are required to perform transfers via the interface which will increase the complexity of the business process. Complex to ensure quality/liability coverage

Option		4a) Integration of ERGaR into EECS
Level of automation	of	<ul style="list-style-type: none"> Fully automated for GO transfer. Transfers of CoO to registries which are not connected to AIB hub, is not fully automated. Needs the sub-option of the single transfer protocol to be effective.
Manual actions		<ul style="list-style-type: none"> Manual actions are required for CoO transfers to registries that do not want or cannot join EECS Gas Scheme.
Complexity and robustness of business processes	and of	<ul style="list-style-type: none"> Issuing Bodies that want to exchange certificates with system participants of the ERGaR CoO scheme have to maintain different transfer protocols and business processes. For all other Issuing Bodies connected to the AIB hub one single transfer protocol would apply. Robust solution. Facilitates to all Issuing Bodies import of GOs from all energy carriers.

Option		4b) Full Integration of ERGaR into EECS gas scheme and AIB hub
Level of automation	of	<ul style="list-style-type: none"> Fully automated

	<ul style="list-style-type: none"> Basically, applying the AIB hub as it already exists, which would require major modifications of the IT-systems of the ERGaR CoO System Participants.
Manual actions	<ul style="list-style-type: none"> No manual actions required in operation mode, except for error handling. Every registry has however the option to handle it on its end with more manual steps and lower automation level, depending on the internal registry set-up.
Complexity and robustness of business processes	<ul style="list-style-type: none"> Robust solution. Facilitates to all Issuing Bodies import of GOs from all energy carriers. Single transfer protocol,

4c) Integration of EECS Gas Scheme into ERGaR Schemes	
Level of automation	<ul style="list-style-type: none"> Partly automated: The transfer, validation and transaction logs are fully automated. Implementation depends on the decision of the registry operator.
Manual actions	<ul style="list-style-type: none"> The transfer, validation and transaction logs are fully automated. Access to the platform via personalised login has to be performed manually. Upload/download of the GOs (up to 25 data packages per upload) are performed manually uploading/ downloading of data packages required.
Complexity and robustness of business processes	<ul style="list-style-type: none"> The Issuing Bodies benefit from one single transfer protocol and IT-solution for importing and exporting gas GOs. No additional business processes are required. Issuing Bodies of GOs for multiple energy carriers need to split their registry processes into electricity and gas registries Issuing Bodies. A solution would have to be developed to separately accommodate energy conversion. In such a set-up, auditors, for example, could have more responsibility for the verification of input GOs for the energy conversion. Verification of such audit reports has a substantial increase in manual workload for the issuing body.

6.1.4 Flexibility of IT solution

In order to comply with continuous updates of European and national legislation, packed with increasing volumes and transactions, flexible IT-solutions are required to allow for efficient, secure and adaptable requirements.

The major questions the IT-solution need to tackle based on the maturity of the market are:

- How flexible is the IT-solution to add/modify transfer data?
- Is the solution scalable?

6.1.4.1 Updating certificate content and transfer protocols

Since updates to a transfer protocol already require alignment of the involved Issuing Bodies the less transfer protocols there are to align with, the easier it is to facilitate evolution. This is particularly relevant in a continuously evolving European legislative framework and for serving a market facilitating the energy transition.

A single transfer protocol for all registries in Europe is the most flexible to ensure future updates can be implemented in all gas registries.

6.1.4.2 Scalability

A single transfer protocol is the most robust solution to scale to an ever-increasing number of registries. To handle an always growing number of certificates to be exchanged, a high level of automation is desirable, both regarding the execution of the transfers as the message quality validation on format and content.

6.1.4.3 Data processing and security

Data processing is a key functionality of IT-systems. With regards to a harmonised European solution for cross-border transfers of gas GOs, the following questions deserve special attention:

- To which degree are data standardised?
- Is the principle of immutability secured?
- What measures are taken to protect against cyber-attacks?
- How can the quality of the data be ensured?
- Does the IT-system generate adequate statistical reports?

Standardisation of exchanged data and transfer protocol

Data harmonisation is a key prerequisite. Any data which is not harmonised, will hamper with the interoperability and efficiency of the IT-systems involved. Either solution benefits from a high level of standardisation in the transfer message protocol, both in terms of content and format of the transferred data, as in terms of the processes related to the transfer and the expectations regarding reactive actions from a counter party.

Engagement into business quality

Registry operators in the form of the gas certificates, hold in their custody electronic documents with financial value on behalf of their account holders. Therefore, the IT-solutions should be complemented with a liability coverage of all connected registry operators and a framework that ensures their commitment regarding the corresponding overarching business processes.

Protection against cyber-attacks

The lower the number of interfaces a registry has to establish, the more focused it can target its protection measures to prevent cyber-attacks.

Quality assurance processes

At macro-level, a central IT solution will have lower overall maintenance cost compared to maintaining separate hubs/platforms. This allows to invest available resources in increased quality assurance regarding transfer message content, immutability of certificates, detection of VAT fraud carousels, etc.

Statistical Data and Monitoring of Transactions

Statistics on the cross-border transfers are key for national authorities as well as all other stakeholders being directly or indirectly involved in renewable gas trading and verification. A central and single database eases the collection of relevant data and can publish aggregated numbers for transparency reasons and statistics.

6.2 Economic assessment

This chapter considers the range of cost for the creation and maintenance of interfaces from the perspective of Issuing Bodies. The costs, which might occur with the option of the establishment of an interface between the ExtraVert platform and the AIB hub or the various IT-options in relation to the integration of both European Schemes, have not been assessed. This is due to the fact that no practical information for the realisation of such complex IT projects is available. Registry operators and their IT-providers were contacted to provide cost estimates on the establishment, operation and maintenance of interfaces with the IT-system of both European Schemes (see Annex: Questionnaire: IT-related costs for setting-up and operating an interface with IT-systems of AIB and ERGaR). In addition to the three responses, the cost estimates were complemented by cost estimates based on the experience of the involved task partners.

Pioneering Issuing Bodies often started cross-border trades with bilateral agreements and protocols. The more such agreements an Issuing Body maintains, the higher the costs of negotiating and setting-up the agreements become. A set-up of a single transfer protocol is beneficial in order to reduce actual as well as transaction costs (e.g., cost of negotiating). As an example, the expenditures for the establishment of an interface between two Issuing Bodies were estimated at around 30,000 Euros per registry. Since a huge part of the costs relates to human resources, different levels of staff costs in European countries will have a significant impact on these costs.

Each Issuing Body should identify their Break Even point regarding the number of bilateral agreements after which it is beneficial to establish an interface with a European Scheme. From practice in AIB, this was generally experienced to be the case as soon as connection with more than one other registry needed to be maintained.

The starting point for connecting to a European Scheme can be very different and so are the potential costs for establishing an interface to a central IT-solution. Generally speaking, the four different scenarios, which could make a significant price difference for the capital expenditures of interfacing with the one European Scheme or the other, can be described as follows:

- no IT-system established at all;
- IT-System established, but not connected to any European Scheme;
- IT-System connected to ExtraVert platform;
- IT-System connected to AIB hub.

Price ranges for a registry to interface with another IT service are large. They hugely depend on registry size but also substantially on the service levels, user friendliness of a registry, privacy, services that an Issuing Body provides to its account holders and automation level of internal processes, profiles of inhouse staffing and inter-relation with wider window contracts for IT services within the wider organisation an Issuing Body operates in. Bringing in a full evaluation of a registry to factor in all these criteria, will bring us too far for this report, as they vary by a factor 50 regardless the IT-option.

The cost estimates received further indicate that the CAPEX for connecting an ERGaR System Participant to the AIB hub might be higher than for connecting to ExtraVert platform. Whereas for AIB members the CAPEX for interfacing with the ExtraVert platform might be higher than for setting up an interface with the AIB hub. In both cases the CAPEX ranges from less than 15,000 Euros to more than 100,000 Euros.

In general, setting up an automated interface may have a higher investment cost than making manual transactions, but a lower operational cost. In all the IT-options registries maintain some liberty regarding the level of automation. If and when the higher CAPEX of highly automated interfaces will be outweighed by lower OPEX, is subject to the number of transfers that will be executed in a given period of time and strongly depends on the market development in the country of the Issuing Body.

Operational costs for maintaining a highly automated central transfer hub/platform with centralised quality assurance validations go down with the number of connected registries who can share the costs. As a result of the economic assessment one central IT-solution can be considered as the most cost-efficient solution for issuing bodies to facilitate a one-to-many connection for cross-registry transfers of GOs.

7 Actions required for implementation of the various options

From the technical assessment it becomes clear that the implementation of each options faces either more or less hurdles. In addition to the IT-related aspects of each option, issues that are more related to the organisational level and processes that are required to ensure the quality of the data and smooth functioning of the European Schemes need to be solved. The major hurdles for each of the assessed IT-options are addressed and actions described to overcome them. To make a clear distinction, if the action is related to modifications of the IT, the involved organisation, the business processes or has a legal dimension, the actions for the implementation of the various options are categorized in:

- technical level (for linking IT systems),
- transfer process level,
- quality assurance level (which processes and manual steps have to be adapted to, up to registration and auditing requirements of market participants of the national organisations),
- organizational level (decision making, governance of Schemes and Organisation, etc.),
- legal level (referring back to the legal framework, CEN, etc.).

7.1 Technical level (linking IT systems)

Option	1) Bilateral Agreements	2) Connection to two Schemes
Hurdles	1. Format, content and structure of XML-files of AIB and ERGaR are different 2. IT-option for the exchange of gas GOs is not defined / set-up	1. Format, content and structure of XML-files between AIB and ERGaR are different 2. different transfer protocols 3. Two different interfaces have to be established and maintained
Action	ad 1) For each data field which is not aligned, an agreement has to be found on how the data is synchronised and conveyed. For mandatory content related data, new data fields have to be created in the databases of the Issuing Bodies. ad 2) An agreement on the IT-option for the exchange of gas GOs has to be found. The IT-option has to be set-up and business processes have to be implemented on both ends.	ad 1) Major programming efforts to enable the processing of data with different content, format and structure in one database ad 2) Major programming efforts to enable/combine two different transfer protocols in one IT-solution ad 3) Two different interfaces have to set-up
Option	3) Interface AIB-ERGaR	4a) Partial Integration of ERGaR
Hurdles	1. Format, content and structure of XML-files between AIB and ERGaR are different 2. Different transfer protocols	1. ERGaR Issuing Bodies have interfaces and transfer protocols that follow ExtraVert

	3. Interface has to be established and maintained	<p>specifications and ERGaR Scheme Rules</p> <p>2. Transfer protocols of the Schemes are different with regards to content and underlying rules.</p> <p>3. For the option A) Dual Transfer protocol: IT-systems of two European Schemes have to be maintained at the same time.</p> <p>4. For option B) Single Transfer Protocol: the transfer protocols of both have to be integrated to a single transfer protocol</p>
Action	<p>Ad 1) alignment of format, content and structure in all involved IT-system, if no “conversion” is installed on the level of European Schemes</p> <p>Ad 2) one approach would be to remove the final validation process of the ExtraVert platform</p> <p>Ad 3) AIB hub and ExtraVert platform could be connected through AIB’s webservice, which requires the creation of an AIB account in the ExtraVert platform, passing the transfer messages from and towards ERGaR System Participants. It requires further assessment, if the existing liability framework would need adaptations.</p>	<p>Ad1) ERGaR Issuing Bodies have to establish new interfaces and adjust their IT, to the transfer protocol of AIB hub</p> <p>Ad2) Either the ERGaR scheme related content is integrated into the transfer protocol, or a separate transfer protocol is created in the EECS schemes and the AIB hub respectively</p> <p>Ad3) For a smooth co-existence of the ExtraVert platform and the AIB hub, a coordination of IT-updates and modifications is needed</p>
Option	4b) Full Integration of ERGaR transfer protocol in the transfer protocol of AIB	4c) Full Integration of EECS Gas Scheme in ERGaR Scheme
Hurdles	1. ERGaR Issuing Bodies have interfaces and transfer protocols that follow ExtraVert specifications and ERGaR Scheme Rules, while EECS Issuing Bodies following the protocol set out in the EECS SD03 HubCom.	<p>1. AIB Issuing Bodies have interfaces and transfer protocols that follow AIB hub specifications and EECS Scheme Rules</p> <p>2. If GO can be used as proof of the input for conversion of energy carriers, a solution has to be found for the conversion of electricity and gas GOs</p>
Action	<p>Ad1) ERGaR Issuing Bodies have to establish new interfaces and adjust their IT to the transfer protocol of AIB hub.</p> <p>The integration of transfer protocols to facilitate the certificates of both</p>	Ad1) AIB Issuing Bodies have to establish new interfaces and adjust their IT to the transfer protocol of the ExtraVert platform

	<p>schemes to be harmonised and facilitated in the single protocol, requires a good vision alignment and the implementation requires careful planning with the involved registries and Issuing Bodies</p> <p>Ad2) Either the ERGaR scheme related content is integrated into the transfer protocol, or a separate transfer protocol is created in the EECS schemes and the AIB hub respectively</p>	<p>Ad2) Either bilateral agreements like in option 1-3, or verification of input GOs via auditors.</p>
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7.2 Transfer Process Level

Option	1) Bilateral Agreements	2) Connection to two Schemes
Hurdles	<ol style="list-style-type: none"> 1. Workload for following up transactions, error handling, exponential to the amount of inter-registry connections. 2. Increased complexity due to different transfer protocols 	<ol style="list-style-type: none"> 1. Different requirements of the message formatting in the two Schemes. 2. Evolutions of data format not being synchronised between both schemes
Action	<p>Ad1) Increase staffing at registry operators.</p> <p>Ad2) Additional checks and monitoring of transfer processes</p>	<p>Ad1) Set-up registry-internal mapping for data in the different formats of the schemes.</p> <p>Ad2) Synchronise the transfer protocol and data formatting of both schemes</p>
Option	3) Interface AIB-ERGaR	4a) Partial Integration of ERGaR Schemes in EECS
Hurdles	<ol style="list-style-type: none"> 1. Different transfer protocols 2. Management of AIB account in ExtraVert platform 3. Developing the interface blocks specifications to ongoing upgrades to the message mechanism that involve multiple year planning. 	<ol style="list-style-type: none"> 1. Different transfer protocols
Action	<p>Ad1) adjustment of ERGaR transfer protocol by removal of final validation (upload of cancellation statement)</p> <p>Ad2) Definition of independent user who supervises and manages AIB's account in the ExtraVert platform</p>	<p>Ad1) ERGaR Issuing Bodies have to adjust their transfer process to the EECS HubCom</p> <p>Ad1) Adjustment of ERGaR transfer protocol</p>

	Ad3) Joint multiple-year priority and investment plans for the two associations	
Option	4b) Full Integration of ERGaR Schemes in EECS	4c) Full Integration of EECS Gas Scheme in ERGaR
Hurdles	1) Different transfer protocols	1) Different transfer protocols
Action	Ad1) ERGaR Issuing Bodies have to adjust their transfer process to the EECS HubCom	Ad1) AIB Issuing Bodies have to adjust their transfer process to the ExtraVert specifications For handling certificates for energy conversion, same actions as for options 1-3, or, if input GOs are verified by auditors, no modification.

7.3 Quality assurance level (which processes and manual steps have to be adapted, up to registration and auditing requirements of market participants of the national organisations)

Option	1) Bilateral Agreements	2) Connection to two Schemes
Hurdles	1. No centralised quality assurance	1. Each Scheme setting out its quality assurance requirements in a different way.
Action	1. Every registry establishing and performing quality assurance processes for each bilateral connection before entering into agreement	1. Registries organising towards compliance with the quality assurance measures of both Schemes.
Option	3) Interface AIB-ERGaR	4a) Partial Integration of ERGaR Schemes in EECS
Hurdles	The quality assurance measures between both Schemes are: 1. phrased and elaborated in a different way and 2. monitored, assessed and enforced in a different way.	The quality assurance measures between both Schemes are 1) phrased and elaborated in a different way and 2) monitored, assessed and enforced in a different way.
Action	Needing to identify and overcome gaps between variant quality assurance measures. E.g., through an agreement between AIB and ERGaR that sets out how this gap shall be bridged, and subsequent adaptations	Ad1) ERGaR Issuing Bodies have to adapt their quality assurance measures by following EECS Rules Ad2) Follow the procedure in EECS Subsidiary Document 09 regarding the application procedure for ERGaR

	to align the quality assurance measures for GOs issued under either of the Schemes.	Scheme(s) to be acknowledged in EECS as an Independent Criteria Scheme. Sign an agreement between AIB and ERGaR regarding the operation of the ICS within EECS. Issuing Bodies can apply for AIB membership for the Certificate Product of the ERGaR Scheme(s), as ICS (or for the EECS GO if they wish) and use the AIB Hub for cross-registry transfer if they adopt the transfer protocol of EECS SD03 HubCom.
Option	4b) Full Integration of ERGaR Schemes in EECS	4c) Full Integration of EECS Gas Scheme in ERGaR
Hurdles	The quality assurance measures between both Schemes are: <ol style="list-style-type: none">1. phrased and elaborated in a different way and2. monitored, assessed and enforced in a different way.	The quality assurance measures between both Schemes are: <ol style="list-style-type: none">1) phrased and elaborated in a different way and 2) monitored, assessed and enforced in a different way.3) For energy conversion, error-sensitive human work is needed for additional audits and checks4) Issuing Bodies in AIB need to reduce and/or modify their harmonised quality assurance standards: this could include harmonised Domain Protocol structure, automated multi-volume transfer.
Action	For non-governmental certificates, besides EECS Gas GOs, include in the EECS Rules a dedicated certificate product that matches the needs of the ERGaR Schemes. Issuing Bodies can apply for AIB membership and use the AIB Hub for cross-registry transfer if they adopt the transfer protocol of EECS SD03 HubCom.	AIB Issuing Bodies have to adapt their quality assurance measures according to the ERGaR CoO Scheme Rules and the Participation Agreement. The transparent Domain Protocol concept, Member audit and Technical Audit concept of AIB would have to be integrated in the ERGaR processes or existing quality assurance level would have to be modified.

7.4 Organizational level (decision making, governance of Schemes and Organisation, ...)

Option	1) Bilateral Agreements	2) Connection to two Schemes
Hurdles	Workload for managing relationships and agreements for all individual connections.	<ol style="list-style-type: none"> 1. Workload for participating in two Schemes (decision making, invoicing, reporting, following updates, etc.) 2. Membership fees for two organisations
Action	Increased staffing.	Ad1) Increased staffing Ad2) Higher expenditures for membership fees
Option	3) Interface AIB-ERGaR	4a) Partial Integration of ERGaR
Hurdles	Legal framework conditions are subject to changes Developing the interface blocks requires ongoing upgrades to the cooperation rules or vice versa.	The further development of the ERGaR Scheme is limited to the framework and boundaries of AIB Scheme Rules and IT
Action	Establish clear rules, how to react to changes of the framework conditions Clarify decision development processes at both organisations, enabling to synchronise any upgrades in rules (they will likely for both schemes interdepend on the changing European regulatory framework)	<ol style="list-style-type: none"> 1. Establish agreement between AIB and ERGaR regarding the operation of the ICS within EECS. 2. Issuing Bodies can apply for AIB membership for the Certificate Product of the ERGaR Scheme(s). 3. Issuing Bodies can apply for Scheme Membership to the EECS Gas Scheme for the EECS Gas GO and/or the Certificate Product of the relevant ERGaR ICS(s) and have voting rights on the relevant Certificates Product(s) .
Option	4b) Full Integration of ERGaR Schemes in EECS	4c) Full Integration of EECS Gas Scheme in ERGaR
Hurdles	<ol style="list-style-type: none"> 1. For integrity reasons, AIB in its membership does not and does not want to include room for parties that are not Issuing Bodies or for parties that have a commercial interest in the trading of certificates. 2. ERGaR has been working on a gas tracking product other than GOS, that has not yet been explicitly dealt with in the EECS Rules. 3. The further development of the ERGaR Scheme has to keep AIB informed of any changes and 	<ol style="list-style-type: none"> 1) Governmental Issuing Bodies want to ensure the integrity of their decision making to be separate from the market parties having commercial interest in using their transfer system. 2) Conversion of gas to electricity and of electricity to gaseous energy encounters the same problem statement as the one of this study.

	must not contradict the EECS Rules and the AIB acknowledged ERGAR ICSs must be possible to convey over the AIB IT architecture.	
Action	<p>Ad1) Consider other ways to deliver the value that market parties are experiencing from their membership to ERGAR.</p> <p>Ad2) Consider whether there is desire to set up a dedicated scheme group for an ERGAR Scheme in EECS, which will have its own decision making on the certificate product specific processes Consider whether there are organisational assets of ERGAR which AIB does not yet cater for and discuss including them in AIB/EECS. (Already facilitated in the organisational structure of AIB: 1) all members have actual influence on content-related decisions; 2) the EECS Gas Scheme Group (GSG) has an autonomy on gas content: gas IBs decide on gas issues independently from electricity; 3) GSG has actual influence in the whole of AIB)</p> <p>Ad3) Maintain robust communication and alignment of planning of AIB and ERGAR Scheme and IT developments, to ensure the maintained facilitation of transfer of the ERGAR ICS Certificates over the AIB Hub.</p>	<p>1) Restructure decision making and funding structure with regards to the ERGAR CoO Scheme so that market parties have no implicit or explicit or perceived influence on admission and other operational decisions.</p> <p>2) Needing additional harmonisation measures to facilitate a swift process for handling certificates for energy carrier conversion.</p>

7.5 Legal level (referring back to the legal framework, CEN, etc.)

Option	1) Bilateral Agreements	2) Connection to two Schemes
Hurdles	<ol style="list-style-type: none"> Individual checks of the legal criteria for GO import (reliability, accuracy, veracity). Different importing Issuing Bodies may have different criteria to qualify certificates for import and different processes for importing certificates from other registries. 	None

Action	Ad1+2) Increase staffing with policy analysers	None
Option	3) Interface AIB-ERGaR	4a) Partial Integration of ERGaR
Hurdles	Interpretation of legal criteria for GO import (reliability, accuracy, veracity) may still lead to individual Issuing Bodies not acknowledging certificates from the other scheme.	None
Action	Besides the technical link, also ensure transparency in the differences of implementation of the principles of reliability, accuracy, and veracity in both schemes. With this transparency, an importing Issuing Body has clarity on the areas where it may seek additional information from the exporting issuing body.	None
Option	4b) Full Integration of ERGaR	4c) Full Integration of EECS Gas Scheme
Hurdles	ERGaR registries have to comply to new set-up which might be in conflict with existing national requirements/stipulations and/or local practices.	Different quality assurance standards and peer-reviews than the ones established by Issuing Bodies in AIB
Action	Legal evaluation to be performed by national registries.	Mapping of the quality assurance and liability insurance of both Schemes and modifying ERGaR Scheme Rules / Participation Agreement if needed.

8 Conclusions

The assessed IT-options describe a wide variety of scenarios for the exchange of gas GOs between Issuing Bodies. Under the current set-up of two different European Schemes, the IT-options can be separated in collaboration between AIB and ERGaR as well as individual approaches of Issuing Bodies.

IT-options that are based on individual solutions between Issuing Bodies, have many disadvantages with regards to the resources needed for their set-up and the decision-finding process. This is especially the case when, for example, changes of the framework conditions result in the revision of the transfer protocol and the underlying data fields. For the short term, as long as no common IT-solution for cross-border transfers is available, however, individual IT-options (bilateral agreements between Issuing Bodies or a connection to both European Schemes) could be a necessary measure to serve upcoming requests for exchanging gas GOs with other Issuing Bodies.

The **collaboration between AIB and ERGaR on the establishment of a joint IT-option** could overcome the challenges of bilateral and individual solutions. Apart from conquering the IT-related differences between these established European schemes, any form of collaboration would require adjustments to the quality assurance level, procedures on decision making, alignment on the scope of the collaboration and many more.

The similar set-up of the transfer protocols and the fact that the content of the conveyed information of the EECS Gas Scheme and the ERGaR CoO Scheme is almost identical is a valuable starting point for each of the assessed options. A further advantage is that both schemes apply the XML-format for the data exchange. For the interoperability of both Schemes and the connected Issuing Bodies, however, different formats and pre-defined codes for data fields as well as no 100% consistency of mandatory data fields is a major hurdle from IT-perspective. Therefore, it becomes clear that **a single transfer protocol with generic data fields and common data field specifications for all certificate transfers in Europe** will substantially enhance efficiency of the interoperability between schemes, Issuing Bodies and biomethane registries. Taking into consideration that a link between the Union Database for gaseous renewable fuels and national biofuel databases as well as national Issuing Bodies could be established in the future, this need for interoperability of the involved databases and a single transfer protocol would gain even more significance. While it should remain possible to include customised requirements for certificates for different energy carriers or for certificate products that serve different purposes, a joint transfer protocol and generic data formatting for all energy certificates will enable all kinds of registries to technically blend in the European energy tracking in the most efficient way.

The outstanding decision on the delegated act for detailed rules for the production of renewable liquid and gaseous fuels of non-biological origin, the ongoing revision of the CEN Standard 16325 and the ongoing energy transition will likely continue to add or alter requirements for the tracking and certification of renewable gases. Taking this into consideration, room for the future evolution of the renewable gas certificates and the underlying transfer protocol is needed in either IT solution.

The establishment of bilateral or individual IT-solutions are considered to be prone to risks but could be acceptable for a manageable number of transfers and in short duration. Issuing Bodies participating in both AIB and ERGaR Schemes will become high drivers for harmonisation and can point out the priority work areas with highest impact, motivating towards gradual synchronisation of the schemes and their IT. The creation of an interface between the AIB hub and the ExtraVert platform, if implemented well, would significantly reduce the impact and risks on the IT-systems of national

Issuing Bodies. The assessment clearly showed that it would demand major efforts for adjusting the transfer protocols and maintaining the interoperability between the interfaces of both European Schemes' IT systems over time. The development of a joint transfer protocol would then still be a desirable target and task for future alignments. Yet, this would not suffice, due to the fact that in addition to the IT framework, it also needs to identify and overcome gaps between variant quality assurance measures of the AIB and ERGaR Schemes.

The technical challenges of connecting and jointly planning two European IT-systems could be addressed by integrating the European Schemes and connecting the IT-systems of all gas Issuing Bodies to one European IT system. This would onboard them in the decision-making in relation to the relevant target system. The Issuing Bodies of either ERGaR, AIB or all of them would have to adapt their IT-systems and their transfer protocols to meet jointly agreed technical requirements. While the content of many data fields has similar meaning in both schemes, it needs mapping to, and adjustment of, the data formatting of the integrating scheme. It is recommended that the integrating scheme takes over data fields from the scheme being integrated, in order to continue serving the information needs of the relevant scheme participants.

With regards to energy conversion and other types of biomethane registries than GO Issuing Bodies, the integration of schemes could have some shortcomings. Depending on how the rules for energy conversion will be defined by the revised CEN Standard 16325 and the delegated act for detailed rules for the production of renewable liquid and gaseous fuels of non-biological origin, the gas and electricity GO Issuing Bodies would need to be connected to each other in order to facilitate the automated exchange of gas and electricity GOs. Such developments would favour an IT-solution for all gas and electricity GOs. **Any IT-solution should serve both officially appointed Issuing Bodies and those of non-governmental certificates**, to ensure that the needs and/or decision power of organisations that are responsible for the issuance and transfer of renewable gas certificates that are not government regulated are addressed. A **broadening of the certificate products** facilitated in such a joint IT-solution would be needed to reflect the current situation and the potential future developments with regards to energy tracking, certification and documentation.

The **automation of the cross-registry certificate transfer** IT system is a key factor and gains importance with the increase of the number of transfers. In the current stage of market development of biomethane production and cross-border gas GO transfers, only a couple of countries show a high number of cross-border transfers, which are, compared with electricity GOs, still relatively low. Taking into consideration Issuing Bodies that do not yet issue any gas GOs and/or are not involved in cross-border transfers at this time, they might face a trade-off between manual processes, investment costs of highly automated IT and the time it takes to connect to one of the European schemes.

Quality assurance and integrity measures go beyond technical requirements of the involved IT-systems and serve the accuracy, reliability, and veracity of the transferred GOs. The **alignment of quality assurance measures** is therefore crucial for all assessed scenarios and IT-options. Since quality assurance measures could be directly linked to business processes and responsibilities of the appointed entity as well as the national regulatory framework, its adjustment might require some time.

Apart from the fact that individual or bilateral solutions between Issuing Bodies may be the solution of urgent demand, the coordinated facilitation of cross-border transfers of gas GOs and other types of certificates require a transition period from the status quo. **It requires a coordinated decision-making process for preparing a single transfer protocol, agreeing on joint quality assurance framework and planning the development and/or adjustment of IT-infrastructure.**

The costs for establishing and maintaining one of the described IT-options are very sensitive to the framework conditions and the specifications. Based on the experience of the involved task partners and feedback from issuing bodies, the cost range for interfacing with another IT-system is large. In general, from the perspective of Issuing Bodies, setting up an automated interface may have a higher investment cost than making manual transactions, but a lower operational cost. Taking further into account the current set-up with two European Schemes, it can be indicated that the CAPEX for connecting an ERGaR System Participant to the AIB hub might be higher than for connecting to ExtraVert platform. Whereas for Issuing Bodies in AIB the CAPEX for interfacing with the ExtraVert platform might be higher than for setting up an interface with the AIB hub.

With regards to OPEX, a highly automated central transfer hub/platform will bring down the costs with ever increasing number of gas GO transfers. Because this will then also outweigh higher CAPEX for setting up an highly automated interface, **a central IT-solution can be considered as the most cost-efficient solution for issuing bodies to facilitate one-to-many connection for cross-registry transfers of GOs.**

Glossary

Account Holder

Person or organisation in respect of whom a transferable account or a cancellation account is maintained on a registration database (for the issuance of certificates).

Association of Issuing Bodies (AIB)

AIB is an international non-profit organisation established under Belgian law, registered in Belgium, as aisbl. The Association of Issuing Bodies (AIB) operates the European Energy Certificate System (EECS®), a multipurpose and multi-energy carrier certificate system facilitating standardised cross border transfer of energy certificates.

AIB Hub (or AIB Communications Hub)

A webservice operated by AIB which provides coordination and synchronisation services, distributing messages between the registries of the AIB Members. The Hub is defined in detail in [EECS Subsidiary Document](#) 03 'HubCom EECS Reigistration Databases' otherwise known as 'HubCom'. (<https://www.aib-net.org/eecs/subsidiary-documents>)

Attribute

Data specifying the characteristics of energy produced by a renewable gas producing installation in terms of the input(s) used and/or the details of that production installation and production process.

Book & claim

A term to indicate that the certificate can be transferred, independently of the transfer of energy to which it is related, from one holder to another, i.e., Trade of the physical product is decoupled from the transfer of the certificates.

Certificate (renewable gas certificate)

An electronic document that records or guarantees information in relation to attributes of the input consumed in a production installation and the production method and amount of a specific energy carrier that is yielded by this production installation.

CertifHy

CertifHy is a project, funded by the fuel cells and hydrogen joint undertaking (FCH JU) of the European commission. It is dedicated to developing a European framework for guarantees of origin for hydrogen.

Competent body

Body duly authorised under the laws and regulations of any state to exercise or discharge any legislative, governmental, regulatory, or administrative function associated with the administration of a national GO scheme designated by the government in accordance with Article 19 of the RED II.

Disclosure

Provision of information to a final customer about the attributes and quantity or share of energy that has been supplied.

EECS®-certificate

A unique electronic certificate specifying and representing the quality and method of production of a specific quantity of output, which is maintained on an EECS® registration database and issued in accordance with the provisions of the EECS® rules.

EECS® GO

The EECS® rules define an EECS® GO as an EECS® certificate corresponding to a type of guarantee of origin.

The EECS® rules define a guarantee of origin as a certificate issued by (a) a competent authority, or (b) by an AIB member acting as the duly authorised agent on behalf of a competent authority, under the laws of a state as a guarantee of the nature and origin of energy for the purpose of providing proof to the final consumer of energy that a given share or quantity of energy, as the case may be:

- was produced from the energy source to which the guarantee relates, and/or
- was produced by the specified technology type to which the guarantee relates, and/or
- has, or the production device(s) which produced it has (or have) other attributes to which the guarantee relates.

ERGaR aisbl

ERGaR (European Renewable Gas Registry) aisbl is an international non-profit organisation established under Belgian law. ERGaR was founded in September 2016 as a cooperation between national renewable gas registries and other major energy organisations interested in supporting the development of ERGaR's vision to enable cross border transfer of renewable gas certificates in Europe.

ERGaR Certificate of Origin (CoO)

An electronic document that corresponds to renewable gas certificates that were issued and transferred to the ExtraVert platform by an ERGaR Scheme participant with the purpose of transferring it to another ERGaR Scheme participant.

ERGaR CoO Scheme

The ERGaR Certificate of Origin Scheme (ERGaR CoO Scheme) is organised and operated by the European renewable gas registry (ERGaR) aisbl. The scheme allows the Europe-wide cross-border title transfer of Certificate of Origin (CoO) between participating national biomethane registries, who create such documents in respect of biomethane that has been injected into the natural gas network in their country of operation.

ERGaR RED MB Scheme

The ERGaR RED Mass Balancing scheme (ERGaR RED MB Scheme) is under review at the European Commission for recognition as a voluntary scheme. ERGaR RED MB is a European administrative system designed to facilitate the mass balancing of cross-border transactions of sustainable

biomethane consignments that meet all the necessary requirements to be accepted as sustainable biofuel (in accordance with the red) in the importing country. It will be organised and operated by the European renewable gas registry aisbl.

Energy Carrier Conversion

The production of an energy carrier from one or more inputs including at least one other energy carrier.

European Scheme

Defines joint rules and provides an IT system for the exchange of GOs and other types of energy carrier certificates between registries of national/regional issuing bodies and other competent authorities/entities.

ExtraVert Platform

IT-system that facilitates the exchange of data-packages between the IT-systems of the System Participants of the ERGaR CoO Scheme.

Guarantee of Origin (Renewable energy carrier)

A guarantee of origin means an electronic document which has the sole function of providing evidence to a final customer that a given share or quantity of energy was produced from renewable sources.

Independent Criteria Scheme (ICS)

the EECS[®] rules define an ICS as a scheme that provides assurance that the output certified by an EECS[®] certificate, and/or the relevant production device with which it is associated, conforms to a specific set of qualities which are additional to those established for the EECS[®] product.

An EECS[®] certificate may convey an ICS of which the quality is guaranteed by the ICS operator.

Issuing Body

Competent Body or Competent Body Agent responsible for:

- 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 GO

Mass balancing

In relation to RED II, mass balancing is a principle to document compliance with sustainability criteria and greenhouse gas emissions savings thresholds in relation to the production and supply of liquid, solid and gaseous energy carriers. The mass balancing enables:

- the mixing of consignments of raw materials or fuels with differing sustainability criteria is allowed;

- requires that information about sustainability and greenhouse gas emissions remain assigned to the consignment mixed with other consignments;
- Requires that the sum of all consignments withdrawn from a mixture have the same sustainability characteristics in the same quantities as the sum of all consignments added to the mixture.

Multiple Counting

Multiple counting concerns a renewable gas certificate being counted multiple times towards the same or multiple purposes (double-claiming), or it being duplicated during transfer (double transfer), it being used multiple times (double cancellation), multiple certificates being issued for a same amount of energy for the same purpose (double issuance), or the same attributes of renewable gas being counted multiple times regardless the existence of a corresponding renewable gas certificate.

Proof of Sustainability (PoS)

A document detailing the verification of sustainability claims relating to biofuel consignments that comply with sustainability and greenhouse gas emissions saving criteria in accordance with RED II Art. 25-30. PoS are issued by conformity assessment bodies (certification bodies) associated with a voluntary scheme recognised by the European Commission under the RED.

Purpose (of a certificate)

The original intended use for which a certificate is issued, whether this is disclosure, support, target counting, demonstrating compliance with a label or a combination of these.

Registry (or Registration Database)

Database operated by an Issuing Body, or its agent, or any other competent authority/entity comprising:

- a) accounts and the GOs/certificates in those accounts.
- b) standing data of Production Devices and information provided to the Issuing Body, competent authority/entity or a third party on its behalf in connection with the registration of those Production Devices; and
- c) standing data of GOs/certificates which have been transferred out of that Registration Database

Renewable transport fuels of non-biological origin (RFNBO)

Within the framework of RED II, renewable transport fuels of non-biological origin refer to liquid or gaseous fuels other than biofuels or biogas and which are used in the transport sector. Their energy content is derived from renewable sources other than biomass. RFNBO can be applied to comply with the 14% renewable energies target described in article 25 from RED II provided that the origin of the renewable electricity and the greenhouse gas emissions savings are fulfilled. The latter are to be defined by a Delegated Act.

Scheme Participant

Issuing bodies or national biomethane registries linked to a European Scheme.

Transfer Protocol

Describes the business processes in relation to the exchange of GOs between two issuing bodies and defines the format, content and structure of the exchanged data.

Literature

- Alberici, S.; Toop, G. & Martinez-Blat, J., 2020, Scoping study setting the technical requirements and options for a Union Database for tracing liquid and gaseous transport fuels
- Association of Issuing Bodies, 2022, «EECS Rules Release v1.1», <https://www.aib-net.org/eecs/eecs-rules>
- Association of Issuing Bodies, 2022, «AIB-EECS-SD03: EECS Registration Databases, v8.1», [European Energy Certification System \(aib-net.org\)](https://www.aib-net.org/eecs/eecs-rules)
- Deutsche Energie-Agentur GmbH, 2022, «Branchenbarometer Biomethan 2021»,
 - [Studie \(dena.de\)](https://www.dena.de)
- European Biogas Association, 2022, «EBA Statistical Report 2021», <https://www.europeanbiogas.eu/eba-statistical-report-2021/>
- CEN European Committee for Standardization, 2022, N204 Working draft CENCLC_JTC_14_EN16325 2022_06_16 track recommendations processed_V2
- European Renewable Gas Registry aisbl, «D4.2 Technical and operational comparison of the biomethane/renewable gas GO system and the electricity GO system», REGATRACE Project, 2021, [PowerPoint-presentatie \(regatrace.eu\)](https://www.regatrace.eu)
- European Renewable Gas Registry, 2022, «ERGaR Certificate of Origin (CoO) Scheme, Scheme Rules V1.2», https://www.ergar.org/wp-content/uploads/2022/05/ERGaR-CoO-Scheme-Rules_v1.2_clean.pdf
- European Renewable Gas Registry, 2022, ERGaR CoO Scheme Statistics, <https://www.ergar.org/ergar-schemes/coo-scheme-statistics/>
- Sailer, K. & Reinholz, T., 2021, Certification of renewable hydrogen in Germany and the European Union as an import requirement, Periscope, Vol. 7, 2021

Annex: Questionnaire: IT-related costs for setting-up and operating an interface with IT-systems of AIB and ERGaR

Introduction

Aim of survey

Deliverable 2.8 of the REGATRACE project targets to make a techno-economic evaluation for integrating/interlinking the AIB and ERGaR hub systems. While doing so, it would benefit to receive cost estimates the operators of the IT/registries and their IT suppliers for the implementation of a connection between AIB and ERGaR IT-solutions and its operation. AGCS has been requested due to their experience with IT-implementation projects to provide a set of requirements for IT-suppliers. These requirements should allow to frame the answers of IT-suppliers and make an analysis and interpretation for REGATRACE authors possible.

The information provided will be included anonymously in the techno-economic assessment of IT-options for linking/integrating AIB and ERGaR hub systems. The report is expected to be published after final approval by the European Commission.

Cost categories

The quotes from IT-suppliers typically can be divided into three different areas, namely

- 1) implementation costs (CAPEX - Capital Expenditures),
- 2) operational costs and
- 3) maintenance costs

The latter two are summarized as OPEX - Operational Expenditures. Implementation costs are one-time costs and OPEX expenditures are recurrent. Depending on the interface provided by the hub, its users (system participants) and the frequency of processes the efforts can vary significantly. Therefore, the following requirements shall support a more qualified and comprehensive estimation of IT-supplier costs for the connection costs to AIB and ERGaR hub.

Background information

Description of Issuing Body/registry

Please introduce your IT-solution and main business process where possible supported with figures and statistics:

Name of issuing body / registry operator	
Brief description	
Number of system participants	

Expected number of transactions	2022	2023	2024
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Description AIB and ERGaR IT-Systems

The technical and operational requirements for connecting to the AIB hub and ERGaR are described in the attached documents:

- AIB: AIB-EECS-SD03: Hub User Compliance Document (HubCom).
- ERGaR: ExtraVert transfer message.

Some additional general information on the interfaces and transfer protocol are provided below:

- Interface – AIB: fully automated web service end to end communication between system participants (facilitating transactions between individual Account Holders at registries operated by different Issuing Bodies);
- ERGaR: system participants account with upload and download functionality for the registry operator
- File Exchange Format: XML for both hubs
- Description Business Process Certificate Transfer:
 - Initiation in national registry (both)
 - Generation of transfer file (individual per national registry / Issuing Body)
 - Transfer of file from sending registry
 - Processing on hub
 - AIB: based on the content of the transfer file the data are automatically validated and in case of positive check automatically forwarded to the receiving registry without manual interaction of AIB staff, the receiving registry processes the transfer file and confirms the receipt with an automated confirmation or refusal message. Staff interventions only for the case of error handling.
 - ERGaR: receiving registry uploads transfer file at ERGaR hub where it will be validated, in case of positive result of the validation the transfer file will be forwarded to the hub account of the receiving registry, the staff of the receiving registry downloads the transfer file and processes it in the receiving registry). There are no manual interactions required by ERGaR staff members.
 - Receipt of file at receiving registry (AIB: automated; ERGaR: manual)
- Description Business Process Certificate Cancellation:
 - AIB: The cancellation at the sending registry will be automatically executed with the confirmation of the transfer by the receiving registry. No manual processes are foreseen for this business process.
 - ERGaR: The sending registry provides a dedicated cancellation/deactivation statement (individual design per national registry) for the receiving registry (system participants) to confirm the cancellation/deactivation after successful transfer.
- Description Business Process for Extension of System Participants:
 - AIB: The system participants list will be extended through an update of the master data. The AIB hub will be expanded with an additional communication endpoint for

the new system participant to allow for sending and receiving data to and from the AIB hub.

- ERGaR: The system participants list will be extended through an update of the transfer file protocol. Each new system participant will receive a dedicated account at the ERGaR hub to execute imports and exports of certificates.

Cost estimates

Please provide a price indication based on your understanding of the connection costs to either the AIB Hub or the ERGaR Extravert Platform. IT-suppliers may find it difficult to give an exact quote based on the limited information provided in this document. Therefore, it is recommended to ask for price ranges to establish an interface. Some IT-suppliers provide a registry system including already established interfaces to AIB and ERGaR hub or just one of them. Consequently, also no costs may apply for registries to connect if they use the IT-suppliers certificate system comprising of hub interfaces.

Based on the introduction of each hub, the IT-suppliers should give price ranges for CAPEX and OPEX for transferring certificates towards another registry over the different hubs, in EURO:

If for any reason information on all requested costs categories is not available, we would still appreciate to receive the available information:

Certificate transfer facilitation towards another registry over the following hub:	AIB	ERGaR
CAPEX (cost of establishing the hub connection from the registry side)	0 – 15000	0 – 15000
	15000 – 30000	15000 – 30000
	30000 - 50000	30000 - 50000
	Above 50000	Above 50000
OPEX operational costs (cost of operating the hub connection at the registry side)		
	0 – 15000	0 – 15000
	15000 – 30000	15000 – 30000
	30000 - 50000	30000 - 50000

	Above 50000	Above 50000
OPEX maintenance costs (cost of maintaining the hub connection at the registry side)		
	0 – 15000	0 – 15000
	15000 – 30000	15000 – 30000
	30000 - 50000	30000 - 50000
	Above 50000	Above 50000