Technical assistance to develop methodologies compliant with disclosure obligations on RES gases

Final Report – Framework Analysis for Disclosure and Methodology for Residual Mix calculation for gases

Association of Issuing Bodies aisbl
December – 2024

AIB
association of issuing bodies

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Directorate-General for Energy
ENER – Energy
Decarbonisation and Sustainability of Energy Sources

Contact: Henrik Dam

E-mail: ENER-UNIT-C2@ec.europa.eu

European Commission
B-1049 Brussels

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Final Report - Framework Analysis for Disclosure and Methodology for Residual Mix calculation for gases

Authors:
Katrien Verwimp
Erwin Cornelis
Bram van der Heijde

Proofreaders:
Martina Gabriel
Carmen Rodriguez
Kadri-Liis Rehtla-Rell
Angela Tschernutter
Liesbeth Switten
Vreni Oselin

Directorate-General for Energy
Decarbonisation and Sustainability of Energy Sources

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LIST OF ABBREVIATIONS

Abbreviation	Full form
AIB	Association of Issuing Bodies – www.aib-net.org
B&C	Book and Claim
BPR	Best Practice Recommendations
CEER	Council of European Energy Regulators – www.ceer.eu
CoO	Certificate of Origin - https://www.ergar.org/ergar-schemes/ergar-coo-scheme/
DA	Delegated Act
DCB	Disclosure Competent Body
EECS®	The European Energy Certificate System
EDC	Ex-Domain Cancellation
FaSTGO	Facilitating Standards for Guarantees of Origin – project page: https://www.aib-net.org/news-events/aib-projects-and-consultations/fastgo
GO	Guarantees of Origin
MB	Mass Balance
MS	Member State/s
PoS	Proof of Sustainability
PPA	Power Purchase Agreement
RE-DISS	Reliable Disclosure System
REGADISS	Reliable Gas Disclosure System – project page: www.aib-net.org/regadiss
REGATRACE	Renewable Gas Trade Centre in Europe – project page: www.regatrace.eu
RFNBOs	Renewable Fuels of Non-Biological Origins
RM	Residual Mix
RTS	Reliable Tracking Systems
UDB	Union Database - https://wikis.ec.europa.eu/display/UDBBIS
VS	Voluntary Schemes

EXECUTIVE SUMMARY

This report aims to develop a **methodology for the calculation of the gas Residual Mix**. It presents a reasoning for the proposed methodology and discusses various aspects including the accuracy of the model, the complexity of the calculations, the transparency in terms of the information to consumers and a specification of the relevant data sources.

FRAMEWORK CONDITIONS

Before delving into the composition of the Residual Mix formula, this report analyses the inputs for setting design criteria: legislative frameworks, legal requirements and initial input from stakeholders.

First, concerning the legal frameworks, it is acknowledged that the Residual Mix only has value in a Disclosure framework with regulatory protection of the uniqueness of claims on renewable and low-carbon gas consumption. Several recent legislative initiatives aim to enhance the impact of energy tracking on the energy transition. Their practical implementation is still in progress.

Three EU Directives provide the main framework for Disclosure of the origin of gas. The recast Directive on the Common Rules for Gas and Hydrogen (hereafter referred to as recast Gas Directive)[1] installs the **first gas Disclosure obligation** on **suppliers** and requires the renewable and low-carbon origin of supplied gas to be stated on the bills, and at least for renewable gas, to substantiate this with **Guarantees of Origin** (GOs). The European Sustainability Reporting Standards (ESRS), issued under the Corporate Sustainability Reporting Directive (CSRD)[2] impose on **corporate energy consumers** the obligation to disclose the energy sources of their consumption and to base this Disclosure on contractual arrangements like GOs. The draft Green Claims Directive[3] proposes Member States to ensure that Green Claims by **traders** are substantiated.

Second, the requirements for GOs are given in the Renewable Energy Directive (EU) 2023/2413 (REDIII)[4]. This Directive not only obliges Member States to **issue GOs** on request of a producer and to ensure that the same unit of renewable sources is taken into account only once; it also requires Member States to **publish** on an annual basis **the Residual Mix**, providing information on the untracked commercial offers. The Directive defines the Residual Mix as “the total annual energy mix of a Member State, excluding the share covered by cancelled GOs”. Further, REDIII stipulates that the Residual Mix includes expired GOs.

Third, preliminary stakeholder views, as reflected in a survey, reveal a diversity of opinions, particularly regarding the instrument to be used for renewable gas consumption claims.

The calculation of the Residual Mix for gas needs to **prevent double claims**. This will depend on the way the various new pieces of new European legislation will be implemented.

[1] Directive (EU) 2024/1788 of the European Parliament and of the Council of 13 June 2024 on common rules for the internal markets for renewable gas, natural gas and hydrogen, amending Directive (EU) 2023/1791 and repealing Directive 2009/73/EC (recast), 15 July 2024.
[2] Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards
[3] Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on substantiation and communication of explicit environmental claims (Green Claims Directive), COM/2023/166
[4] Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652

Challenges include the tracking of energy sources across Energy Carrier Conversion, like electricity from renewable sources that is converted to hydrogen and vice versa. Implementation of the criteria for Renewable Fuels of Non-Biological Origin (RFNBO) in the relevant Delegated Act to the RED is an essential area to monitor to prevent renewable origin being claimed more than once. This is also the case with the final outcome of the revision process of the CEN-CENELEC EN16325 standard on guarantees of origin, of which the voting outcome will be known only shortly after the finalisation of this project.

This report also acknowledges that **energy tracking has different purposes (Disclosure, target accounting, financial support)** and that those may build on different criteria (e.g. sustainability, GHG emission saving, additionality, temporal correlation, geographical deliverability) and different tracking mechanisms (e.g. book-and-claim, mass-balance, bundled sale of energy with tracking instrument).

As the Residual Mix provides information on the untracked commercial offers, all explicitly tracked gases must be excluded from its calculation. This report hence considers the impact of the **co-existence of different tracking tools:** GOs and the Union Database for sustainable biofuels (UDB).

Proofs of Sustainability (PoS) that are recorded in this UDB account for policy targets in the country of consumption. As they track energy until the individual point of consumption, their interaction with the GO system is an important area of attention.

TOWARDS A RESIDUAL MIX CALCULATION

A **formula for the calculation of the Residual Mix** (see Figure 1) is elaborated in this report. It takes the methodology for the Residual Mix calculation for electricity as a basis, while including gas-specific topics. These topics are storage, Energy Carrier conversion, and import and export, as these are much more predominant for gas than they ever have been for electricity .

A separate Residual Mix calculation per **system boundary**, per Member State is needed. This means a separate Residual Mix for the natural gas distribution and transmission system and a separate Residual Mix for the hydrogen network. For gases that are transported by vehicle, the supply chains are much less regulated than pipeline-transported gases. The conditions for feasibility and the relevance of a Residual Mix in vehicle-transported gaseous supply chains are outside this report's scope.

RESIDUAL MIX IN PRACTICE

Numerical data availability regarding production of gases, per energy source category, and consumption, per end-use sector, is a challenge, especially for certain types of gases and dissemination outside pipeline networks. Data sources need to be improved, and their definitions need to be aligned in order to come to a consistent Residual Mix for all dissemination system boundaries.

Timely availability of such numbers is another key challenge. If the origin of consumed gases is to be provided to consumers in a way that supports them in their supplier choices, the Residual Mix and their supplier's energy mix needs to be available not too long after the period of energy supply. Preferably, just as with electricity, the supplier mix should be available by 1 July of the year following the year of supply. This requires the Residual Mix to be available by 1 June of that year, with numerical data inputs to be collected in March and April, allowing for Residual Mix calculations to be performed, consulted and confirmed in May.

There is further unclarity of the framework for accounting of the attributes of imported gases for disclosure by, or towards, consumers, although procedures are envisaged for accounting such gases in EU policy targets via the UDB.

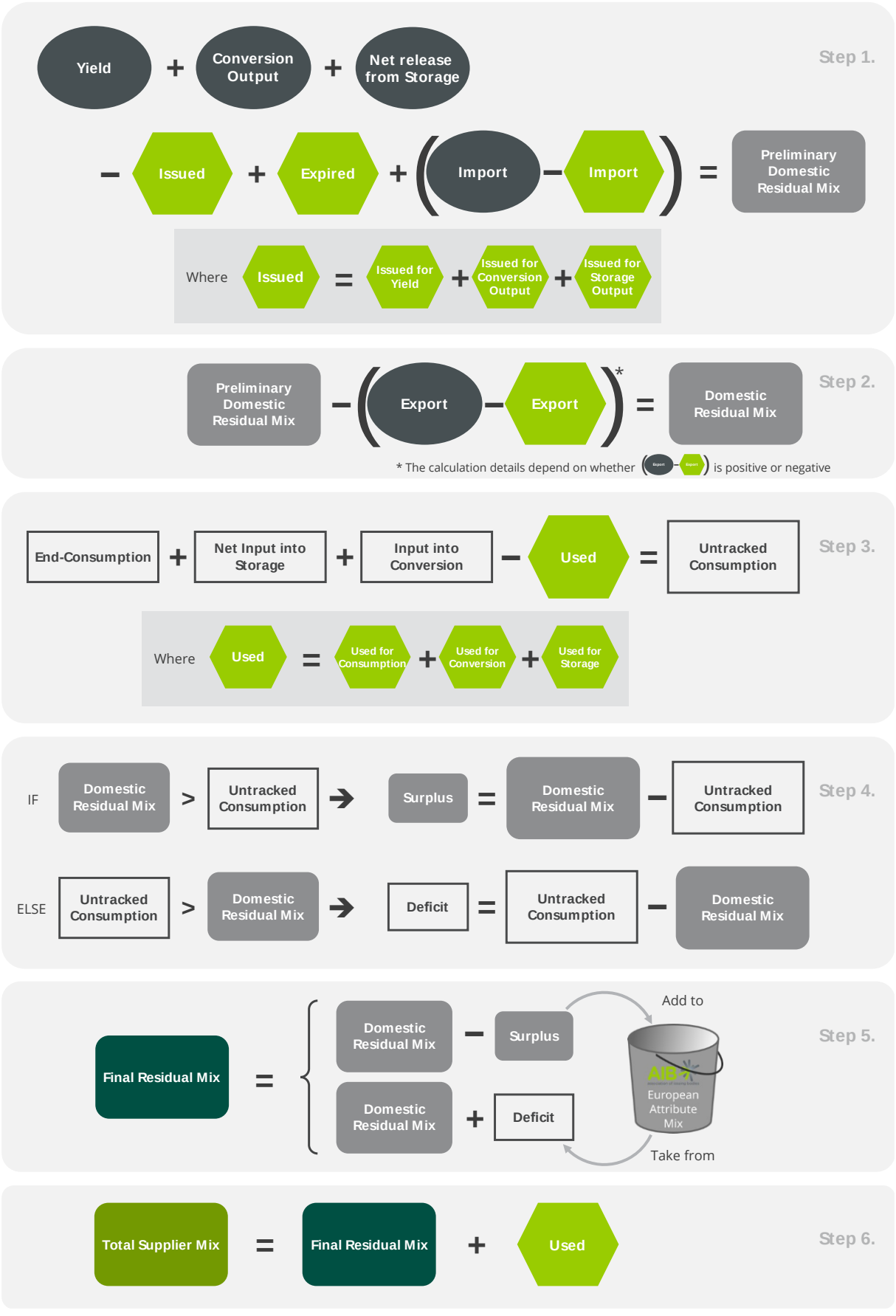

Figure 1: Visualisation of the proposed calculation methodology for the Residual Mix for gases.

Today, the actual **implementation of** many rules in **recent legislation** impacting claims on renewable gas consumption, is **not yet fully implemented**, so their consistency cannot yet be confirmed in practice. Additionally, the numerical data is not yet systematically available to support accurate Residual Mix calculation across all Member States of the European Union and the interacting natural gas and hydrogen markets. Despite data being collected and stored, the timely availability still needs improvement. Further, practice has shown that achieving consistent implementation of Residual Mix calculation methods across all Member States can take time.

Hence to date, there may not be a sufficient base in the EU for a detailed calculation method for a Residual Mix for gases. Therefore, it is as well considered that an **alternative, simplified calculation method** can be used until the necessary conditions are established, see Figure 2. This would mean assuming the Residual Mix for gaseous Energy Carriers consists of incumbent fossil energy source: natural gas on the one hand and unabated Steam Methane Reforming-based hydrogen on the other hand.

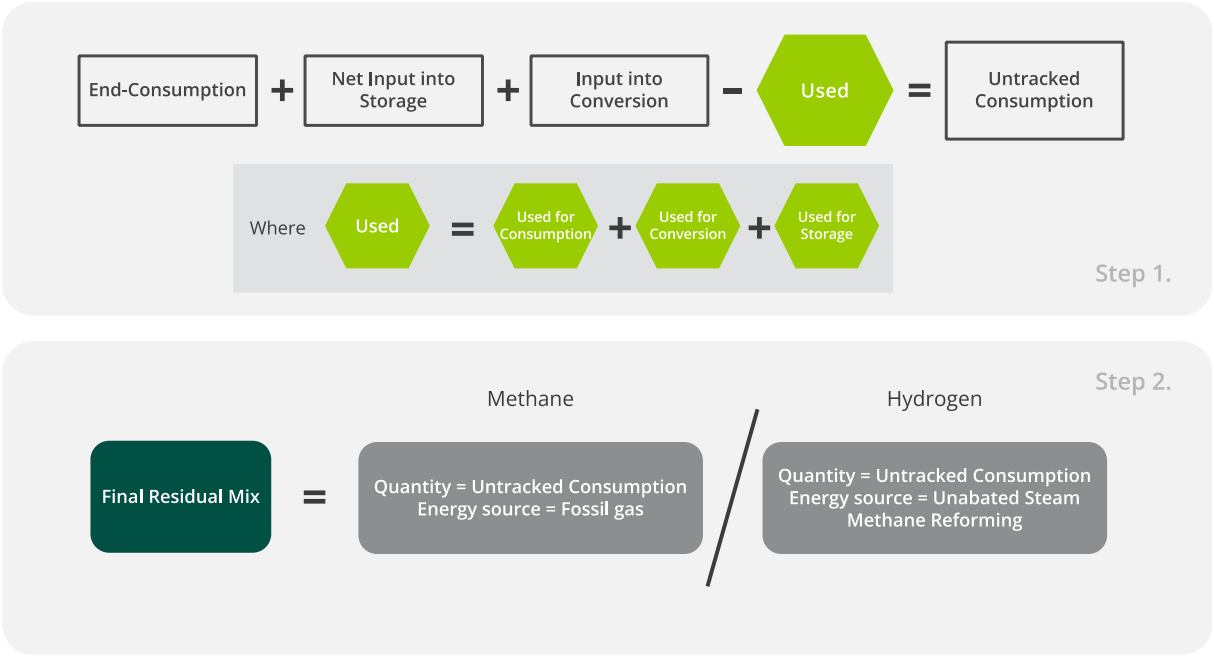

Figure 2: Visualisation of a proposed simplified calculation methodology for the Residual Mix for gases.

When deriving the emissions of the Residual Mix from the energy sources of the Residual Mix, further subcategorization of the fossil energy sources will however be needed, especially when there is a significant share of fossil gases with higher emission intensity than methane.

A calculation example, involving six countries (Belgium, Denmark, France, Germany, Luxembourg and the Netherlands), was conducted to test the calculation methods in practice. This test confirms the challenges related to data availability and proposes the simplified method as the most practical one for the Residual Mix for gases on the short term.

This study further proposes potential variants of a model in order to enable more effective harmonised calculations and ensuring a wider availability to users of residual mixes for all types of energy. It has been subject to an open stakeholder consultation.

1 INTRODUCTION

1.1 Introducing the REGADISS project

REGADISS - Reliable Gas Disclosure System is a one-year project under a service contract to DG ENER of the European Commission, based on the terms of reference N° ENER/2023/MVP/0010. The goal is to provide technical assistance to develop methodologies compliant with Disclosure obligations on gases from renewable energy sources.

The project aims at developing the basics for a methodology for a Residual Mix (RM) for gases, in line with the gas Disclosure obligation following Art. 19.8 of the Directive 2023/2413 as regards the promotion of energy from renewable sources (REDIII) and the Directive (EU) 2024/1788 of the European Parliament and of the Council of 13 June 2024 on common rules for the internal markets for renewable gas, natural gas and hydrogen, amending Directive (EU) 2023/1791 and repealing Directive 2009/73/EC (recast), in this document referred to as “the recast Gas Directive”.

To achieve this objective, the project is structured in five tasks:

- Task 1: Analysis of the current legal framework and methodologies for the Residual Mix calculation in the EU Member States
- Task 2: Technical and legal requirements that a methodology for Residual Mix in gases shall comply with
- Task 3: Draft methodology for Disclosure supervision and Residual Mix calculation for gases
- Task 4: Stakeholder consultation & dissemination
- Task 5: Final version of the methodology

1.2 Situating this report within REGADISS

This is the final report of REGADISS. It builds upon the draft methodology report (REGADISS Task 3), incorporating feedback from the Open Stakeholder Consultation which ran from mid-July to mid-September 2024. The conclusions of this Consultation are attached to this report in Annex I.2. The draft methodology was updated where relevant, following findings during the calculation of the example Residual Mix.

1.3 Why Residual Mix: Guarantees of Origin and Disclosure

1.3.1 Disclosure

‘Disclosure’ in the context of this document means: *the provision of information regarding the origin of supplied energy, to the customer and to the general public*. This meaning stems from the definition in the draft revision of the Guarantee of Origin Standard of CEN/CENELEC - EN16325, dated May 2024, where Disclosure is identified as the Purpose of the Guarantee of Origin.

Disclosure of the origin of gas supplied to consumers, gives them a starting point for assessing their impact on the energy transition. It empowers them to make more active purchasing choices regarding the energy they consume.

1.3.2 Guarantees of Origin (GO)

Guarantees of Origin (GO) are by legislative design the instrument for informing consumers on the renewable origin of gases, including hydrogen, as well as electricity, heating and cooling. This follows from art. 19 the Renewable Energy Directive (hereafter referred to as the RED), as revised by Directive 2023/2413 (EU) (REDIII). GOs are issued upon request of a producer by a governmentally appointed issuing body. GOs must fulfil the requirements set out in the EN16325 standard on Guarantees of Origin.

GOs are tracking instruments of the origin of energy in a market where physical tracking of the origin of energy flows is not possible. GOs are often used in a book-and-claim framework, where the GO is detached from the commercial transfer of the energy commodity. There are also other uses of GOs, such as in “bundled sales,” where the GO is sold together with the energy, and in the mass-balancing approach, where GOs are used as a tracking instrument to account for renewable energy within a system that blends renewable and non-renewable energy sources. ANNEX II elaborates on the legal and standardisation framework for GOs. ANNEX III elaborates on the difference between mass-balance and book-and-claim chain of custody tracking systems.

1.3.3 Residual Mix (RM)

The Residual Mix is the energy source mix that is left over once the reliably tracked consumption is taken out from the generation mix, as is illustrated by Figure 3. The gas Residual Mix is to be used where an end-user sources gas from an unknown origin: the energy source mix in this case shall be considered as the Residual Mix.

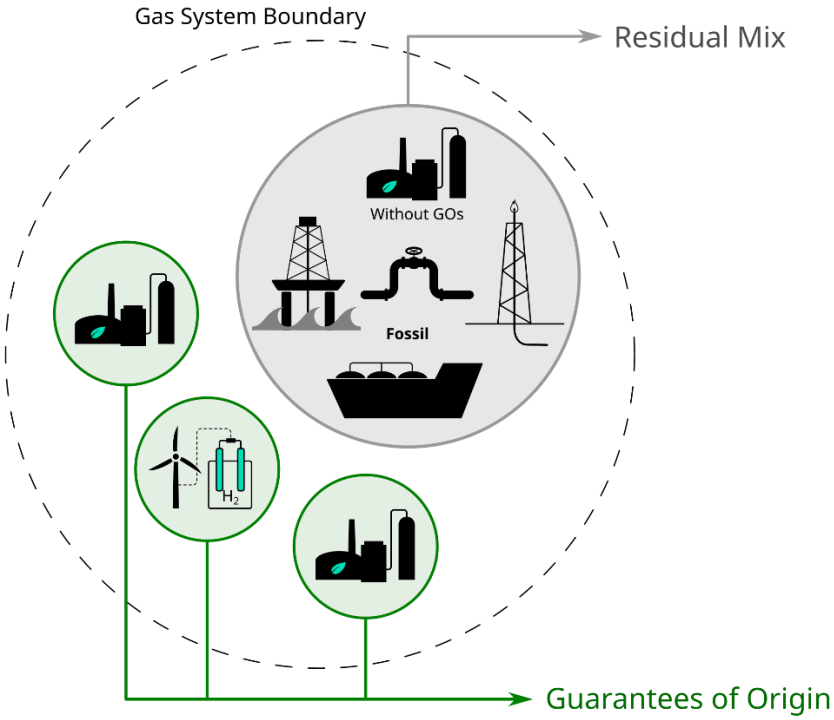

Figure 3: Illustration of Residual Mix.

The goal of the concept of Residual Mix is to ensure the robustness of environmental claims of clean gas consumption. This is done by providing clarity on the climate impact of the default purchase for consumers and suppliers who do not make such an active consumer/purchasing

choice. Hence, a Residual Mix is an integral part of an energy certificate system for Disclosure towards consumers, in order to prevent double counting in energy source Disclosure.

1.4 The author: AIB – Association of Issuing Bodies

1.4.1 Association managing a standard for Guarantees of Origin

AIB is a non-profit association of 37 members from 30 European countries who have been appointed by their governments to manage the Guarantee of Origin for electricity and gas under Article 19 of the RED. The European Energy Certificate System, EECS®, the standard operated by and for issuing bodies of GOs, makes it easier to issue and trade standardised certificates of origin in Europe. AIB is driven by efficiency and trustworthiness. AIB's aim is to ensure an accessible and harmonised European energy Disclosure system.

1.4.2 What is EECS®?

The European Energy Certificate System, EECS® for short, is a standard developed by and for members of the AIB. Its aim is to make cross-border transfers of GOs (cost) efficient and reliable for big volumes. In that sense, it builds on and goes beyond Article 19 of the REDIII and the CEN EN 16325 Standard for GOs. To do that, further details on the GOs need to be harmonised. These harmonisation requirements constitute the EECS® Rules.[5]

EECS® Certificates are issued, transferred and cancelled to avoid duplicates for the same output. They are the sole proof of the qualities or attributes of energy output, with no other Disclosure used except during cancellation. If multiple certificates with different purposes are issued for the same output, each must contain a reference to the others. The purpose of a certificate must not conflict with that of any other certificates for the same output. Scheme members[6] must clearly communicate the certificate's purpose to account holders as a certificate can only be used as per its purpose.

The reader is referred to Annex II.2.1 for further information on the EECS® Rules.

1.5 Aim of this report

This report aims to present a methodology for determining the Residual Mix for gases.

As the Residual Mix addresses a gap in the framework for Disclosure of the origin of energy, its requirements must consider the overall Disclosure framework in which it is applied. Hence, this report uses the requirements for reliable Disclosure of gases as a foundation, and from there onwards, studies the needs to take into account for the Residual Mix. As legislation holds the strongest protection opportunities for reliable Disclosure, the analysis starts from the legal framework and from there onwards clarifies conditions for the Residual Mix. This includes considerations on how information exchange with the European Union Database for sustainable biofuels could be dealt with.

[5] See: https://www.aib-net.org/eecs/eecsr-rules

[6] AIB currently operates two Schemes under EECS®: the Electricity and Gas Scheme. A Scheme Member has successfully completed an application to the relevant Scheme and may Issue EECS Certificates under that Scheme, which can be transferred over the AIB Hub. All Scheme Members are periodically audited to confirm they comply with the EECS® Rules.

To evaluate the Residual Mix calculation's practical feasibility, considerations on the availability of data for such calculations are included. These considerations include data quality, credibility and timing for publication of the Residual Mix in a meaningful Disclosure context.

This report builds on three preceding reports with detailed analysis: report "REGADISS Task 1 - Analysis of the current legal framework and methodologies: overview of currently used approaches" and "REGADISS Task 2: Technical and legal requirements", both integrated in "REGADISS Task 3: Draft methodology for disclosure supervision and residual mix calculation for gases". The main findings of these two reports are processed in the next two chapters. More details from the Task 1 and 2 reports are taken up in the Annexes to this report. Building on the Task 3 report with the draft calculation methodology for a Residual Mix for gases, this final report presents an updated calculation methodology, fed with input from the open stakeholder consultation, and improved based on observations during the example calculation.

1.6 Reading guideline

This report outlines the development of a Residual Mix (RM) calculation methodology for renewable and low-carbon gases, aligned with EU disclosure requirements. Below is a concise guide to help readers navigate the document effectively.

1. **Executive Summary**
   - *Purpose:* Overview of key findings, methodologies, and recommendations.
   - *Who Should Read:* Policymakers and stakeholders seeking a high-level understanding of the report's objectives and conclusions.
2. **Introduction (Chapter 1)**
   - *Purpose:* Contextualizes the REGADISS project and its relevance to EU energy disclosure frameworks.
   - *Who Should Read:* Readers new to the topic or seeking background on the project's objectives and scope.
3. **Background and Framework Conditions (Chapters 2–3)**
   - *Purpose:* Provides insights into the current state of gas disclosure in Member States and the legislative framework supporting RM implementation.
   - *Who Should Read:* Regulators and stakeholders interested in the legal and operational landscape of gas disclosure.
4. **Towards a Residual Mix (Chapters 4–5)**
   - *Purpose:* Details the proposed RM calculation methodology, including key design aspects and practical steps.
   - *Who Should Read:* Technical experts and policymakers focused on implementation.
5. **Residual Mix in Practice (Chapters 6–8)**
   - *Purpose:* Demonstrates how the methodology applies using case studies and example calculations.
   - *Who Should Read:* Practitioners and Member State authorities implementing RM calculations.
6. **Conclusions and Recommendations (Chapters 9–10)**
   - *Purpose:* Summarizes findings and offers recommendations for harmonizing tracking systems and addressing challenges.
   - *Who Should Read:* Decision-makers, industry representatives, and anyone interested in actionable steps forward.
7. **Annexes**

- *Purpose:* Provides supplementary details, stakeholder input, legal frameworks, and technical specifics.
- *Who Should Read:* Specialists requiring in-depth information or supporting evidence for the main report.

How to Use This Guide

- For a quick overview, start with the Executive Summary.
- To understand the current challenges and context, focus on Chapters 2–3.
- For detailed guidance on methodology and implementation, explore Chapters 4–8.
- Refer to the Recommendations in Chapters 9–10 for actionable insights.

For an overview of referenced EU Legislation, the explanation of key concepts in a glossary and a bibliography, the reader is referred to ANNEX XI.

BACKGROUND AND FRAMEWORK CONDITIONS

2 BACKGROUND: GAS DISCLOSURE IN THE MEMBER STATES TODAY

2.1 State-of-play in the Member States

As a precursor to this Task 3 Report, REGADISS examined the current status of the Residual Mix for electricity and gas in EU Member States. national legal frameworks on and currently applied methodologies for electricity and gas Residual Mixes were inventoried. Currently, 24 Issuing Bodies for gas GOs have been appointed by their governments, spread over 21 EU Member States and Switzerland. However, no country has yet – at the moment of writing – established a Residual Mix for gases, as first Disclosure rules need to be established before a Residual Mix can enable reliable and transparent Disclosure of energy sources.

The obligation for the Disclosure of the origin of supplied or consumed gaseous energy varies across different countries. Austria, Estonia, Ireland, Netherlands, Latvia, Lithuania, and Finland currently have a Disclosure obligation in place. However, in the Netherlands, this obligation applies only to renewable gases, not natural gas, which means there is no Disclosure information for customers for gas. Spain currently has no Disclosure obligation but offers the possibility through the GO System. With the ongoing recast Gas Directive, Disclosure rules are expected to be gradually rolled out in all Member States.

Figure 4 and Table 1 summarize information on competence for Issuing gas GOs, Disclosure competence, for which Energy Carriers gas GOs are issued and any relevant national legislation. The Table is constructed based on a survey in the EECS® Gas Scheme Group, complemented with responses from the Datasheet GO and Disclosure survey, which was updated as part of project REGADISS.[7]

Table 1 shows a wide variation in implementation of gas GO issuance and Disclosure supervision. In many Member States, the competence for issuance and Disclosure supervision are embodied by the same authority as for electricity, but not everywhere. Numerous Member States have completed the transposition of REDII regarding GOs for gases, while others are consulting legislation or awaiting the finalisation of the CEN EN16325 standard for GOs.

Currently, little is known about the statistics of gas GOs. At AIB, besides the existing central collection of national electricity GO statistics[8], publication of gas GO statistics is still under development and will only be available by the end of 2024. This will relate to issuance, transfer, cancellation, expiry of gas GOs per country. Furthermore, Member States provide in their two-yearly report to the European Commission statistics on the issuing of gas GO and the resulting annual renewable energy consumption[9]. See further information in Section 2.2. ERGaR publishes aggregated data on total quantities transferred across borders[10], yet not indicating which relate to gas GOs and which to non-governmental certificates, and not indicating the countries to which issuance, import, export and consumption quantities relate.

[7] See https://www.aib-net.org/facts/national-datasheets-gos-and-disclosure for the revised survey template and the responses received.
[8] https://www.aib-net.org/facts/market-information/statistics
[9] Commission Implementing Regulation (EU) 2022/2299 Annex XVI:
[10] https://www.ergar.org/ergar-schemes/coo-scheme-statistics/

ANNEX IV.4 illustrates how the energy sources of supplied gas are displayed on the invoice of gas suppliers in Austria.

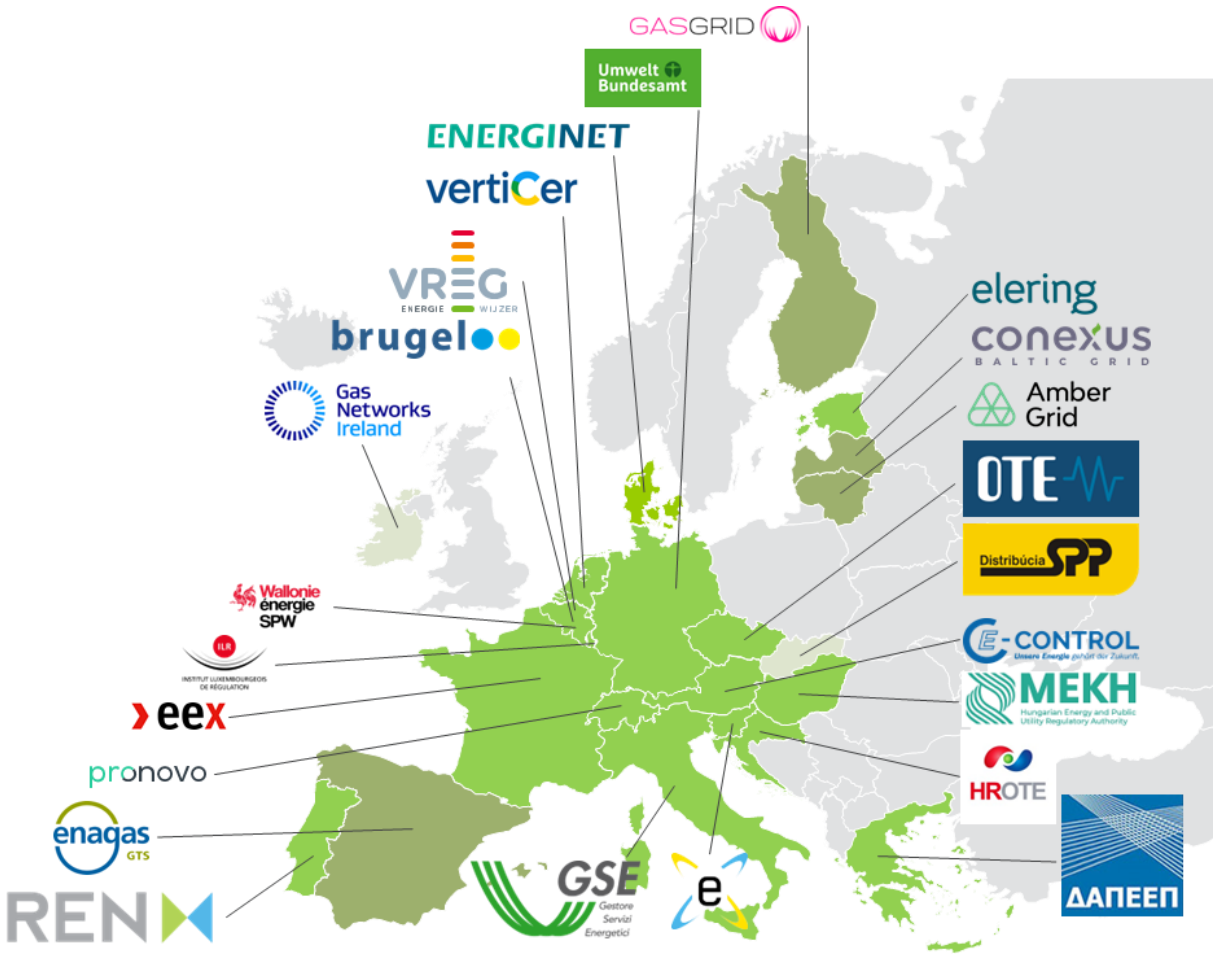

Figure 4: Countries where a Competent Body for gas GOs has been appointed. Countries in lime green have the same Competent Body for electricity and gas GOs, which is a Member of AIB. Dark green countries have separate Competent Bodies, both of which are AIB Members. Pale green countries (Slovakia and Ireland) have separate Competent Bodies, where the gas Issuing Body is not (yet) an AIB Member.

Table 1: Overview of State-of-Play in Member States regarding Issuance of gas GOs, Disclosure competence and any relevant legislation.

Country - Domain	Designated issuing Issuing Body for gas GO	Disclosure competent body*	Gaseous energy carriers for which GOs are issued**	Legislation link	Remark
Austria	E-Control	E-Control	Biomethane, Natural Gas, Hydrogen	See Austrian Domain Protocol, section C.1-C.2, pp. 13-15	
Belgium – Brussels	BRUGEL	BRUGEL	Energy gas, Hydrogen	Gas Ordinance (FR – NL)	
Belgium – Flanders	VREG	VREG	Methane, Hydrogen and Other	Energy Order (NL)	

Country - Domain	Designated issuing Issuing Body for gas GO	Disclosure competent body*	Gaseous energy carriers for which GOs are issued**	Legislation link	Remark
Belgium – Wallonia	SPW	CWaPE	Methane	Government decree on Guarantees of Origin for Renewable Gases (FR)	
Croatia	HROTE	-	Methane, Hydrogen	GO Regulation (HR)	
Czech Republic	OTE	ERU	Methane, Hydrogen	Act 165/2012 Coll (CZ)	
Denmark (Grid-injected)	Energinet	Energinet	Methane, Hydrogen	GO Order (DK)	Off-grid Renewable Hydrogen: issued by Danish Energy Agency
Estonia	Elering	Elering AS	Biomethane, hydrogen (soon)	Energy Sector Organisation Act (EN) Regulation on GOs (EE)	
Finland	Gasgrid Finland	Energiavirasto (Energy Authority)	Gas from renewable energy sources, such as biogas, biomethane, e-methane, and Hydrogen	GO Act (EN) – Govt. Decree on GOs (EN)	
France	EEX	French Ministry of Energy Transition	Methane, Hydrogen	Energy Code (FR)	
Germany	UBA	UBA	Biogas	GWKHV (DE)	
Greece	DAPEEP	Regulatory Authority for Energy Water and Waste (RAEWW)		GO issuing body appointment (EN) Disclosure (GR)	RAEWW responsible for suppliers in general; no specific reference to Disclosure
Hungary	MEKH	MEKH	All renewable gases	Legislation under consultation	
Ireland	Gas Networks Ireland	GNI	Natural gas including (bio)methane	Statutory Instrument (National Legislation) No. 350 of 2022	

Country - Domain	Designated issuing Issuing Body for gas GO	Disclosure competent body*	Gaseous energy carriers for which GOs are issued**	Legislation link	Remark
Latvia	Conexus Baltic Grid	Public Utilities Commission of Latvia	Methane	Energy Law (EN) Domain protocol (EN) For disclosure - Regulations Regarding Information to Final Customers of Electricity and Natural Gas (but this hasn't been updated for many years to include gas) – (EN)	
Lithuania	AB Amber Grid	VERT	Biomethane	GO Rules – Document provided by Amber Grid (EN)	
Luxembourg	ILR	ILR	TBD	Amending Regulation (FR)	
Netherlands	VertiCer	ACM (Authority for Consumer and Market)	Methane, Hydrogen (and in principle other gases)	Gas Act, §5.16, Implementation of Gos for biomethane (NL) – Implementing Act RED for Gos, Implementation of Gos for other gases (NL) – Ministerial Regulation on Gos (NL)	
Portugal – Mainland	REN/EEGO	ERSE	Renewable and Low-carbon gases	Decree-Law n° 84/2022 (PT) – Secondary legislation (EN)	
Slovakia	SPP Distribúcia	SPP Distribúcia		Act on Energy Act No. 251/2012	
Slovenia	AGEN-RS	AGEN-RS			

Country - Domain	Designated issuing Issuing Body for gas GO	Disclosure competent body*	Gaseous energy carriers for which GOs are issued**	Legislation link	Remark
Spain	ENAGAS GTS	-	Methane, Hydrogen and Unspecified (non-upgraded biogas)	Order on GOs for gas from RES (ES)	Disclosures offered on voluntary basis – no supervision foreseen yet
Sweden	Swedish Energy Agency	Energy Markets Inspectorate (Ei)	All	Expected	Awaiting outcome of CEN EN 16325 revision process
Switzerland	Pronovo	SFOE (Swiss Federal Office of Energy)	All renewable gases, liquids and renewable/non-renewable Hydrogen	Rules for issuing renewable gas GOs and liquid GOs -active in 2025 (DE)	Planned launch of registry: 1st January 2025

*In some countries the Disclosure competent body is explicitly designated for checking compliance to gas Disclosure rules. In other countries the supervisor for electricity Disclosure is expected to be the competent body for gas Disclosure, but not yet tasked by national legislation for doing so.
** The terminology used for which energy carriers receive GOs is not harmonised.

2.2 Member States' report on RES consumption and GOs

Task 1 of REGADISS analysed the Member States' reports to the EU Commission on RES Consumption and GO Issuance and Cancellation in the framework of the reporting obligation in Annex XVI of the Commission Implementing Regulation (EU) 2022/2299. These reports for 2020 and 2021 were compared with the Residual Mix calculations for the corresponding years. While this section highlights the most important findings, the full analysis may be found in ANNEX V.

Although the comparison of the results for individual Member States lead to the conclusion that there are large differences between Member States' interpretations of the numbers to be reported, more importantly the aggregated statistics for all Member States in Figure 5 show clear shortcomings.

Indeed, in the ideal case, we would expect the reported national RES consumption to be equal to the RES fraction in the total supplier mix (light grey and dark green bars in Figure 5). Similarly, the RES fraction in the Total Supplier Mix, after the RES share in the Final Residual Mix has been subtracted, is expected to be equal to the sum of all cancelled GOs (for RES) (light green and dark grey bars in Figure 5). The statistics for 2020 and 2021 show that this is clearly not the case.

Although there are many reasons for the discrepancies between these statistics, the most important ones are:

- Misalignment between the timeframe for the issuance and cancellation GOs on which to report, and the timeframe for the Residual Mix calculation;

- Energy for which support is granted may not be eligible for the issuance of a GO, but it may also not appear directly in the Residual Mix;
- Exclusion of RES fraction from expired GOs in the national Residual Mix used; and
- Discrepancies because of Ex-Domain Cancellations, mostly by which country they are to be reported.

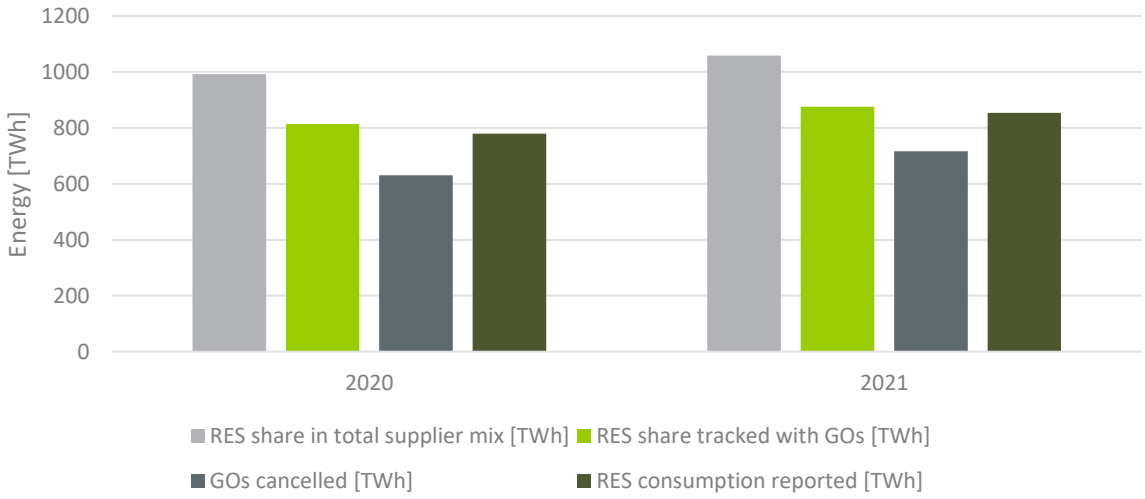

Figure 5: Comparison of the sum over all reporting Member States of 1) the calculated RES fraction in the Total Supplier Mix (TSM), 2) the remaining RES fraction in the TSM after the RES fraction from the Residual Mix has been subtracted, 3) the energy volume corresponding with the reported number of cancelled GOs and 4) the reported national RES consumption.

It is concluded that the Member States' reports on RES Consumption and GOs may at one point feed the Residual Mix calculation with data, but currently the data quality is insufficient, and the data is gathered too late for the Residual Mix calculation. The lack in quality may be solved to a large degree by aligning the interpretations of different Member States on what to report.

2.3 Stakeholder interaction leading up to this report

REGADISS gathered stakeholder views regarding Residual Mix calculations for gases at several stages during the project. Any methodology proposal for the Residual Mix aims to be acceptable across the European Union and to the different stakeholders, and this is why it is essential to involve them. To that end, REGADISS organised several consultations and workshops to gather the views and input of relevant stakeholders. A short summary is provided in this section.

2.3.1 Stakeholders' preliminary considerations on Residual Mix calculation

In its early stages, REGADISS reached out to relevant stakeholders seeking opinions and/or advice on this topic. A survey invited views from various stakeholders regarding the methodology for determining the Residual Mix for gases, prior to designing the draft calculation methodology. The survey asked for specific views regarding the system boundaries within which claims are made, and for which a dedicated Residual Mix would need to be calculated. The respondents were also invited to list data sources regarding production and consumption of renewable and other gases, and regarding issuance, transfer and cancellation of tracking instruments used in reliable tracking mechanisms. The survey form and the detailed survey results are provided in ANNEX I.1.

In total 27 respondents provided feedback via this survey, covering a variety of activities and responsibilities, see Figure 6.

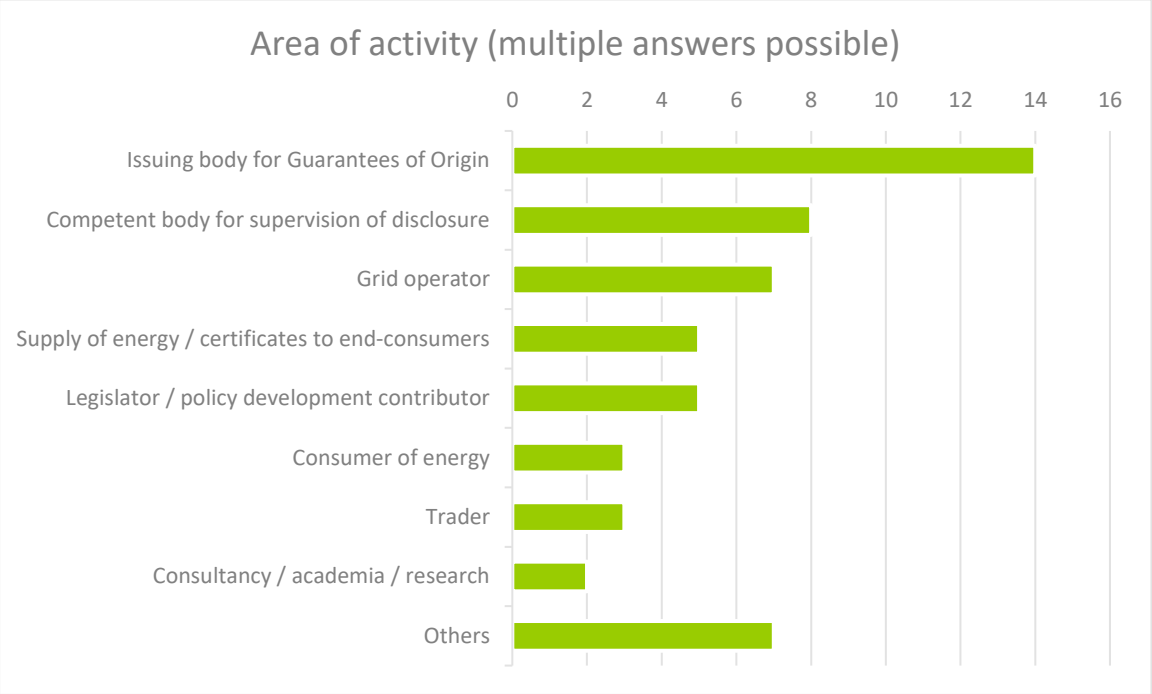

Figure 6: Activities of the respondents to the survey.

More than half of the respondents highlighted the relevance of a Residual Mix for gases as a key tool to inform end-consumer about the attributes of gas and to avoid double counting. About one in ten respondents believe that establishing a Residual Mix for gases is premature due to the low volume of renewable gases.

There was no clear preference among the respondents whether a separate Residual Mix need to be determined within different distribution system boundaries (transport through an interconnected pipeline system, transport by vehicle, transfer of renewable characteristics without physical connection ...).

The respondents did not express one most preferred option for segregating between system boundaries. The following system boundaries have the highest preference:

- For gases taken from all European regulated natural gas grids
- For every single non-interconnected natural gas grid (= separately for local grids and for gases taken from the European interconnected natural gas grid)
- For every single hydrogen grid

On the question which energy sources need their own category in the Residual Mix for gases, roughly two in three respondents are in favour of distinguishing multiple categories for renewable energy sources and of considering fossil gases as one source of energy. Most respondents are in favour of considering nuclear as one source of energy, without further subcategories.

When calculating a separate Residual Mix per type of gas, most correspondents propose to define two categories of relevance: natural gas (compatible gas) and hydrogen, in line with Art 19.8 of RED III and the draft EN16325 standard.

Almost half of the respondents indicated that Proofs of Sustainability should not entitle for claiming the renewable characteristics of the origin of gases to end-consumers, nor for claiming

the renewable characteristics of the origin of gases to end-consumers, while about one third of the respondents is in favour. The remainder part of the respondents is undecided. Amongst the respondents, the opponents include mostly issuing bodies and competent bodies for supervision of Disclosure, while the proponents include mostly suppliers and consumers of energy.

2.3.2 Stakeholder workshop on the draft methodology report

On 3 September, the REGADISS Project team organised an online workshop, detailing the achievements and findings of the project so far, and providing an opportunity for stakeholders to interactively ask questions and provide feedback. The conclusions of this Consultation and the feedback received during the workshop are attached to this report in ANNEX I.1.

The workshop in essence presented two main possibilities for the calculation of a Residual Mix for gases: a simplified methodology (Residual Mix equals fossil natural gas) and a detailed methodology. Both methodologies have their merits and shortcomings, and the general consensus seems to be that the simplified method is suited mostly for the short term, whereas the detailed method will earn its place as the market for renewable gases grows and evolves.

During the workshop, a suggestion was made to distinguish multiple possible gas sources under the “fossil gas” category. This could be useful as the environmental impact varies greatly depending on the source. Related to this, it was brought forward that there should be a distinction between fossil and low-carbon gases. Participants asked about whether non-GO tracking instruments would be permissible under EU Law. It would depend on the national implementation by Member States. It is foreseeable that there will be both GO-tracked and UDB-tracked gases, and these would be most important to take into account for the calculation of the Residual Mix. Several questions related to the emissions in the residual mix for gases. It was clarified that the REGADISS project develop a first building block, namely the energy source mix. Emission calculation is the next step. It follows upon that first building block, once the energy source mix is clear. It is essential to first have the composition of that energy source mix aligned, as double counting would occur when the methodology is differing everywhere.

2.3.3 Stakeholder consultation on the draft methodology report

Following the publication of the Task 3 report, regarding the draft calculation methodology for a Residual Mix for gases, an open stakeholder consultation ran from mid-July until mid-September. This subsection provides a summary of the gathered stakeholder feedback. The full stakeholder consultation report is provided in ANNEX I.2.

7 responses were received from organisations in the Czech Republic, Denmark, France, Germany and Portugal. 3 of them indicated to be a competent body for disclosure supervision, and 3 were TSO/DSO (among others, and multiple categories could be selected).

Respondents agreed that the simplified Residual Mix calculation is a good temporary solution, given that tracked gases currently form only a minority in the gas market and that reliable tracking systems are still immature. Most respondents found that the detailed calculation would be a good idea as soon as the conditions mentioned in the T3 report are established.

When asked about the detailed calculation of the Residual Mix, a majority indicated that the calculation is (theoretically) correct. Those with reservations about the detailed calculation suggested parts from the detailed calculation may be taken over in the simplified calculation, such as tracking instrument imports/exports. The respondent who indicated the calculation was incorrect argued that the methodology lacks a clear distinction between the Residual Mix and

the GO on the one hand, and mass balancing on the other, which is already much more established in gas markets.

Some respondents questioned the applicability of the Residual Mix for greenhouse gas accounting purposes. Others pointed out that the fall-back scenario of a Residual Mix consisting per default of fossil natural gas only, would only apply to the natural gas system. Hydrogen and other gases would need dedicated simplified RM calculations to reflect the specific situation for those markets.

There was a consensus that the simplified calculation is the preferred option on the short term. On the long term, the views are more diverse. A small majority prefers the detailed calculation, but a small minority thinks the simplified calculation should be maintained.

Asked for any other feedback, the respondents highlighted the complexity of the EU Regulatory framework, which allows inconsistencies between different MS; the importance of accurate GHG footprint disclosure the Residual Mix should provide; the fact that all tracking instruments, and not just the GO, should be considered in the Residual Mix; and finally discrepancies in tracking of stored gas, due to the proposed methodology's lack of an inventory of gases in storage, considering gases may enter and leave storage in different balancing periods.

3 FRAMEWORK CONDITIONS FOR A RELIABLE RESIDUAL MIX

3.1 Reliable Disclosure fundamentals

3.1.1 Four pillars for reliable Disclosure

To make Energy Disclosure meaningful and reliable, double claiming shall be prevented. This benefits from the existing legal obligation that Member States shall ensure that the same unit of energy from renewable sources is taken into account only once (see RED, Art.19). The FaStGO Project identified the following 4 pillars for establishing a reliable Disclosure and avoiding double claims on the origin of energy, besides the management of a reliable Guarantee of Origin system:

1) Disclosure (as) obligation
   - There shall be an obligation on suppliers to inform consumers on the origin of all energy supplied to them, this may be done by means of information on their bills.
2) Unique Instrument
   - A single method to prove the origin of energy is needed, and this method shall ensure that every MWh produced with specific Attributes, is only disclosed once. To ensure the robustness, it needs protection by legislation which should define the unique instrument that can be used for making claims on the origin of consumed energy. Ideally, where this energy stems from renewable sources, this shall be proven by using GOs, except for the renewable share of the Residual Mix.
3) Residual Mix unless Full Disclosure
   - To compensate for energy tracked with GOs, the mix with leftovers must be determined and used for the supplies that are not backed with GOs. That mix must take into account cross-border flows of GOs. This is called the Residual Mix.
   - Only where legislation imposes for all energy consumption to be covered with cancelled GOs, no Residual Mix is needed. Such situation is referred to as “Full Disclosure”.
4) Supervision
   - Regarding the Disclosure obligation there is supervision on suppliers, which is independent from suppliers, including the verification that the disclosed information is reliable.

Further, in its recent advice “Guidelines of Good Practice for Trustworthy Information on Green Offers and Consumer Protection Against Misleading Marketing (‘Greenwashing’)”[11] the Council of European Energy Regulators CEER advises to base consumer information on the origin of gases on gas GOs under the supervision responsibility of the Member States. CEER has developed recommendations involving the Disclosure system and its main instrument, the GO.

Of further relevance are the Best Practice Recommendation (BPR) from the Reliable Disclosure Systems for Europe (RE-DISS), which constituted an IEEE funded project that ended in 2015 and developed a Residual Mix method for electricity. Until today these BPR

[11] See Recommendations 4-5-6-7 (pp. 21-24) in Section 6.2, https://www.ceer.eu/documents/104400/-/-/832ddef0-87de-c539-38f8-ec4d6ce63269

serve as a guideline for the issuance, tracking, and cancellation of GOs. They also address the calculation of Residual Mix and the role of Reliable Tracking Systems (RTS). Several important takeaways from electricity Disclosure recommendations are equally relevant for gases. While many are adopted in EU legislation since the closure of the RE-DISS project, the following recommendation remains particularly relevant for consideration in this report:

RE-DISS BPR §17

a) Besides GOs, only Reliable Tracking Systems and the Residual Mix should be available for usage for Disclosure. No other mechanism should be accepted.

Note: It needs clarification which other RTS exist for gases. Especially the tracking framework of Proofs of Sustainability in the UDB would benefit from clarification whether it legally entitles for gas Disclosure.

3.1.2 Why does a GO system need supportive Disclosure regulation?

The objective of obliging the relevant actors in the market to disclose the origin of their energy supply/consumption, is to avoid any implicit or explicit assumption on their energy mix that is not substantiated with proof.
The GO system is a robust system for avoiding double counting of energy attributes. While the GO is intended to be used for Disclosure of the origin of energy towards consumers, additionally there is a need for measures to facilitate Member States in exercising their obligations to avoid double claims of the underlying energy covered by the certificates. This relates to the framework of the GO system, enforcing the usage of the GO and setting requirements that prevent double claims. Lacking such, the GO system risks being undermined by parallel claims.

3.1.3 Ensure a unique instrument to prevent double claims

As highlighted above; in order to establish a reliable Disclosure system, it is necessary to implement GOs and the Residual Mix. Additionally, where historically or politically established, other Reliable Tracking Systems can be incorporated as a third component. It is essential that every tracking instrument ensures that it uniquely represents the right to claim the Attributes of the underlying energy. Otherwise, there is a risk that for one unit of energy, multiple separate tracking instruments are issued. If they are used to disclose consumption information to multiple distinct end-consumers, that constitutes **double claims/double Disclosure**. Such double claims or double Disclosure undermine the reliability of the entire Disclosure system and should thus be avoided at all costs.

3.1.4 Consistency between issuance and usage of GOs for methane, hydrogen and other gas

Discussions in the sector have shown that credible consumption claims need consistency between the type of gas for which a GO was issued, and the type of gas that is consumed.

On top of that, this is essential for the feasibility of the RM calculation formula build-up, with a view to prevent leakage of tracking instruments from its controlled system boundary. Therefore, a fundamental for reliable disclosure is to **ensure consistency in the type of gas for which a tracking instrument was issued, and the tracking instrument that is used to claim the energy source of that gas.**

E.g., for claiming the attributes of hydrogen consumption, only allow tracking instruments that were issued for hydrogen. Install rules that ensure cancelled GOs are consistent with the type of gas and the dissemination level of gas consumption. This is essential for a consistent Residual Mix calculation within the system boundary of that energy carrier and type of gas.

3.1.5 Why do we need the Residual Mix?

A Residual Mix is needed when there is a Disclosure requirement for the origin of supplied energy and when a substantial share of the consumption is explicitly tracked using energy certificates. In such cases, the Residual Mix provides a means of accounting of the untracked portion of energy consumption, thereby ensuring complete and reliable Disclosure of energy sources. For gases, such Disclosure obligation has just been introduced in EU legislation, namely in the recast Gas Directive.

Note that Art. 2 (13) of REDII defines 'Residual Energy Mix' as *the total annual energy mix for a Member State, excluding the share covered by cancelled Guarantees of Origin*. This definition deserves a careful interpretation, as elaborated further in this report.

Furthermore, disclosing the origin of gas supplied to customers gives them a starting point for their impact on the energy transition. It empowers them to make more active purchasing choices regarding the energy they consume.

Guarantees of Origin (GO) are by legislative design the instrument for informing consumers on the origin of the gas(es) they consume, as well as of their electricity, heating and cooling. This follows from the RED.

The Residual Mix is a crucial component in the context of reliable Disclosure, as it refers to the mix of energy sources left over after all claims of produced energy have been made. Until Full Disclosure is implemented everywhere, the Residual Mix is essential to ensure transparency. Full Disclosure, or Full Consumption Disclosure, requires issuing GOs for all production from every energy source (Full Issuance), AND cancellation of GOs for all consumption of energy.

The concept of Residual Mix aims to enhance the validity of environmental claims about clean gas consumption. It provides clear information to compare the climate impact of default purchases for consumers and suppliers with those who do make active purchasing choices.

3.1.6 Supervision and harmonised Residual Mix calculation method

Harmonisation of Disclosure practices is not only necessary to make sure the actors in different roles and different countries have the same understanding and apply the same principles, but also essential to prevent double claims. The method for determining the origin of energy and the Residual Mix must synchronise over interconnected markets. This will ensure that the Disclosure of the renewable origin of gas is as reliable and transparent as that of electricity, further empowering consumers to make informed energy choices. Not doing so risks that energy attributes are lost or duplicated between countries.

National competent authorities oversee the Disclosure obligation through the following practices:

- Enforce that Disclosure practices adhere to the rules, which prevents duplicate claims of renewable energy consumption
- Publish at national level the figures for the Residual Mix

- Synchronise the methodology for the national Residual Mix calculation with other countries, to ensure consistency in the accounting of cross-border flows of renewable attributes.

The next section elaborates on the relevant aspects from EU legislation, and how this translates into technical requirements for the Residual Mix.

3.1.7 Existing guidance for Disclosure

ANNEX IV summarizes the main relevant parts of guidance for Disclosure from the CEER Advice on Trustworthy Green Offers and from the Best Practice Recommendations from the RE-DISS Project. These further flow into the guidance in Chapter 7 on Supplier Disclosure.

3.2 EU legal Disclosure obligations for actors in the supply chain

Many legislative initiatives are built on clean energy tracking. The recent legislative developments fill many former gaps on the road toward reliable Disclosure. However, an inconsistent implementation would feed the challenge of preventing double counting of the same renewable energy. This is especially at risk if different aspects of EU legislation would select their tracking methodologies separately from each other. This leads to the identification of technical requirements and options for overcoming this challenge while implementing a framework for reliable Disclosure.

That brings a focus on **identifying risks for double claims of consumption of the same renewable gas** and how those can be mitigated.

3.2.1 Disclosure by gas suppliers

The recast Gas Directive in its Annex 1§5 installs the **first gas Disclosure obligation** on **suppliers** and imposes to mention on the bills the renewable and low-carbon origin of supplied gas, and at least for renewable gas, substantiate this with **Guarantees of Origin**.

It partly mirrors the Disclosure obligations of the Internal Energy Market Directive (EU) 2019/944 Annex 1§5.

> **Annex I MINIMUM REQUIREMENTS FOR BILLING AND BILLING INFORMATION FOR**
>
> **NATURAL GAS AND HYDROGEN**
>
> (…)
>
> §5 Disclosure of energy sources
>
> ***Suppliers shall specify in bills the share of renewable and separately low-carbon gas purchased by the final customer*** *in accordance with the supply contract for natural gas and hydrogen (product level Disclosure). In the event of a mixture the supplier shall provide the same information* ***separately for different categories of gas, including renewable gas or low-carbon gas****.*
>
> *The following information shall be made available to final customers in, with, or signposted to within their bills and billing information:*
>
> *a) the share of renewable gas and low-carbon gas in the mix of the supplier (at national level, namely in the Member State in which the supply contract for gas has been concluded, as well as at the level of the supplier if the supplier is active*

in several Member States) over the preceding year in a comprehensible and clearly comparable manner;

b) information on the environmental impact, in at least terms of CO_2 emissions resulting from the natural gas or hydrogen supplied by the supplier over the preceding year.

As regards point (a) of the second subparagraph, with respect to natural gas and hydrogen obtained via a gas exchange or imported from an undertaking situated outside the Union, aggregate figures provided by the exchange or the undertaking in question over the preceding year may be used.

The Disclosure of the share of renewable gas purchased by the final customers shall be done by using guarantees of origin based on Directive (EU) 2018/2001. When a customer consumes natural gas or hydrogen from a hydrogen or natural gas network, including gaseous renewable fuels of non-biological origin and biomethane, as demonstrated in the commercial offer by the supplier, Member States shall ensure that the guarantees of origin that are cancelled correspond to the relevant network characteristics.

The regulatory authority or another competent national authority shall take the necessary steps to ensure that the information provided by suppliers to final customers pursuant to this point is reliable and is provided at a national level in a clearly comparable manner.

The recast Gas Directive further installs a definition for Renewable Gas and for Low-Carbon Gas, and requires that both these categories of gas shall be certified towards the sustainability criteria and greenhouse gas emission saving criteria set out in the RED. For these purposes, Member States shall require economic operators to use a mass balance system. Members States shall also ensure supervision on the reliability and comparability of the information disclosed by gas suppliers.

3.2.2 Disclosure by corporate energy consumers

The European Sustainability Reporting Standards (ESRS), issued under the Corporate Sustainability Reporting Directive (EU) 2022/2464[12] (CSRD) imposes on **corporate energy consumers** to disclose the energy sources of their consumption and to base this on contractual arrangements like GOs.

The CSRD entered into force on 5 January 2023 and Member States had until 6 July 2024 to transpose it into national legislation. The Directive strengthens the social and environmental reporting rules for the companies. A wider range of listed companies must report on sustainability according to the ESRS. These also apply to large public-interest companies with more than 500 employees. The Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplements Directive 2013/34/EU13, as amended by the CSRD, regarding sustainability reporting standards.

The ESRS are divided into several annexes, each focusing on a different aspect of sustainability reporting. One of these is E1 – Climate Change. It provides disclosure requirements for organisations to report on their climate mitigation and climate adaptation

[12] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022L2464
[13] Delegated regulation (EU) 2023/2772 - EN - EUR-Lex (europa.eu)

efforts. It also covers energy related matters, to the extent that they are related to climate change.

This report only zooms in on the information to be disclosed related to the origin of consumed energy by the relevant consumers.

Relevant excerpts of the CSRD and ESRS are in ANNEX VI.

3.2.2.1 Awareness of double counting risk

There may be a risk of double counting and by-passing the GOs, because of the relatively vague phrasing of the emboldened text below:

1. **The origin of electricity and gas must be disclosed based on a market-based approach, but this is not restricted to the GOs only**. This is not consistent with the requirement of RED and IEM to base their energy origin on GOs only. (Similar for renewable gases once the recast Gas Directive comes out). If corporate consumers are allowed to create their own market-based instrument, this could result in double counting of energy for which GOs are issued, or that is included in the Residual Mix.
2. **Scope 2 GHG emissions (i.e. if electricity or gas is used) must be calculated both based on market based AND location-based approach**.

This leads to confusion which can lead to the same renewable gas being counted by more than one consumer. Implementation of the rules needs mitigation for this double counting risk. For the residual mix calculation method, it is important to ensure, before including renewable or low-carbon gases into the RM, aggregated numerical figures are available regarding all possible contractual instruments through which claims can be made regarding the consumption of such gases.

3.2.2.2 Strengths

The fact that now also corporates must disclose the origin of their energy is a significant step forward in strengthening reliable Disclosure. This requirement enhances transparency, traceability, and accountability, ensuring that companies are held responsible for the sources of the energy they use. By making the origin of energy public, it helps promote trust among stakeholders and prevents false claims about energy sourcing.

3.2.2.3 Relevance of the Residual Mix for corporate Disclosure of the energy source mix

One might wonder whether the Residual Mix for gas can be ignored because gas suppliers are not obliged to mention it on the invoice.

For electricity, the Supplier Disclosure requirements are going beyond those for gas, because non-renewables must also be stated on the invoice according to IEM Annex 1.5, where the Gas Directive Annex 1.5 includes only the supplier obligation to mention renewable and low-carbon gases on the invoice.

On the other hand, the ESRS require Disclosure of all energy sources. In terms of market-based reporting, under the ESRS dual reporting requirement, energy source reporting for corporates can only be consistent with the supplier Disclosure framework, if the Residual Mix is reported to cover the energy source of consumption for which no GOs are cancelled. This consistency is essential to prevent double claims of the same energy production from renewable sources.

3.2.3 Disclosure by traders

The **draft Green Claims Directive** aims to oblige Member States to ensure that Green Claims by **traders** are substantiated.

The proposal for the Green Claims Directive COM (2023/0085)[14] mandates traders to substantiate their explicit environmental claims about products or business-to-consumer commercial practices.

Art 3§1 (h)

Member States shall ensure that traders carry out an assessment to substantiate explicit environmental claims. (…)

Who this applies to, follows from the definition of Trader:

Art2§2

'trader' means trader as defined in Article 2, point (b), of Directive 2005/29/EC;

Directive (EU) 2005/29/EC, art2§b

'trader' means any natural or legal person who, in commercial practices covered by this Directive, is acting for purposes relating to his trade, business, craft or profession and anyone acting in the name of or on behalf of a trader;

The draft Green Claims Directive has yet to be discussed in trilogue between the European Council, Parliament and Commission, so its final form and implementation by Member States are yet to be shaped. It has however the potential to close any remaining double counting risks and to ensure consistency in the claims made.

The draft also mandates differentiation of GHG emissions and offsets. This helps a lot in setting up a framework for reliable Disclosure as it keeps renewable gas Attributes within the gas consumption sector and prevents leakage of the Attributes outside of certain system boundaries, preventing to use them for offsetting emissions in other sectors.

3.2.4 Mitigating Double counting risk resulting from misaligned Disclosure legislations

The supplier Disclosure obligation set out in annex 1§5 of the Gas Directive is consistent with the Guarantee of Origin system framework defined in art. 19 of the RED. While Art.45 of ESRS E1 (2023/2772)[15] requires any undertaking to disclose their GHG emissions by using both location-based and market-based methods, the Member States' implementation of the Green Claims Directive at national level may further guide this process. As the latter requires to validate environmental claims using scientific evidence, it presents an opportunity to strengthen the GO as the unique instrument for reliable tracking of the origin of energy. However, if Member States fail to establish a unique instrument for reliable claims, there is a real risk of weakening the Disclosure framework and allowing double claims.

[14] Proposal for a Directive of the European Parliament and of the Council on substantiation and communication of explicit environmental claims (Green Claims Directive) (Commission proposal – 2023| Parliament position March 2024 : https://www.europarl.europa.eu/news/en/press-room/20240308IPR19001/parliament-wants-to-improve-consumer-protection-against-misleading-claims

[15] See http://data.europa.eu/eli/reg_del/2023/2772/oj

3.3 Interaction of different legal requirements on energy origin tracking

The Guarantee of Origin is the designated legal instrument for tracking renewable gas for the purpose of Disclosure of the origin of supplied energy towards consumers.

Not all European legislation regulating energy origin tracking for policy targets refers explicitly to the Guarantee of Origin. However, Member States are legally obliged and mandated to ensure that the same renewable energy shall be accounted for only once. Member states implementing the European legislation must pay attention to this to guarantee this prevention of double counting of the same quantity of renewable energy production.

3.3.1 Guarantees of Origin: instrument for informing consumers

The requirements for Guarantees of Origin are given in art. 19 of the RED, which not only obliges Member States to **issue GOs** on request of a producer, but also to ensure that the same unit of renewable sources is taken into account only once. It also requires Member States to **publish the Residual Mix** on an annual basis and points out in art. 19 (8) that this Residual Mix is for untracked commercial offers and is defined in the RED as the total annual energy mix for a Member State, excluding the share covered by cancelled GOs. Art. 19 of the RED requires Member States to ensure that GOs comply with the CEN EN16325 standard for GOs, a standard for electricity GOs of which the revision including the update to gas and hydrogen GOs, is still in draft at the time of writing this report. ANNEX II elaborates on the legislation and standardization framework for GOs.

Guarantees of origin can be transferred between account holders in the registries of governmentally appointed GO issuing bodies. This way they can be transferred across national borders in Europe. Currently no recognition of GOs is in place for gases (biomethane and hydrogen) from outside the EU. Lack of a clear procedure and conditions for such recognition of non-EU GOs for renewable gases at import, despite existing procedures for accounting for such gases in EU policy targets, may hinder efforts to prevent double counting of the renewable attributes of imported gases.

3.3.2 Preventing double claims

The **prevention of double claims** will depend on the consistent implementation of different pieces of new European legislation. Challenges include the tracking of energy sources across Energy Carrier conversion, like electricity from renewable sources that is converted into hydrogen and vice versa. Implementation of the RFNBO criteria in the relevant Delegated Act to the RED is an essential area to monitor to prevent renewable origin from being claimed more than once.

Further, there are **different purposes for energy tracking (Disclosure, target accounting, financial support)** and those may build on different criteria (e.g. sustainability, GHG emission savings, additionality, temporal correlation, geographical deliverability) and different tracking mechanisms (e.g. book-and-claim, mass-balance, bundled sale of energy with tracking instrument). For more information about the difference between these tracking systems, the reader is referred to ANNEX III. This Annex delves into the difference between mass-balance and book-and-claim systems and explores the requirements for a multi-purpose tracking instrument that can be used for both Disclosure and policy target accounting.

The GO's biggest strength is the uniqueness-guaranteeing properties in its system management. That aspect makes it an ideal building block for data gathering towards multiple purposes (for both Disclosure and policy target accounting) in one single mechanism.

As a general principle that needs consistent implementation, preventing double usage claims (= "double Disclosure") of the same renewable gas quantity requires:

1) A unique instrument for renewable gas claims, or otherwise well-identified mutually exclusive instruments, with transparent usage and reporting procedures; and
2) The definition of the Residual Mix which excludes all the instruments that are entitled for making green gas claims.

In summary, several recent European legislative initiatives aim to enhance the impact of energy tracking on the energy transition. Now, their practical implementation needs a **coherent approach** to ensure these intentions come true. The first focus shall hence relate to enhancing reliable Disclosure, as the Residual Mix concept only adds value where a robust Disclosure framework is in place.

3.3.3 Tracking through the Union Database

3.3.3.1 The role of the UDB for tracking gases along their value chain

Article 31a of REDIII requires that information about injection and withdrawal of renewable gaseous fuels shall be provided in a Union Database (UDB). Economic operators must provide information on sustainability criteria, emission savings and other. This information is required up to the point of injection into the gas network as the interconnected gas system shall be considered as single mass balance system. This information shall be certified under National or Voluntary Schemes[16].

The UDB for the gaseous fuels value chain was operational at the end of November and should be implemented at Member State level with their transposition of RED III by 21 May 2024. The developer and operator of the UDB, being the European Commission, are set in the REDIII.

ANNEX VII elaborates on the interaction between the Union Database and GOs for gases.

3.3.3.2 Conditions for preventing double counting with other reliable tracking systems than GOs

As regards preventing double claims on the same renewable gas, the analysis in ANNEX VII leads to a list of conditions that need to be in place.

Currently, flows of records or certificates issued under voluntary schemes, especially if not registered in the UDB, are not systematically collected at Member State level. Exhaustive reporting requirements are not yet in place. They are only in the UDB when PoS are used for target accounting purposes, not when used for consumption claims and national pull mechanisms.

This leads to the conclusion that in the current legal setting and data collection processes, any proof of sustainability for which no corresponding GO is cancelled and that is not registered in the UDB, would cause double counting, as these renewable gases are also in the Residual Mix. The national Disclosure supervisory authorities have the right to get access to the UDB in order to validate which renewable gases are registered for consumption in their domain, and whether or not a GO is linked to it.

[16] Note that the EU Commission has recently approved some voluntary schemes for RFNBO (e.g. CertifHy by Commission Decision of 19 December 2024). An overview of all approved Voluntary Schemes is available on https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/voluntary-schemes_en.

3.3.3.3 GOs and PoS should be inseparable at consumption

As such, GOs and PoS issued for the same unit of energy should be inseparable at the point of energy consumption where that specific unit of energy is claimed. Indeed, where both exist for the same unit of energy, their separate trade risks double claims of the same unit of energy.

While information flows on GOs and PoS, towards, within, and between GO registries and UDB, can be designed in multiple ways, either design will need to incorporate this principle.

3.3.4 Tracking towards RFNBO criteria

3.3.4.1 The Delegated Acts on RFNBOs

For Renewable Fuels of Non-Biological Origin (RFNBOs), very specific criteria apply. Tracking across energy conversion towards RFNBOs complicates the Residual Mix calculation.

The Delegated Act RFNBO[17] of 10 February 2023 sets out the rules for defining renewable fuels of non-biological origin (RFNBOs), such as hydrogen produced from renewable electricity. RFNBOs must have a life-cycle greenhouse gas emission saving of at least 70% compared to the fossil fuel comparator. The GHG DA[18] provides a methodology for calculating the life-cycle emissions, taking into account the emissions from electricity generation, processing, and transport.

ANNEX VIII elaborates on the interaction between two delegated acts on RFNBOS and the Disclosure framework in the scope of preventing double claims. It first touches upon the general framework and subsequently on some attention points with impact on the Residual Mix and our focus regarding double claim prevention.

3.3.4.2 Tracking through PPAs, but all covered by GO and UDB

The bottom line of the analysis in ANNEX VIII is that the link between renewable energy production and consumption for RFNBO target accounting purposes, can in many cases be proven with the existence of Power Purchase Agreements (PPAs). Reading this together with the Member State obligation (RED art. 19) to ensure that all energy sources are accounted only once poses constraints on the Residual Mix calculation. DG ENER clarified in its Q&A in 2023 that energy represented by GOs shouldn't be double counted. Further, tracking for target accounting will be registered in the Union Database, when the system is rolled out.

In order to be eligible for target accounting or support, RFNBOs will have to be registered in the UDB, and the UDB should according to RED III article 31a have information on which RFNBOs are accompanied with GOs. This stipulates which tracking instruments must be considered in the RM formula developed in this report, namely the GO and the energy tracked in the UDB.

3.3.4.3 Conversion

As illustrated by RFNBOs, consistently handling inputs into, and outputs from Energy Carrier Conversion is essential for a robust Residual Mix calculation. This needs consistent approaches in the RM formulas for different Energy Carriers.

[17] RFNBO DA: See Commission Delegated Regulation (EU) 2023/1184.
[18] GHG DA: See Commission Delegated Regulation (EU) 2023/1185

3.3.5 Tracking for EU-ETS

The European Emission Trading Scheme (EU-ETS) is a cap-and-trade system to reduce carbon emission via a market mechanism. The cap sets a limit on the total amount of greenhouse gases that can be emitted by sectors covered by the system: energy sector and manufacturing industry (around 10,000 installations), as well as aircraft operators flying within the EU and departing to Switzerland and the United Kingdom. From 2024, emissions from maritime transport are covered as well. From 2027, a parallel ETS2-system will start its operation, covering the CO_2 emissions from fuel combustion in buildings, road transport and small industry not covered by the existing EU ETS.

For the EU-ETS to operate effectively, it must be underpinned by robust, transparent, consistent and accurate mechanisms for monitoring and reporting of the greenhouse gas emissions of the installations and operations covered by the EU-ETS. While the legal basis for the EU-ETS follows from Directive (EU) 2023/959, the accounting principles are elaborated in the Commission Implementing Regulation (EU) 2024/2493 on the monitoring and reporting of greenhouse gas emissions (also known as the Monitoring and Reporting Regulation or MRR) and several Guidance Documents[19].

This Monitoring and Reporting Regulation stipulates that the monitoring and reporting shall cover all process emissions and combustion emissions from all emission sources. The combustion emissions shall be calculated by multiplying the activity data (expressed as TJ) by the combustion fuel's specific emission factor (expressed as t CO_2/TJ).

The Monitoring and Reporting Regulation further specifies the carbon emission factors for various solid, liquid and gaseous fuels.

- **For natural gas**, the Monitoring and Reporting Regulation sets the emission factors at 56,1 t CO_2/TJ (net calorific value), in line with the IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
- (Gaseous) **biofuels, synthetic low-carbon fuels, renewable fuels of non-biological origin (RFNBO) or recycled carbon fuels (RCF)** are 'zero-rated' (Monitoring and Reporting Regulation 2024/2493, Art 3(23c) and (23d)).
- **For mixed fuels**, the operator of an installation, included in the scope of the EU ETS, may determine the biomass fraction and identical zero-rated biomass fraction of biogas using purchase records of biogas of equivalent energy content (Monitoring and Reporting Regulation 2024/2493, Art 39(4)).
    - Through a Disclosure of a Guarantee of Origin, operators must provide evidence that there is no double counting of the same biogas quantity, in particular that the biogas purchased is not claimed to be used by anyone else.
    - Operators must provide evidence that a purchase of a quantity of biogas is connected to the cancellation of the respective quantity in the Union Database or in a national database.

From this follows that gases, registered in the UDB, do entitle for the EU-ETS requirements, provided that double counting is avoided. The Disclosure framework and by consequence the Residual Mix calculation hence must take both tracking instruments into account: the GO-system and the Union Database. To avoid double counting, data must be provided on the quantities of gas tracked through the UDB that are accompanied by GOs.

[19] See: Monitoring, reporting and verification of EU ETS emissions - European Commission (europa.eu)

3.4 Conditions for a practical Residual Mix calculation

A Residual Mix calculation needs clarity about the **system boundary** within which it is applicable. This report will consider the question of whether a separate Residual Mix per type of gas and per system boundary is required: should system boundaries be per type of gas, for gas networks, hydrogen networks and gases transported by vehicle? This question is not explicitly answered in EU legislation and a harmonised response is recommended to establish a credible framework for origin Disclosure that is trusted by energy consumers.

Numerical data availability regarding the production of gases, per energy source category, and consumption, per end-use sector, is a challenge, especially for certain types of gases and dissemination outside pipeline networks. Data sources need to be improved, and their definitions need to be aligned in order to come to a consistent Residual Mix for all dissemination system boundaries.

The **timely availability of data** is another main challenge. If the origin of consumed gases wants to be provided to consumers in a way that supports them in their supplier choices, the Residual Mix and their supplier's energy mix need to be available not too long after the period of energy supply. Preferably, like with electricity, the supplier mix is available by 1 July of the year following the year of supply, which requires the Residual Mix to be available by 1 June of that year, and the numerical data inputs to be collected in March and April, so that Residual Mix calculations can take place and be consulted and confirmed in May.

Responsibilities for legislators and implementors related to energy origin tracking are mapped, as is touched upon the responsibilities of EU Member States, particularly upon the interaction with a centralised tracking tool for policy target accounting like the **Union Database for Sustainable Biofuels**.

Member States are obliged to annually publish the Residual Mix, including expired GOs, and follow its definition that Residual Energy Mix is "the total annual energy mix of a Member State, excluding the share covered by cancelled GOs". Observing diverging existing practices and strong views in the market, careful consideration is needed on how to implement the legal requirements for the calculation of the 'Residual Energy Mix' in REDIII.

3.5 Summary of conditions for a reliable Residual Mix

In summary, the basic conditions for a reliable Residual Mix are:

- accurate and timely data collection,
- harmonised tracking systems,
- legislation that protects against double claims,
- standardised RM calculation methodologies,
- well-defined system boundaries.

The next chapter (Chapter 4) will elaborate on the calculation methodology for the RM, taking into consideration initial stakeholder views.

4 CALCULATING THE RESIDUAL MIX – DESIGN ASPECTS

4.1 Approach

As elaborated in Chapter 0 and in FaStGO T4.2[20], a Residual Mix can only add value where there is a reliable Disclosure framework in place: it needs legislation to protect the uniqueness of the instrument that is allowed to be used for making claims on the origin of consumed/supplied energy. Assuming this is in place, the calculation formula for the Residual Mix can be constructed.

In developing a methodology to calculate Residual Mix for gases, inspiration can be found in the existing calculation method for a Residual Mix for electricity, as in ANNEX IX. However, adjustments to the specific characteristics of the gas sector are necessary. This chapter sets out the main design aspects for the Residual Mix calculation and brings them together into a general formula. Subsequently it considers how to fill in the terms of the formula.

This approach has been subject to an open stakeholder consultation from mid-July to mid-September 2024. The input gathered from the stakeholder consultation is summarised in Annex I.2 and the feedback has been duly processed in this final REGADISS report.

4.2 System boundaries

Before establishing the formula, the challenge is to consistently determine the perimeter of Disclosure of the energy sources.

This needs acknowledgement of the system boundaries of the area where the environmental characteristics can be claimed. Within each system boundary where environmental characteristics of consumed/supplied gas can be disclosed to gas consumers, a separate RM needs to be calculated.

This section considers three main dimensions for defining the system boundaries. After addressing the geographical and geopolitical dimensions, all jurisdictions must then apply the same criteria for defining system boundaries in terms of considered Energy Carriers and dissemination level. That is essential for determining the European Attribute Mix (EAM), as set out in Section 5 Residual Mix Calculation method in a consistent manner that prevents double counting across different countries.

4.2.1 Geographical/Geopolitical Demarcations

Geographical demarcations serve as a critical system boundary within the EU when calculating Residual Mixes for gases. The borders of a country or region indicate the zone where specific regulations and data collection mechanisms apply. As such, characteristics of a hydrogen and natural gas system need to be considered at the country level, as well as the relevant interactions per system of the production facilities, consumption patterns, and gas storage facilities. The borders of a country or a region, hence set out the scope of analysis for

[20] FaStGO Deliverable 4.2 may be consulted at https://www.aib-net.org/news-events/aib-projects-and-consultations/fastgo/project-deliverables.

calculating Residual Mixes, enabling tracking of the sources and types of gases produced, transferred and consumed within that jurisdiction.

As such, the first dimension this reports considers as system boundary, is a state.

4.2.2 Energy Carriers/Types of Gas

Beyond the location of consumption, we need to consider the composition of gases consumed in individual states. The physical composition of a gas affects its potential uses and influences, which GOs a consumer would expect to be cancelled accordingly. Depending on the distribution channel, consumers count on a specific composition of the gas they acquire.

The way Energy Carriers and/or types of gas are defined in the applicable standards for Guarantees of Origin, here provides guidance. EECS® Fact Sheet 22 Type of Gas[21] holds a categorisation of gases that can be used here. The same categorisation of gases is included in the current draft of the EN16325 GO Standard, under the term Energy Carrier. It comes down to the following categories of gases:

- Methane,
- Ethane,
- Propane,
- Butane,
- Dimethyl Ether,
- Hydrogen,
- Ammonia,
- Unspecified Gas.

There is not a legal basis for collecting the relevant data needed for a Residual Mix calculation for all types of gas. Such sector-overviewing data collection is only in sight for two of the above categories, namely methane and hydrogen. The gas composition is hardly ever occurring in a 100% purity of a single molecule. Therefore, the type of gas won't be considered a system boundary, where it is influenced by the way the gases are disseminated. This is elaborated in Section 4.2.3 Dissemination level – Network characteristics below.

4.2.3 Dissemination level – Network characteristics

As mentioned above, regulations provide protection of data integrity. Jurisdictions rather regulate certain distribution channels than composition aspects.

Setting a system boundary in accordance with harmonised concepts across the whole EU/EEA, has therefore the highest chance of coming to a practicable calculation method for the RM.

This needs a dive into the legislative aspects that help clarifying the system boundaries.

The recast of the Renewable Energy Directive (2023/2413) states in Article 19.8:

(…) When a customer consumes gas from a hydrogen or natural gas network, including gaseous renewable fuels of non-biological origin and biomethane, as demonstrated in the commercial offer by the supplier, Member States shall ensure that the guarantees of origin that are cancelled correspond to ***the relevant network characteristics****.*

[21] See: https://www.aib-net.org/eecs/fact-sheets

This provides a reference to consider the Natural Gas Network and the Hydrogen Network as system boundaries. However, the concept of a "natural gas network" is not defined. A proposition suggests equating it with the Natural Gas System as defined in Art. 2 of the recast Gas Directive

(3) 'natural gas system' means a system of infrastructure, including pipelines, liquefied natural gas (LNG) terminals and natural gas storage facilities, which transports natural gas;

(4) 'hydrogen system' means a system of infrastructure, including hydrogen networks, hydrogen storage and hydrogen terminals, which contains hydrogen of a high grade of purity;

(17) 'transmission' means the transport of natural gas through a network, which mainly contains high-pressure pipelines, other than an upstream pipeline network and other than the part of high-pressure pipelines primarily used in the context of local distribution of natural gas, with a view to its delivery to customers, excluding supply;

(19) 'distribution' means the transport of natural gas through local or regional pipeline networks with a view to its delivery to customers, excluding supply;

(21) 'hydrogen network' means a network of onshore and offshore pipelines used for the transport of hydrogen of a high grade of purity with a view to its delivery to customers, excluding supply;

(23) 'hydrogen transmission network' means a network of pipelines for the transport of hydrogen of a high grade of purity, in particular a network which includes hydrogen interconnectors or which is directly connected to hydrogen storage, hydrogen terminals or two or more hydrogen interconnectors or which primarily serves the purpose of transporting hydrogen to other hydrogen networks, hydrogen storage or hydrogen terminals, without excluding the possibility of such networks to serve the purpose of supplying directly connected customers;

(24) 'hydrogen distribution network' means a network of pipelines for the local or regional transport of hydrogen of a high grade of purity, which primarily serves the purpose of supplying directly connected customers and does not include hydrogen interconnectors, and which is not directly connected to hydrogen storage facilities or hydrogen terminals, unless the network in question was a natural gas distribution system on … [date of entry into force of this Directive] and has been partially or fully repurposed for the transport of hydrogen, or to two or more hydrogen interconnectors;

The Draft CEN EN16325 standard on GOs defines a data field on the GO called "Dissemination Level", and a list of parameter values for this data field.

Excerpt from the May 2024 draft of the EN16325 standard:

Annex E
(normative)

Dissemination level of the physical energy for which the GO is issued

The parameter value for the Attribute on the GO that indicates the dissemination level of the produced physical energy for which the GO is issued, as in 4.5.2.2 q), is one of the following:

1) Consumed by the operator of the production device [this applies for Electricity, Gas and Heating and Cooling];
2) Disseminated over a Distribution or Transmission System:
   a) for Electricity;
   b) for Natural Gas;
   c) for Hydrogen;
3) Disseminated over a Closed Distribution System:
   a) for Electricity;
   b) for Natural Gas;
   c) for Hydrogen;
4) Disseminated over any other network than a Distribution or Transmission System or Closed Distribution System:
   a) for Electricity;
   b) for Natural Gas;
   c) for Hydrogen;
   d) another Gas system;
5) Disseminated over a heating or cooling Grid [this applies for Heating and Cooling];
6) Disseminated by vehicle [this applies for Gas and Heating and Cooling];
7) Dissemination unspecified – not consumed by the operator of the Production Device [this applies for Gas].

An advantage of adopting these parameter values for the data field Dissemination Level, is that this update can help Member States to fulfil their obligation from REDIII, art. 19.8, which lays down that Member States shall ensure that cancelled gas GOs correspond to “the relevant network characteristics”. This further enables to clarify the system boundary.

Note: The type of gaseous Energy Carrier that flows through the natural gas systems, is defined as follows:

Art. 2 of the recast Gas Directive

‘natural gas’ means gas that primarily consists of methane, including biomethane, or other types of gas, that can technically and safely be injected into, and transported through, the natural gas system;

Since the term “natural gas” includes both fossil and renewable sources, it is important to use this term without assumption of the energy source.

4.2.4 Mass balancing system

According to art. 9 of the recast Gas Directive

§1 Renewable gas shall be certified in accordance with Articles 29, 29a and 30 of Directive (EU) 2018/2001. Low-carbon fuels shall be certified in accordance with this Article.

§2 In order to ensure that the greenhouse gas emissions savings from the use of low-carbon fuels are at least 70 %, Member States shall require economic operators to show that that threshold and the requirements established in the methodology referred to in paragraph 5 of this Article have been complied with. For those purposes, they shall ***require economic***

operators to use a mass balance system *in line with Article 30(1) and (2) of Directive (EU) 2018/2001.*

In cases where gas GO usage is limited to a specific mass balancing system, the Residual Mix calculation could be confined to that same system. This restriction ensures that the Residual Mix accurately reflects the energy attributes of the gases consumed within the defined system boundaries of the mass balancing system.

Particularly, over time, in regions where hydrogen networks are geographically confined, such as industrial clusters or specific urban areas, separate mass-balancing systems may be established to track hydrogen production, distribution, and consumption. This would imply that the environmental attributes of hydrogen are accurately accounted for within defined boundaries.

Currently, in practice this restriction of GO usage per mass balancing system, is not installed in the GO system rules. It may be applied on a voluntary basis but is not protected in EU legislation. Therefore, a separate RM per mass-balance system today cannot be applied consistently in the existing legal framework.

4.2.5 Combining and simplifying system boundaries

There are three potential options for defining system boundaries for the Disclosure system within which a Residual Mix can be calculated for gases.

1. A single-system boundary for all gases
   - In this option, both the hydrogen network and the natural gas system are considered within a single system boundary. This means that the Residual Mix calculation encompasses both hydrogen and natural gas without any distinction between the two.
   - Note that the report of FaStGO task 4.2 highlighted inconsistencies associated with utilising a single Residual Mix for natural gas and hydrogen. These inconsistencies include the ability to claim renewable hydrogen's environmental attributes without its injection into the gas network, potentially inflating consumption figures. Furthermore, it allows gas suppliers to claim tracked renewable energy without physically introducing it into the gas supply system, undermining efforts to reduce GHG emissions.
   - Additionally, cross-usage of GOs between different gaseous Energy Carriers complicates carbon footprint calculations along the value chain due to differing hydrogen and methane carbon footprints. Such an approach can cause confusion and lack of trust. This hinders market acceptance, necessitating exploration of alternative options.
2. Two separate boundaries for natural gas and hydrogen, further subcategorizing per dissemination level, as set out above in Section 4.2.3 Dissemination level – Network characteristics.
   - With this option, the Residual Mix calculation involves two distinct system boundaries—one for the natural gas system and another for the hydrogen network. Each system boundary is treated separately, allowing for independent calculations and analysis of the Residual Mix for natural gas and hydrogen.
   - According to RED article 19.8, GO cancellations are constrained to the relevant network characteristics, which may help mitigate challenges associated with the cross-usage of GOs.
3. System Boundaries per Mass-Balancing System (Gas and Distinct Geographically Confined H_2 Networks)

- This option involves defining system boundaries based on mass-balancing systems, which may vary for gas and distinct geographically confined hydrogen networks. The Residual Mix calculation would consider the mass-balancing systems separately for natural gas and hydrogen, accounting for any geographical confinement of hydrogen networks.

It is essential to ensure that the Residual Mix system boundaries coincide with the actual Disclosure system boundaries. This means that the width of the area where Guarantees of Origin are allowed to be claimed must correspond to the width of the system boundaries for which a dedicated Residual Mix is calculated.

Option 1 is disregarded as it doesn't consider the different use cases for specific gas compositions.

Option 3 does not work as GOs are allowed to be used outside the mass balancing system, and the Residual Mix has to compensate the fuel mix for the area where GOs are used.

Therefore, option 2 deserves further elaboration for setting the system boundary in which the RM is calculated. Considering the Dissemination Level distinguishes the natural gas system and the hydrogen system in categories of "own consumption", pipeline distribution, and vehicle transport. The category pipeline distribution could be kept as a whole. Alternatively, it can be distinguished further between private networks and networks that comply with the Gas and Hydrogen Directive's definition of "Distribution and Transmission System" and "Closed Distribution Systems".

4.2.6 Realistic and pragmatic system boundary selection for the RM calculation in practice: the natural gas transmission and distribution system

At present, both for natural gas and hydrogen there are, or will be foreseen, transparent and reliable data collection mechanisms, where these gases circulate in regulated systems.

Therefore, this report will focus on a RM calculation for Natural Gas and Hydrogen within the system boundary of the corresponding Natural Gas Distribution and Transmission System and Hydrogen Distribution and Transmission System. Where free choice of supplier applies, Closed Distribution Systems can be further included in those system boundaries.

A Residual Mix calculation can be developed for other dissemination levels and other Energy Carriers once centrally collected data becomes available.

For short-term RM calculations, it is acknowledged that the hydrogen network is primarily in the preparation phase. One of the challenges faced when considering the inclusion of the hydrogen network within the system boundaries is data scarcity. This lack of data poses a significant hurdle in performing any RM calculations for the system boundary of the hydrogen. On top of this, the general policy strategies seem not to enhance the usage of hydrogen for household consumers, being the audience for whom a Residual Mix is most relevant.

Therefore, it is proposed to set up RM calculations for the Natural Gas Distribution and Transmission System at this stage. This approach is practical and relevant given the constraints explained before. However, the potential of the hydrogen network and its role in the future is also recognised.

4.2.7 Consistent use of gross production and on-site consumption

The distinction between gross and net production should be consistently applied through the Residual Mix calculation formula and the available data sources. If a jurisdiction chooses to

utilize gross production, it is necessary to adjust the volumes to account for on-site consumption.

This approach should be applied consistently for all terms in the Residual Mix calculation formula, and it should not only be applied consistently across the jurisdiction's territory but also across the different tracking instruments considered, see 4.4 below. In this case, production statistics reporting should encompass both gross production and on-site consumption (not only network-injection).

4.3 Which Energy Sources to disclose to consumers?

The energy sources to display in the Residual Mix, should align with the energy sources that suppliers disclose to consumers in their fuel mix on their bills.

The primary source of energy production is the core relevant information for Disclosure, and hence for the Residual Mix. Categorising energy sources in a fuel mix hence should be oriented to be of maximal value in relation with the interest of consumers. On the one hand, sufficient detail should be provided to a consumer to satisfy their hunger for information, on the other hand, an overload of detail may diffuse the consumer's understanding. The categorisation of energy sources that are provided to a consumer should maximally empower the consumer in his purchasing choices and, when applicable, in how he wants to impact the mix of the sources of the energy he consumes.

Legislation offers a starting point. The Gas Directive Annex 1§5 requires Disclosure of renewable and low carbon gases. This invites a look at the legislative definitions of renewable gas, energy from renewable sources and low-carbon gas.

Term	Definition	Legislation
Energy from renewable sources or renewable energy	energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas	Renewable Energy Directive (2018/2001)[22]
Renewable gas	means biogas as defined in Article 2, point (28), of Directive (EU) 2018/2001including biogas that has been upgraded to biomethane, and renewable fuels of non-biological origin as defined in Article 2, point (36), of that Directive	Gas Market Directive (EU) 2024/1788
Low-carbon gas	means the part of gaseous fuels in recycled carbon fuels as defined in Article 2, point (35), of Directive (EU) 2018/2001, low-carbon hydrogen and synthetic gaseous fuels the energy content of which is derived from low-carbon hydrogen, that meet the greenhouse gas emission reduction threshold of 70 % compared to the fossil fuel comparator for renewable fuels of non-	Gas Market Directive (EU) 2024/1788

[22] http://data.europa.eu/eli/dir/2018/2001/oj

biological origin set out in the methodology adopted pursuant to Article 29a(3) of Directive (EU) 2018/2001;

At high level, energy sources for gas production can be categorised into renewable, fossil, and nuclear energy. For clarity, the categories of energy sources shall be mutually exclusive. Using the definition of renewable energy and responses from the survey (see Annex I.1) the renewable categories can be further divided into multiple subcategories such as biomass including biogas, solar, wind, hydropower, and other renewables. The fossil source category can also be divided into low-carbon and other fossil sources. Lastly, there may be little interest for the further subdividing the category of nuclear energy into more detailed subcategories, see Table 2.

The energy categories can be further elaborated by integrating compliance with the criteria of Advanced Biofuels, as elaborated in Annex IX of the Renewable Energy Directive which focuses on the production of biogas for transport and advanced biofuels. This addition would enable consumers to make more informed decisions on the environmental impact of the purchased gas. Yet, consumers might require a further subcategorization for a more granular carbon accounting. For instance, 'natural gas imported via pipeline' and 'natural gas imported as LNG' could be subcategories of fossil natural gas.

Table 2: Energy Sources to be considered in a Residual Mix for gases.

	Energy Source
Renewable	- Biomass including biogas - Solar - Wind - Hydropower - Other renewables
Fossil	- Low carbon - Other fossil
Nuclear	- Nuclear

A significant challenge in implementing a comprehensive categorisation of energy sources is the availability of data. While the concept is categorising energy sources into renewable, fossil, nuclear, and further subcategories is straightforward in theory, obtaining accurate and up-to-date data for each subcategory of energy sources can be quite challenging in practice.

Where data is available, and when moving into emission calculations for the RM, further subcategorizations can be made, similar to the categorisation of energy sources in the RM calculation for electricity.

4.4 The instrument for renewable gas consumption claims

4.4.1 Untracked commercial offers

Art. 19 of the RED indicates that the Residual Mix is for non-tracked commercial offers (19.8), that Member States must publish the Residual Mix (19.4) and that, in doing so, they must include expired GOs in the Residual Mix (19.3). As the Residual Mix is for untracked commercial offers, following RED art.19.8, clarity is needed on the quantity of gas consumption for which a claim on the energy source already exists.

It needs a clear and harmonised understanding of the definition of the Residual Mix, which is given by RED art. 2.

Residual Mix =

"residual energy mix" means the total annual energy mix for a Member State, excluding the share covered by cancelled Guarantees of Origin

- Member States shall **publish the Residual Mix annually**
- **Expired GOs must be in Residual Mix**
- Residual Mix = **for untracked commercial offers**

(Source: REDIII art. 2 & 19)

Figure 7: Defining provisions on the Residual Mix in the Renewable Energy Directive.

The definition of the Residual Mix constitutes of two terms that are deducted from each other: 1) "the total annual energy mix for a Member State" and 2) "the share covered by cancelled GOs". For understanding this definition of the Residual Mix two options are elaborated.

4.4.2 Option 1) Only GOs qualify for reliable Disclosure

The definition of the Residual Mix in RED art.2 only excludes cancelled GOs from the annual energy mix for a Member State. This logic builds on the fact that the GO system has intrinsic double counting prevention measures in its design, protected by legislation.

This raises the question whether the **definition of the Residual Mix leaves room for PoS based claims if they are not backed by GOs**.

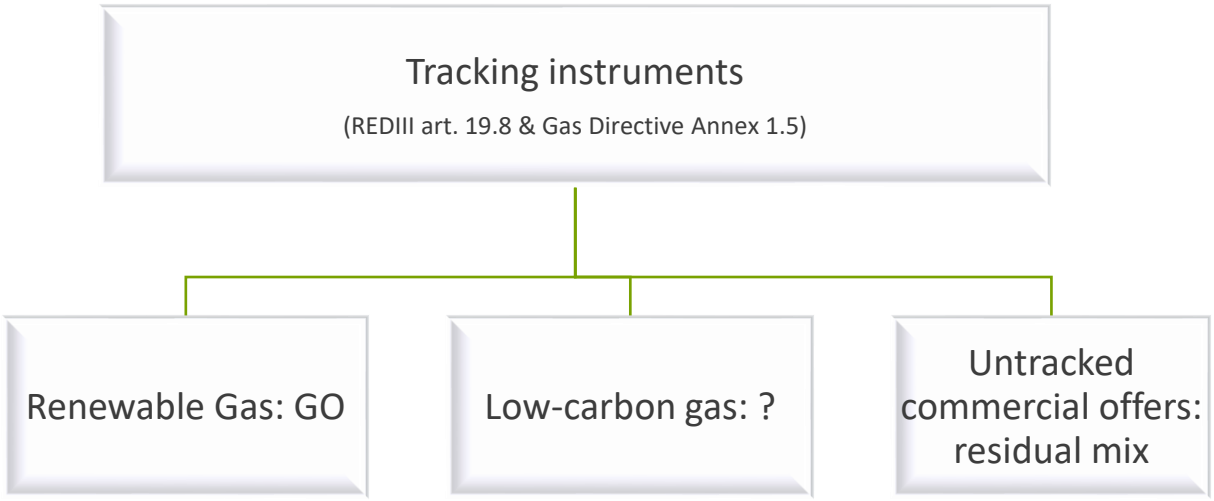

Figure 8: Disclosure instruments for gas suppliers.

If the annual energy mix for a Member State is understood as the production mix, and if, in the Residual Mix, only GOs are deducted from the national production mix, there needs to be national legislation to prevent double counting. Indeed, if other tracking instruments than GOs

were used as the basis for claiming renewable or low-carbon energy consumption, the attributes associated with them would be counted twice—once with the tracking instrument and again when incorporated into the Residual Mix.

The approach of disclosing renewable gases only when backed by cancelled GOs, includes the scenario where the GOs are transferred to the UDB. Yet, it has to be acknowledged that at the time of writing this report, there is an existing market with a habit of trading renewable gas Attributes also outside the official GO system. Whether this will continue to exist, will depend on Member States' implementation of the RED, CSRD and upcoming Green Claims Directive.

Option 1 is applicable in countries where national legislation only allows GOs for claims of renewable gas consumption, regardless of the actor of the claim.

4.4.3 Option 2) also UDB PoS without GO qualifies for consumption claims for renewable gas

4.4.3.1 Total annual energy mix for a Member State

In the definition of the RM, a closer look can be given to the "annual energy mix for a Member State".

The Union Database tracks Proofs of Sustainability for the purpose of accounting compliance towards policy targets. There may be PoS registered in the UDB, for which no GOs are issued. Unless national legislation foresees otherwise, it may be hard to change habits in a market that historically trades documentation based on PoS and making renewable gas consumption claims based on it. Whereas the European GO system has intrinsic double counting measures in its design criteria, alternative double counting prevention measures would need to be in place for documentation-based tracking. The Union Database for sustainable biofuels aims to provide such a measure.

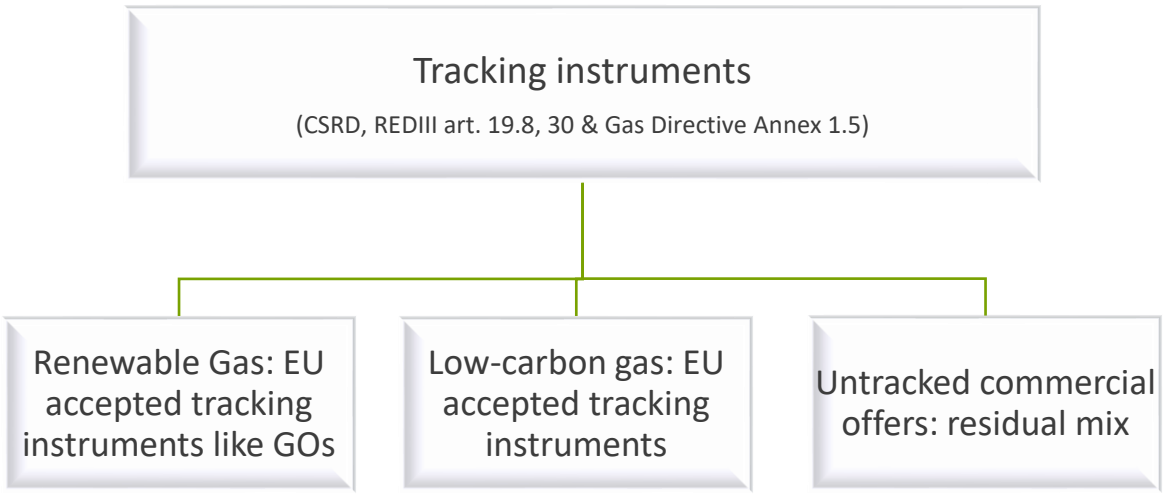

Figure 9: Gas Disclosure instruments for actors, other than suppliers.

While gas suppliers will be obliged to cancel gas GOs for their supply of renewable gases, corporates may declare consumption of renewable gases based on registered consumption of renewable gases in the Union Database. Ideally, these are also backed by Guarantees of Origin, for consistency, yet where this is not the case, still it must be prevented that the Residual Mix would count the same environmental attributes more than once.

The term “total annual energy mix for a Member State” in the definition of the residual energy mix then cannot be seen as only the energy sources of the national production mix, but also, accounts the energy sources of imports and exports that are tracked with mass balancing systems on condition that double counting measures are in place.

4.4.3.2 Condition for other than GO-based claims: Mass balancing complemented with double counting prevention measures

Where national legislation would allow to make claims on consumption of renewable gas, based on other tracking instruments/methods than GOs, this option needs clear consideration in the Residual Mix calculation methodology. Given Annex 1.5 of the recast Gas Directive, this option could only exist where national legislation allows so, and only for other parties than gas suppliers. Where national databases and/or the Union Database for sustainable biofuels aim to ensure the prevention of double counting, this can work. Attention needs to be given to certain aspects, to ensure consistency to the market, as elaborated here below.

4.4.3.3 Attention points to overcome hurdles for a reliable residual mix calculation

Where Member States would allow other instruments than GOs for renewable gas consumption claims, there are some work areas for the further refining of the interaction between multiple tracking systems.

Following questions are relevant to shape a complete picture of this option:

1. **Import from outside EU**: If PoS without GO can be used for Disclosure, does the same apply to gases imported from outside EU?
    - Would import of PoS entitle for renewable gas consumption claims? Would it be conditional to existence of legislation that forbids that these renewable attributes could still be claimed in the originating country? E.g. ensuring that the renewable electricity with which hydrogen is produced, is not claimed already elsewhere?
    - While import from Swiss and UK biomethane GOs is currently not allowed under RED art. 19, would import of their PoS entitle for a renewable gas consumption claim, when tracked in the UDB?
2. **Expiry**: PoS do not expire, while GOs have a maximum lifetime of 18 months (or less, depending on the country of usage).
    - Where a GO expired, for the gas that is still covered by a PoS in the UDB, if it is allowed to use PoS, it needs prevention of double counting with the Residual Mix.
        - Either the PoS shouldn’t entitle for a renewable gas consumption claim, or
        - the expired GOs should not be added to the Residual Mix.

      The latter would go against RED art.19.
    - Where a producer chooses not to apply for GOs, would the buyer of his gas benefit from exemption of expiry date to which the GO is subject? Can PoS based consumption claims of renewable gas be seen as legally allowed circumventions of the GO expiry rule? If so, then why have a GO expiry rule? (or: would then the PoS get an expiry date?)
    - If claims are allowed based on tracking instruments that don’t expire, there is an additional challenge in the RM calculation timeline. A workaround is needed for a meaningful Residual Mix calculation. Examples of workaround suggestions:
        - Collect data based on the transaction date of the cancellations, leaving the yet-uncancelled PoS to count for next year’s RM, assuming the inaccuracy will balance itself out over the years, or

- An ultimate PoS cancellation date for consumption year Y-1.

3. The **energy quantities**, covered by **GOs and PoS might differ**:
   - Auxiliary energy consumption does not qualify for GO issuance, whereas a PoS for the same energy production may entail more energy (nett versus gross energy production).
   - Mismatches may occur when calculating gas production based on Lower Heating Value versus Higher Heating Value.
   - PoS account for emissions related to transport losses and for aggregation phase changes, while for GOs it is optional to cancel GOs for related losses.
   - When considering virtual liquefaction: where does the single-mass balancing system for PoS end?
4. **Subsidised gases**:
   - Where a MS decides not to facilitate issuance of gas GOs for subsidised gases, it may have its own allocation system for declaring the renewable attributes of the relevant gases. Would the UDB features include a mechanism to check that this is the case? Would it display that the PoS doesn't entitle for a renewable gas claim where the originating MS has already allocated the renewable attributes? (e.g. Germany allocates them to the consumers who pay for the tax that pays for the subsidy, for electricity)
   - Where a MS decides to issue GOs for subsidised gases but not provide these GOs to the producer and auction the GOs (in order to recover part of the subsidy cost): the renewable attributes circulate with the GO in the market without the control of the producer. Would the UDB feature a mechanism for to check if auctioned GOs were issued with a PoS that is in the UDB? Or would it be forbidden to auction GOs (and lose control over the party owning it) if PoS are registered in the UDB?
5. Will there be a different right to claim the renewable attributes related to PoS in the UDB, where a producer chooses not to apply for GOs, then in the situation where the MS decides not to issue GOs for subsidised gases and has its own allocation system? Given the risk for double claims in the latter situation, would the UDB provide a display indicating that in this situation, renewable gas consumption claims are not allowed?
6. General: will all PoS without GO in the UDB entitle for renewable gas consumption claim or only those that cannot yet already be claimed elsewhere?

Finally, the question remains if a producer would make the effort of applying for GOs. If the GO and PoS issuance process are not integrated, this comes with separate workload for applying for it. Especially if non-GO based claims are coming with less restrictions, the producer might not see the benefit of applying for GOs. The standardisation of gas GOs in EN16325 has been under intense discussion over the past 5 years, which aims to protect the integrity of renewable gas consumption claims. Can the integrity be protected if the GO rules are circumvented?

4.4.3.4 Conditions for preventing double counting with other reliable tracking systems than GOs

If consumption claims on renewable and low-carbon gases would legitimately be made based on other instruments than GOs, then, in order to prevent double claims of the same renewable & low-carbon Attributes:

1. These other Tracking Instruments should be following the physical flows of gases. This follows from the definition of the Residual Mix in Art. 19.2 13) of RED: "'Residual Energy Mix' means the total annual energy mix for a Member State, excluding the share covered by cancelled Guarantees of Origin". Indeed, only the share covered by

cancelled GOs is excluded from the total annual energy mix of a Member State. Therefore, the energy covered by other tracking systems than GOs must be included in the “total annual energy mix” of a Member State; and

2. There should be double counting prevention measures for that “other reliable tracking instrument”, in all stages of its existence, ensuring uniqueness at issuance, transfer, cancellation, usage, including erroneous duplication prevention, and there should be rules that explicitly forbid claims being made outside the legitimate tracking systems;
3. The Disclosure supervisory authority of the Member State should have insight in the data on these instruments, for which energy production they are issued, where they are used, and whether this is in line with the Disclosure rules for the country of consumption;
4. If such instrument were to be PoS that are registered in the UDB, then in addition to the gas supplier, the national Disclosure supervisor and both the national and international party who calculate the Residual Mix would also need to know which PoS entitles for the Disclosure towards the respective consumer. Access to these parties to the relevant data inside the UDB can overcome this.
5. Data collection mechanisms should be in place at national and central level for the whole calculation area of the Residual Mix.

5 RESIDUAL MIX CALCULATION METHOD

5.1 Aim of the Residual Mix: determine attributes to disclose Untracked Consumption

This chapter sets up a formula with the aim of calculating the energy source mix with which to disclose the Untracked Consumption. This is the overall aim of the Residual Mix calculation: to determine how to disclose any energy for which no tracking instruments have been used, and to specify the fuel/source mix that gas suppliers shall mention on their bills.

The Residual Mix must be understood as being complementary to the tracking instruments; anything that is not covered by reliable tracking instruments, should be accounted for in the Residual Mix. This also requires that, across the Residual Mix calculation area the sum of energy represented by available tracking instruments and the volume covered with the Residual Mix, equals the total volume of physical gas flows.

5.2 Detailed calculation – general formula

Figure 10 and Figure 11 illustrate the proposed calculation methodology for the Residual Mix for gases.

Each term in the formula, considers two aspects in parallel, namely:

1) absolute quantity of energy, and
2) the distribution of energy sources over that energy quantity, also indicated as 'attributes'.

The only exception are the untracked quantities: they only consider the energy quantity as a placeholder, to be filled in with attributes in a later step in the calculation.

The following subsections explain in detail how this formula is established and out of which terms it is composed. Table 3 clarifies some of the frequently used terms in the Residual Mix calculation.

Table 3: Glossary relevant to Residual Mix formula

Term	Meaning
Attribute	Data field specifying the characteristics of an energy unit produced by a Production Device in terms of the input(s) used and/or the details (standing date) of the Production Device and Production Process (an example of an Attribute is "Energy Source", which can for instance be "wind energy" or "biomass") In the Residual Mix formula, *Attribute* mostly refers to information on energy sources and emissions.
Deficit	Refers to *Attribute Deficit*, where the quantity of energy and related Attributes in the Domestic Residual Mix of a country are insufficient to cover all Untracked Consumption in that country. In this case, the missing quantity of energy is taken from the European Attribute Mix (EAM), and the attributes from the EAM are allocated proportionally to the deficit.
EAM, European Attribute Mix	Pool of Attributes from which countries with a Deficit can supplement their Residual Mix

Product Mix	A gas supplier can offer gases with a specific energy source mix to his clients. Where he backs his offering with Tracking Instruments, he can accordingly claim to have supplied gases with an attribute mix as covered by the used Tracking Instruments. Where an offer is not backed with cancellation of GOs or other RTS, the energy source mix of the offer equals the Residual Mix of that country. A supplier may offer different products, each with their own energy source mix
Total Supplier Mix	The mix of energy sources in the total supply over all products of a gas supplier, is generally called the "Total Supplier Mix". Transparency on the Total Supplier Mix is recommended to inform customers, who may use their free choice of supplier to enhance the impact of their purchase in relation to an overall supplier profile
Surplus	Refers to *Attribute Surplus*, where the quantity of energy and related Attributes in the Domestic Residual Mix of a country exceed the Untracked Consumption of that same country. The Surplus is transferred through the European Attribute Mix to countries with a Deficit
Tracking Instrument	Guarantees of Origin (GO) and other Reliable Tracking Systems (RTS)
Used Tracking Instruments	Cancelled GOs and validated other RTS, with the aim of allocating the attributes of those Tracking Instruments to energy consumption
Yield	Production of energy from a specific gaseous energy carrier within a system boundary, whether generated from primary energy sources, or directly yielded as energy source (e.g. fossil natural gas extracted from the earth in that specific country)

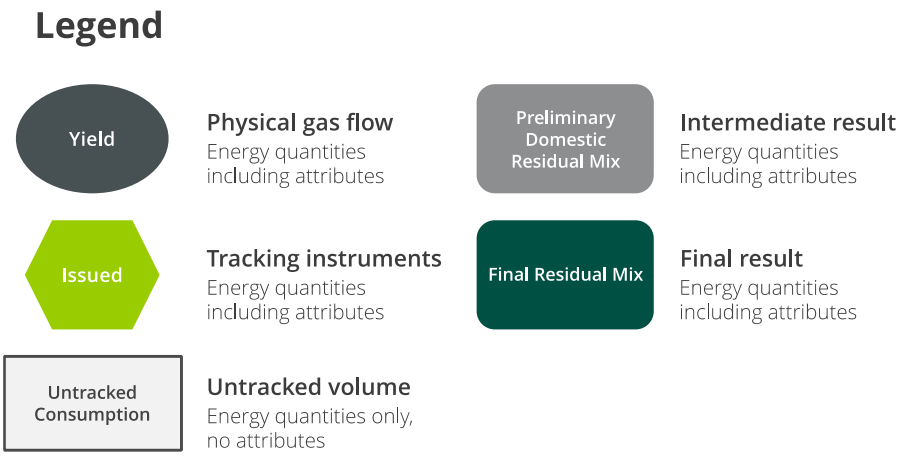

Figure 10: Legend of symbols used in the Residual Mix calculation schematic

As explained in the legend in Figure 10, each volume and each energy source proportion can either be applied to physical gas flows (dark grey ovals), as well as to Tracking Instruments (light green hexagons). Intermediate and final results (rectangles with rounded corners) also consist of an absolute energy quantity and proportions of energy sources in that volume.

The formula also includes untracked volumes, for which the proportions of energy sources are not known or do not matter. They only consider the absolute energy quantity, for instance for the overall volume of energy consumption. These terms are represented as white rectangles with dark grey edges.

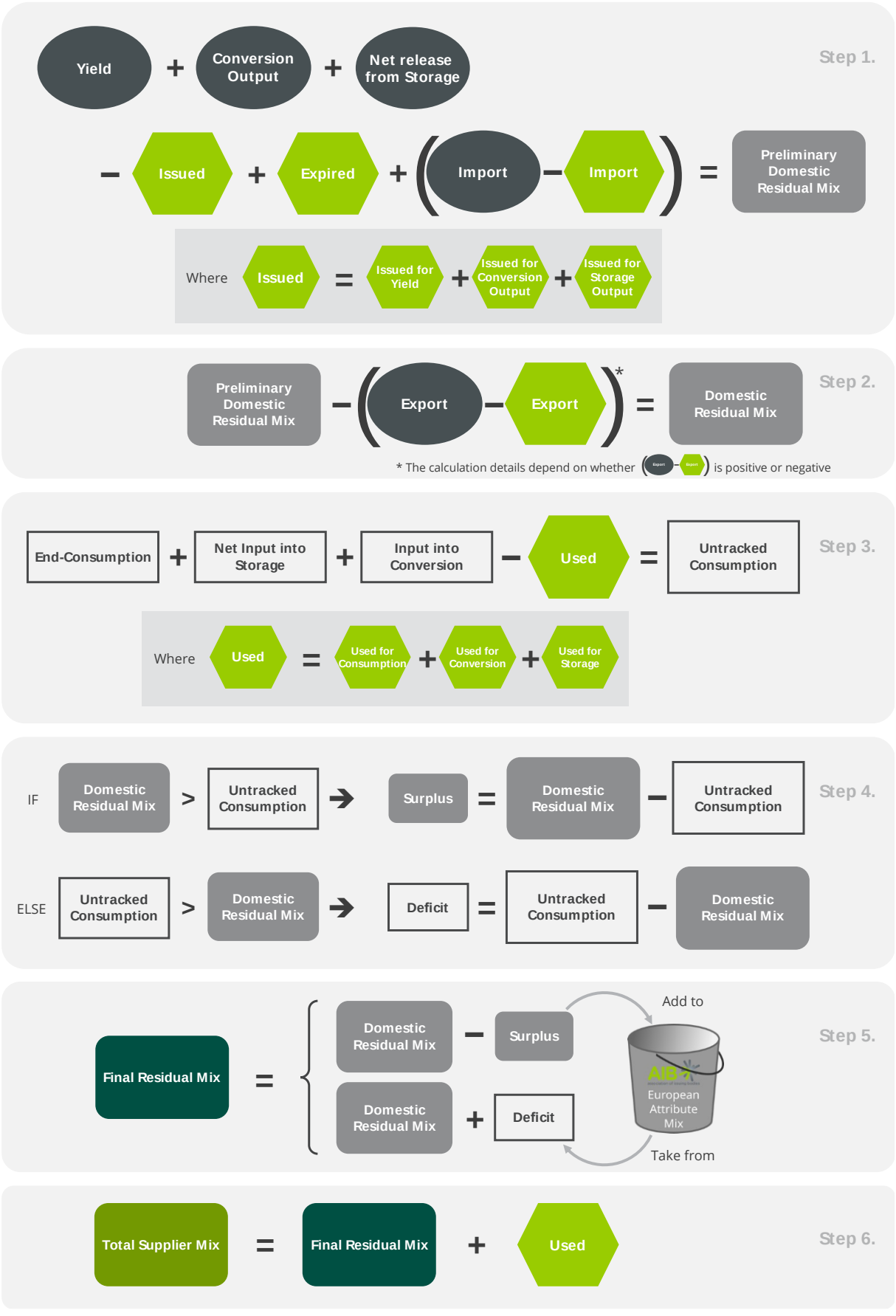

Figure 11: Residual Mix Calculation Methodology – conceptual representation.

5.3 Step 1: Preliminary Domestic Residual Mix: quantifying available attributes within one country

The Residual Mix calculation formula starts by considering the total **available quantity of energy** of **the considered gaseous Energy Carrier**, in a country, and the energy sources from which these originate. This called the Preliminary Domestic Residual Mix, which is determined in a formula as set out in Figure 12 below.

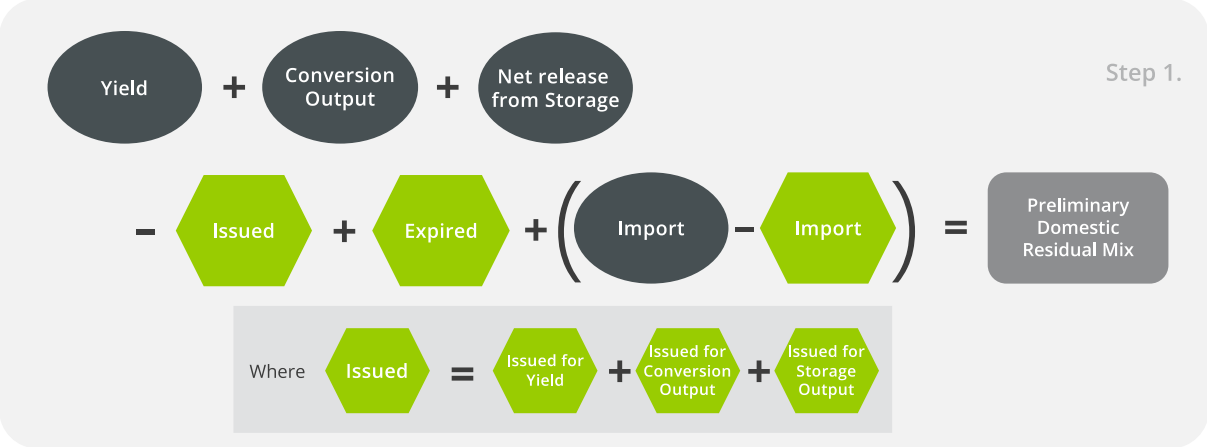

Figure 12: Calculation of the Preliminary Domestic Residual Mix.

5.3.1 Production & yields

The determination of attributes not represented by Tracking instruments, here called the "Preliminary Domestic Residual Mix" starts with a quantification of the gaseous energy that is produced within the system boundary per energy source. In the scope explained below, this looks at the production and other yielding of natural gas (including fossil natural gas and biomethane), or of hydrogen within the country.

5.3.2 Conversion output

Next, the role of Energy Carrier Conversion in the calculation of the Residual Mix is considered. Conversion includes the conversion of one gas type into another (e.g. steam methane reforming of biomethane to produce hydrogen) and the conversion of electricity or heat into a type of gas (e.g. hydrogen production via electrolysis).

In this step of the calculation, only those conversion processes are considered that have as output the energy carrier for which the Residual Mix is being calculated. Conversion processes taking this energy carrier as input are only considered in step 3 of the calculation methodology.

This means that both the output of the considered energy carrier from conversion processes feeding gas into this system boundary, as well as the input of the considered energy carrier into conversion processes towards gas are relevant.

What to include in the term "conversion output"?

The term "Conversion Output" in the Preliminary Domestic Residual Mix only considers the gases that are the output of a so-called "Conversion Issuance" process documented with Tracking Instruments. The latter implies that Tracking Instruments for the conversion input of another energy carrier that were cancelled, and subsequently new Tracking Instruments of the considered energy carrier have been issued. Conversion may also occur without

involving associated Tracking Instruments; in that case, the volume of energy output from these processes is accounted for under the term “Yield”.

5.3.3 Net release from storage

A difference between the gas and electricity sectors is that quantities of stored gas are much higher than those of stored electricity and that gas is often stored for long terms. Furthermore, it serves a strategic purpose, securing the supply of natural gas to the EU economy. A similar trend can be anticipated for hydrogen.

Storage may be accounted for in the Residual Mix calculations in several ways, that vary in calculation complexity.

One option is to explicitly consider the attributes of physical flows flowing into and out of storage devices. This complements the cancellation and re-issuance of Tracking Instruments for storage. However, this also requires that an **inventory of the attributes present in storage** is kept. Additionally, arrangements should be made for **how to allocate attributes to the discharge**, e.g., last-in/first-out, first-in/first-out, free choice by storage operator decides or free choice by market party. This option risks becoming quite complex, even more if different countries would have different approaches. If no such inventory is in place yet, the energy source of the released gas could be considered as ‘unknown’.

Therefore, a **second simpler option is not to consider the attributes of physical flows flowing into and out of storage devices.** The storage balance is then considered **as a term under Untracked Consumption**, see step 3. Net inflow into storage (or storage charging) over one year adds to the consumption; net outflow or release from storage reduces the consumption.

In the REGADISS proposal for the Residual Mix calculation methodology uses the first, detailed option is tested.

5.3.4 Issued Tracking Instruments

Issued Tracking Instruments represent renewable (or other) attributes assigned to specific gas production. Deducting issued Tracking Instruments from available attributes in the overall energy production is the crucial purpose of the Residual Mix calculation; namely, to quantify the untracked quantities of gas available, and to prevent double counting of the renewable and low-carbon attributes from produced gases. Furthermore, deducting these Tracking Instruments from the available physical sources, promotes transparency by accurately reporting the true composition of the Residual Mix.

Tracking instruments?

For ease of reading, this text uses the term Tracking Instruments to refer collectively to **Guarantees of Origin and other Reliable Tracking Systems**, or shortly “GO and other RTS”. Where national legislators allow other mechanisms than Guarantees of Origin to back a claim on the origin of consumed energy, the Residual Mix needs to account for them to prevent double claims. The precondition is of course that the relevant national framework prevents the other tracking systems from duplicating claims that are already made regarding the environmental attributes of that gas. The “R” in “RTS” underlines the assumption that the other Tracking Systems have mechanisms in place to be considered reliable, and to prevent double counting. Non-reliable tracking systems should not entitle for a claim on renewable or low-carbon gas consumption. Section 4.4 Instrument for renewable gas

consumption claims elaborates on the instruments acknowledged for tracking energy sources and other attributes.

Figure 11 subdivides the Issued Tracking Instruments into three categories: issuance for production/yield, storage issuance and conversion issuance. For the first category, GOs or other RTS are issued in the classical sense: a volume of energy carrier is generated from a well-defined source, and a corresponding number of Tracking Instruments is issued to the owner of the production device. In the other two categories, there are additional rules regarding cancellation of Tracking Instruments for the input to a conversion device, and for cancellation of Tracking Instruments for energy as it is being stored. Although the final issuance is no different, the categories help distinguishing different procedures to be followed by the involved parties.

5.3.5 Expired Tracking Instruments

This term considers how to account in the RM for the energy that is covered GOs (or other RTS) which have expired.

Legislation foresees that Guarantees of Origin expire. This implies that they can no longer be used for claiming renewable energy consumption. RED art. 19 also explicitly states that Member States shall include expired GOs in the Residual Mix.

In case other Reliable Tracking Systems are used for Disclosure, and in case there are expiry rules for those systems, the same reasoning can apply.

Expired Tracking Instruments represent renewable attributes that were once valid but have since reached their expiration date. Despite their expiration, they still reflect the renewable attribute of the gas. Excluding them would overlook a portion of the renewable attribute, resulting in an incomplete assessment of the Residual Mix. Expired Tracking Instruments cannot be utilised for further claims in the gas market. By including them in the Domestic Residual Mix, the renewable (or other) attributes are accounted for in the Residual Mix calculation.

5.3.6 Import of physical energy and Tracking Instruments

For electricity, the RM calculation methodology does include imports and exports of electricity from countries outside the calculation area, however, not in step 1 – the determination of the Preliminary Domestic Residual Mix – but in step 2 as a correction of the Preliminary Domestic Residual Mix.

But imports and exports of gases from outside the calculation area (EU) are significantly higher than those of electricity. To illustrate, in 2022, the EU-27 imported 97.6% of the natural gas it consumed, while for electricity imports only account for 0.5%.[23]

While for electricity the values for the Preliminary Domestic Residual Mix (step 1) are much higher than the corrections based on imports/exports (step 2), even for importing countries such as Finland, it is the other way around for natural gas[24].

[23] Source: EU Energy in Figures, Statistical Yearbook 2024
[24] For the time being, there is no import of hydrogen in the EU-27.

Hence, if imports/exports would be included as a correction on the Preliminary Domestic Residual Mix as is currently done for electricity, big numbers would be used to correct small numbers.

That would result in peculiar effects, such as artificial multiplication of Expired Tracking instruments in the resulting Final Residual Mix.

For that reason, the calculation of the Residual Mix for gas considers imports as a term of the Preliminary Domestic Residual Mix calculation (step 1) while gas exports are still considered as a correction of the Preliminary Domestic Residual Mix (step 2).

Including imports in the Residual Mix calculation requires knowledge on the source of the imported energy. However, it is often hard to know the source of imported gases. Even if these are known, reliable disclosure schemes must be in place in the countries the EU imports from to ensure that the renewable attributes can no longer be claimed by a market party in that exporting country once these attributes would be imported into Europe.

Therefore, unless imported gases are accompanied by a Tracking Instrument, the source of imports is assumed to be “unknown”. If a Tracking Instrument is imported along with the physical quantities of gas, the subtraction of the imported Tracking Instruments in Step 1 results in a zero operation: such imports of gas with Tracking Instruments will not influence the Preliminary Domestic Residual Mix. Imported Tracking Instruments from outside the calculation area are most likely associated with imports of renewable or low-carbon gases through the UDB.

5.3.7 Summary: Preliminary Domestic Residual Mix

This leads to the following formula to determine the Preliminary Domestic Residual Mix volume for a respective Energy Carrier, within the system boundary:

$$\begin{aligned}\text{Preliminary Domestic Residual Mix}_{c,s} &= \text{Yield}_{c,s} + \text{Output from Conversion}_{c,s} + \text{Net release from Storage}_{c,s} - \text{Issuance}_{c,s} + \text{Expiry}_{c,s} \\ &+ \left(\text{Imported energy}_{c,s} - \text{Imported Tracking Instruments}_{c,s}\right)\end{aligned}$$

This formula is applied to all countries c and all energy sources s separately.

5.4 Step 2: Crossing borders – correct for exports outside calculation area

The Preliminary Domestic Residual Mix provides an intermediate picture of the untracked attributes in one of the countries within the RM calculation area. However, interaction with countries outside the calculation area is possible, and for gases even substantial.

To obtain the Domestic Residual Mix, the Preliminary Domestic Residual Mix is corrected for export to countries outside the calculation area, both for physical gas and for Tracking Instruments. This is illustrated in Figure 13 and further elaborated in this section.

Figure 13: Calculation of Domestic Residual Mix, accounting for exports of physical gas and Tracking Instruments.

5.4.1 Export of gases with Tracking Instruments

Any gases that are exported along with corresponding Tracking Instruments, will be considered to have the same attributes as the Tracking Instruments. As such, the physical quantity and the Tracking Instruments will cancel each other out, and the Domestic Residual Mix does not change compared to the Preliminary Domestic Residual Mix.

5.4.2 Export of gases without Tracking Instruments

Any export out of the calculation area, unaccompanied by Tracking Instruments, will be assigned the same attribute shares as the Preliminary Domestic Residual Mix. As such, the proportion of sources does not change from the Preliminary to the actual Domestic Residual Mix, but the absolute physical quantity of energy decreases.

This construction, however, exports part of the renewable segment of the Preliminary Domestic Residual Mix (stemming from expired Tracking Instruments for instance). Should these become available for claims in the importing country, attention is needed to overcome the risk of claiming of these renewable attributes by multiple market players in this country. If this country aims to set up a reliable attribute accounting and disclosure scheme, it best makes explicit how and to which consumption it allocates these attributes.

An alternative and safe approach could therefore be to not allocating an energy source to the quantity of exported gas. In order words, assuming that the source of exported energy is "unknown" -, eliminates this risk.

5.4.3 Export of Tracking Instruments without exporting gas / Ex-Domain Cancellations

In the hypothetical case where a country exports more Tracking Instruments to another country outside the calculation area than it exports physical quantities of gas, the question arises as to which energy sources should be considered for the quantity of gas within the exporting country that is no longer represented by Tracking Instruments.

The formula of Step 2 stipulates that in this case a quantity of energy, equal to the quantity of exported Tracking Instruments, is added to the Preliminary Domestic Residual Mix. The question is which attributes should be allocated to that added energy. Surely it should **not** be the attributes on the exported Tracking Instruments. That is because those attributes would be double counted: once in the Residual Mix inside the calculation area, and once towards the consumer for whom the exported Tracking Instruments are cancelled outside the area.

Instead, the energy added to the Preliminary Domestic Residual Mix should be considered as an **import of the Residual Mix from outside the calculation area**, equal and opposite to the exported Tracking Instruments. However, it is safe to assume that there is no Residual Mix outside the calculation area to indicate which energy sources need to be considered for that compensation. Hence, in this hypothetical case of a net export of Tracking Instruments to outside the calculation area, the energy source ‘unknown’ should be considered.

Considering the energy source ‘unknown’ for the gas that is no longer represented by the exported Tracking Instruments eliminates the risk for double counting.

5.4.4 Summary: Calculation of Domestic Residual Mix

The formula for calculating the Domestic Residual Mix involves compensating the Preliminary Domestic Residual Mix for exported gases and Tracking Instruments:

Domestic Residual Mix
= Preliminary Domestic Residual Mix – (Exported Gas – Exported Tracking Instruments)

The Preliminary Domestic Residual Mix represents the untracked attributes within the country, including those from imports outside the calculation area, namely gas that is not backed by a tracking instrument, or expired Tracking Instruments. The Domestic Residual Mix corrects this preliminary mix for exports to countries outside the calculation area.

5.5 Step 3: Untracked Consumption

Total gas offtake figures are providing the overall quantity of energy to which Attributes are allocated. They include both the energy off-take for which Tracking Instruments have been used, and the so-called Untracked Consumption. The latter is the quantity of energy that is, eventually, to be covered with the residual mix.

Figure 11, partly repeated in Figure 14, visualises the absence of the energy source mix of the Untracked Consumption. It shows how this “Untracked Consumption” can be quantified, so that, in a subsequent step, the residual mix, can be allocated to it as is energy source mix. The Untracked Consumption refers to the portion of total gas consumption that is not covered by cancelled GOs nor by validation of other RTS. This represents the gas that cannot be directly attributed to specific energy sources. By subtracting the cancelled GOs and RTS from total consumption, the overall quantity of Untracked Consumption is obtained.

Untracked Consumption = Consumption – Used Tracking Instruments

This demands a closer look to the terms “consumption” and the “use of reliable Tracking Instruments”.

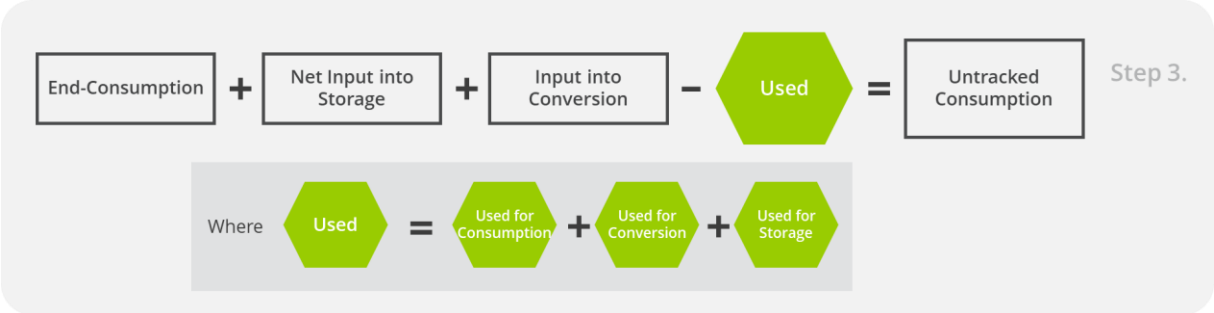

Figure 14: Conceptual calculation of Untracked Consumption.

5.5.1 Consumption

End-consumption of gas historically partakes the lion’s share of gas-offtake from a gas network. However, not all gas taken from a gas network can be seen as end-consumption of gas. Even if the term “end consumption” also includes transmission and distribution losses, there are other terms to take into account in the gas offtake from a network. In this proposal, also net gas inflow into storage and gas input into conversion is seen as a consumption category.

Losses from storage and conversion can be seen as final energy consumption. Gas off-take figures are therefore divided into three subcategories. This calculation proposal is consistent with this principle: as net input into storage is considered, storage losses are automatically accounted. Also, for conversion, the input into conversion in one energy carrier, and the related

output in another will account for conversion losses under the consumption of the input energy carrier.

5.5.2 Transmission and distribution losses

Energy losses associated with the transmission and distribution of gases are much less than for electricity. Losses include gas consumed by compression stations, auxiliary gas at storage facilities, gas vented during grid maintenance activities and leaks.

Like in the Residual Mix calculation method for electricity, transmission losses are included in the end-consumption.

5.5.3 Use of Reliable Tracking Instruments

When energy is tracked through cancellation of GOs or, where applicable, using other Reliable Tracking Systems (RTS), it means that these instruments have been used to disclose the origin of consumed gas. Thus, statistics on cancelled GOs and, where applicable, other RTS, provide the figures for the “consumption of tracked renewable gas”.

With the adjusted calculation of the Preliminary Domestic Residual Mix in Section 5.3, there are three distinct subcategories for “use of Tracking Instruments”:

1. **Gas consumption**
   This category includes GOs and RTS that are cancelled to reflect the origin of consumption of gas.
2. **Use for charging Gas Storage**
   In this category, GOs and RTS that are cancelled to cover the energy source stored in gas storage devices. At a later point in time (either in the same disclosure period or in a later one), Tracking Instruments may be issued again when releasing the gas from the storage; storage losses need to be deducted.
3. **Use for input into Energy Carrier Conversion**
   This category addresses GOs and RTS cancelled to account for conversion inputs.

For the ease of writing, the term **used Tracking Instruments** will here be used to collectively refer to cancelled GOs and to validation of other RTS with the aim of allocating the attributes of those Tracking Instruments to energy consumption.

5.6 Step 4: European Attribute Mix – correct for cross-border transfers within calculation area

If the Residual Mix is calculated for a single country, it is expected that the total consumed gas volume equals the available physical sources, and that the volume of Untracked Consumption equals that of the Domestic Residual Mix.

When considering multiple countries in the Residual Mix area, there may be cross-border flows of both physical gas and of Tracking Instruments in between these countries. These cross-border flows within the calculation area are not explicitly accounted for in the Residual Mix formula. Instead, the European Attribute Mix is constructed as a tool to level out imbalances caused by differences between cross-border flows in physical gas and in Tracking Instruments.

By comparing the Domestic Residual Mix (the quantity of untracked gas added to the country) with the Untracked Consumption (the quantity of untracked gas taken-off in the country), a national balance of attributes not covered by Tracking Instruments is determined.

Countries for which the Domestic Residual Mix is larger than the Untracked Consumption have a so-called "**Surplus of Attributes**" and countries for which the Domestic Residual Mix is smaller than the Untracked Consumption have a so-called "Deficit of Attributes", see Figure 15.

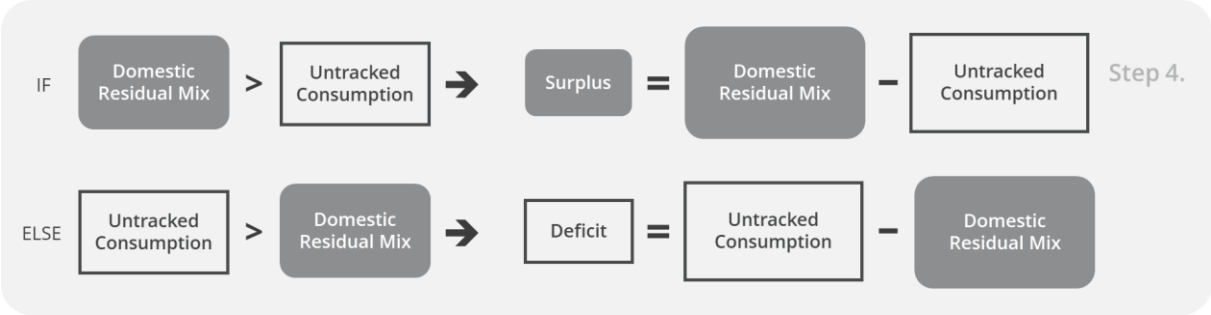

Figure 15: Calculation of attribute surplus and deficit.

The Surplus of Attributes of each country in this situation flows into a pool of leftovers. This pool is called the "European Attribute Mix" or (EAM), see Figure 16. For each country, the composition of the attribute surplus, flowing to the EAM, is proportional to that of the Domestic Residual Mix for that country.

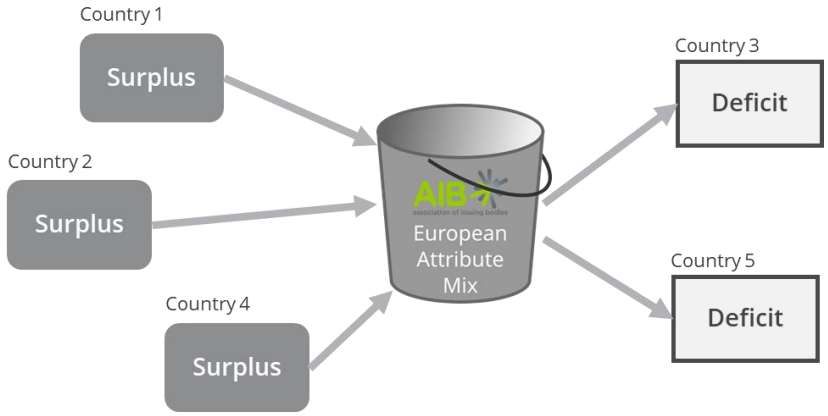

Figure 16: Surplus attributes are added to the European Attribute Mix and spread evenly to compensate the attribute deficits.

This EAM, as pool of leftover Attributes, has an essential function, as it fills the gaps in those countries where there is an attribute deficit. This is done in the next step.

5.7 Step 5: Final Residual Mix

5.7.1 Filling in Untracked Consumption with Domestic Residual Mix

Repeating the overall aim of the Residual Mix exercise, the Domestic Residual Mix is used to determine how to disclose the Untracked Consumption in every country in the Residual Mix calculation area. However, for every individual country in the calculation area, the quantity of energy represented in the Domestic Residual Mix almost never matches with the energy quantity of the Untracked Consumption.

5.7.2 Surplus countries: spillover from Domestic Residual Mix to EAM

In surplus countries, where the Domestic Residual Mix exceeds the Untracked Consumption, part of the Domestic Residual Mix is added to the European Attribute Mix. The remainder part is the Final Residual Mix.

In each of these countries, the surplus attributes are allocated to the European Attribute Mix (EAM) in the same proportion as the Domestic Residual Mix. As a result, the composition of the Final Residual Mix is proportional to the Domestic Residual Mix as well.

5.7.3 Deficit countries: top up Domestic Residual Mix with EAM

In deficit countries, the Domestic Residual Mix is unable to cover all Untracked Consumption. The lacking energy and attributes must be topped up from the EAM. The attribute mix of what is taken from the EAM is proportional to that of the EAM itself.

The Attributes obtained from the EAM are simply added to those in the Domestic Residual Mix to determine the Final Residual Mix, which covers the total quantity of Untracked Consumption.

Figure 17: Calculation of Final Residual Mix for surplus and deficit countries.

5.7.4 Filling in remaining Unknown energy sources

In the previous steps, “unknown” energy sources were sometimes used in order to avoid double counting of attributes where the source to be included in the Domestic Residual Mixes could not be known for sure. These “unknown” shares have propagated down to Step 5. In this step, it is time to resolve any “unknown” energy sources.

As a conservative assumption, any remaining gas quantities with “unknown” energy source will be assumed to be fossil to rule out any double counting of renewable or low-carbon attributes.

5.8 Total Supplier Mix: sum of all fuel mixes of all suppliers

The Total Supplier Mix or (TSM) refers to the overall volume of Attributes disclosed by all suppliers within a country, encompassing both explicitly tracked through Used Tracking Instruments and those disclosed through the Final Residual Mix. It is determined by adding the Used Tracking Instruments per attribute to the Final Residual Mix.

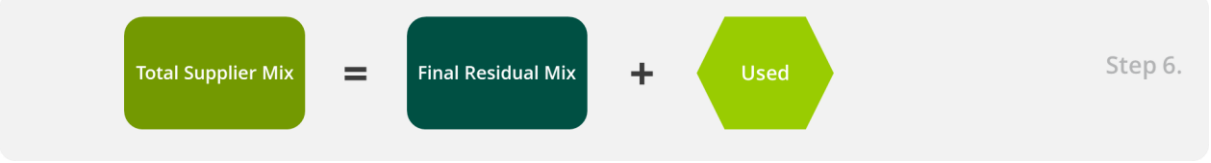

Figure 18: Total Supplier Mix: sum of Final Residual Mix and Used Tracking Instruments.

The TSM equals the total gas consumption inside the country, as Untracked Consumption is derived from subtracting Cancellations from the total consumption.

5.9 Simplified alternative: fossil Residual Mix while data flows are not yet synchronised

As elaborated, the Residual Mix is the missing puzzle piece in a Disclosure framework of which the reliability needs protection by legislation. The previous sections of this chapter have set out a Residual Mix calculation methodology for gases by following a formula similar to what is used for electricity Residual Mix.

In practice, however, there are some hurdles to overcome in the following areas:

- Clarity on the instrument for Disclosure and prevention measures for double claims if the RM would contain renewable or low-carbon gases;
- Availability of data sources for the RM calculation;
- Timely publication of data input into the RM calculation.

As long as these hurdles hamper an accurate and timely calculation of the Residual Mix according to the methodology developed in the previous subchapters, a simplified methodology could be used as an alternative.

Gas and hydrogen production for which no Tracking Instruments are issued, is mostly based on fossil natural gas. In 2022, EU-27 produced 3,4 bcm or 36 TWh biomethane[25], a fraction of which is injected into natural gas grids. Compared with the gross inland consumption of natural gas, refinery gas and biogases combined – 3610 TWh in 2022 – biomethane only represented 1%.

In 2023, EU-27 produced 7,935 kton of hydrogen, 91% of which originated from unabated Steam Methane Reforming and 7,9% of which as a by-product. Water electrolysis and abated Steam Methane Reforming also only accounted for 1% of the total hydrogen production, see Figure 19.[26]

[25] Source: European Biomass Association – Statistical report 2023 – Launch webinar
[26] European Hydrogen Observatory – statistics on hydrogen production

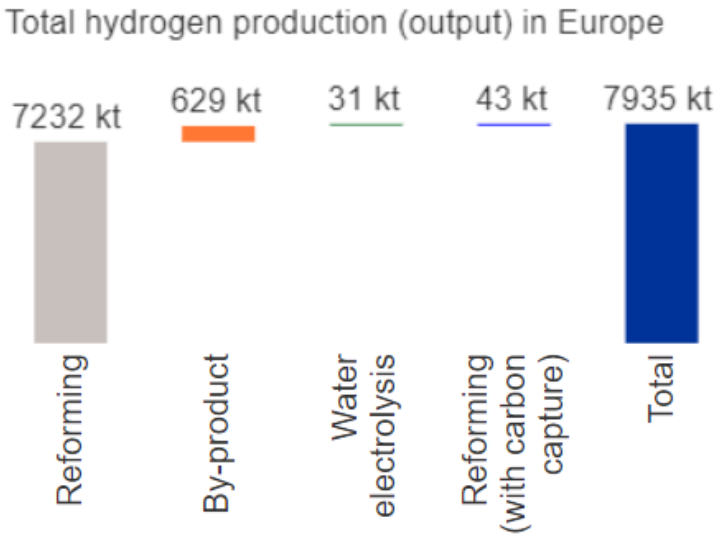

Figure 19: Visualisation of the share of different production processes for hydrogen in Europe, showing the predominant role of Steam Methane Reforming.[27]

Hence, as a simplified method, one can consider that the Residual Mix consists of the incumbent fossil energy source only. More specifically, for methane-type of gas, the Residual Mix could be considered "fossil natural gas", while for hydrogen the Residual Mix could be considered "hydrogen produced by unabated Steam Methane Reforming", as shown in Figure 20

Figure 20. Doing so, would eliminate the need for a Residual Mix calculation in a more elaborated way.

Pending solution of the availability and consistency of data sources, this approach can hold. It is clearer to provide a full fossil Residual Mix than to risk including double-claimed renewable gases in the Residual Mix, as long as the legal framework sustains some areas of confusion as explained in Section 4.4 and as elaborated in 2020 in the FaStGO Task 4.2 report.

This approach provides clarity and avoids the risk of including double-claimed renewable gases until a clearer legal framework and reliable data sources are established. However, as renewable gas volumes increase, that may not all be disclosed to consumers, and especially where such volumes are transferred across borders, a more accurate Residual Mix calculation may become essential.

[27] Image source: European Hydrogen Observatory – statistics on hydrogen production

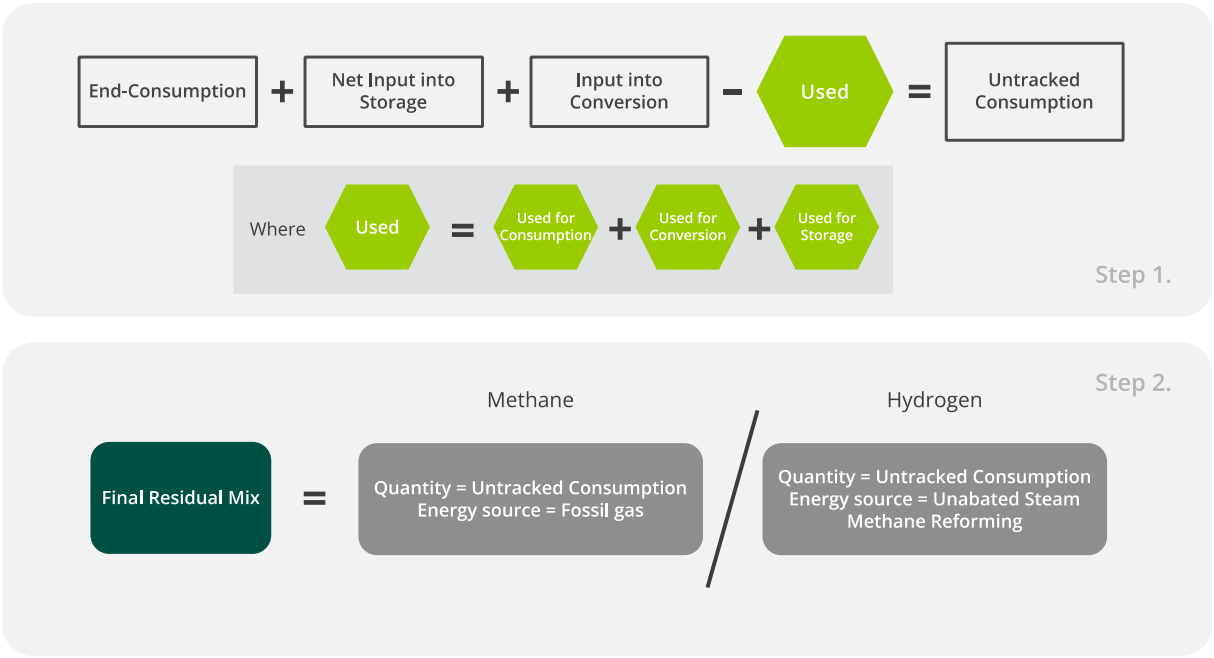

Figure 20: Summary of the concept of a simplified Residual Mix, where the Residual Mix is assumed to consist entirely of the incumbent fossil energy source.

A more **detailed Residual Mix calculation becomes necessary** when:

1) **significant volumes of biomethane or hydrogen or low-carbon gases** are injected into the gas grid **without corresponding GOs or tracking into the UDB**, or
2) when **renewable gas and low-carbon gas production** and the **cross-border flows of their renewable attributes become substantial**.
3) When **differentiation of different sources for fossil gases** is desirable (e.g., to distinguish shale gas from fracking from other fossil natural gas).

RESIDUAL MIX IN PRACTICE

6 DATA SOURCES AND QUALITY

To calculate the Residual Mix in practice, the terms in the formula, depicted by Figure 11 or Figure 20, need to be populated by data. This chapter discusses which data sources can be used and assesses the quality of the available data provided by these data.

First, the required data inputs are summarised. Then, the potential data sources are discussed, followed by an assessment by when these data are available for the Residual Mix calculation.

6.1 Overview of the required data inputs

Data inputs are needed for the physical quantities of gas and for the number of Tracking Instruments. The data input needs depend on the complexity of the calculation method for the Residual Mix for gases. Table 4, resp. Table 5, summarises the data input needs for the detailed, resp. simplified, calculation method.

Table 4: Data needs for the detailed calculation method for Residual Mix for gases

Data input	Requested details
Physical quantities	
Yield (production or conversion output) of gas	Split by the energy source categories considered
Release from storage	Split by energy source if such information can be provided by the storage facilities operators, if not, the energy source must be considered as unknown
Import of gas	Split by country, regardless of whether the trade partner is another country within the calculation area or a country outside the calculation area Specific energy sources can be considered only if double counting and double claiming of the exported quantity of gas is prevented by the exporting country; if not, the energy source must be considered as unknown
Export of gas	Split by country, regardless of whether the trade partner is another country within the calculation area or a country outside the calculation area; no energy sources need to be specified
Input into gas storage	No energy sources need to be specified
Consumption of gas	No energy sources need to be specified
Tracking Instruments	
Issuance of Tracking Instruments	Detailing whether they concern production, conversion or release from storage
Expiry of Tracking Instruments	
Import and export of Tracking Instruments	Split by country, regardless of whether the trade partner is another country within the calculation area or a country outside the calculation area
Cancellation of Tracking Instruments	Detailing whether they concern consumption, conversion or storage
General	In case different Tracking Instruments represent the same quantity of energy, the correspondence between the concerned Tracking Instruments is needed as additional input to prevent double counting.

Table 5: Data needs for the simplified calculation method for Residual Mix for gases

Data input	Requested details
Physical quantities	
Input into gas storage	No energy sources need to be specified
Consumption of gas	No energy sources need to be specified
Tracking Instruments	
Cancellation of Tracking Instruments	Detailing whether they concern consumption, conversion or storage
General	In case different Tracking Instruments represent the same quantity of energy, the correspondence between the concerned Tracking Instruments is needed as additional input to prevent double counting.

The time granularity is annual in line with the current practice for the Residual Mix calculation for electricity. However, in order to cope with the timespan between production of gas and issuance of Tracking Instruments and between consumption of gas and cancellation of Tracking Instruments, calendar years (1 Jan X – 31 Dec X) are considered for physical quantities and years shifted with 3 months (1 Apr X – 31 Mar X+1) are considered for Tracking Instruments.

6.2 Overview of data sources and available data inputs

6.2.1 Data on physical quantities

Table 6 presents an overview of the data sources on physical quantities with characteristics of the available data inputs.

Table 6: Overview of data sources and available data inputs on physical quantities.

SOURCE	Eurostat	IEA	GIE Aggregated Gas Storage Inventory	European Biogas Association	EU Hydrogen Observatory
Gas	Natural gas	Natural gas	Natural gas	Biogas / - methane	Hydrogen
Production	X	X		X	X
Import	X	X		X	X
Export	X	X		X	X
Storage	X	X	X		
Consumption	X	X		X	X
Time granularity	Monthly	Monthly	Daily	Annual	Annual
Geogr. coverage	EU 27	22 MS	EU	22 MS	24 MS
Available after	3,5 months	2 months	1 day	11 months	10 months
Cost	Free	Report: Free Database: 930 €	Free	Policy makers: free Others: 2067 €	Free

6.2.1.1 Eurostat data on Gas Supply, Consumption and Import-Export

Eurostat offers a dataset named "Supply, transformation, and consumption of Gas – monthly data[28]". The dataset is publicly available, free of charge. The dataset covers **natural gas only**, it provides data the quantities shown in Table 7.

The dataset covers all EU Member States, EFTA-countries, EU candidate countries, and potential candidate countries. Data for the UK are available only for the period 1990-2019. Data is available per individual country and per month.

Table 7: Mapping data fields in Eurostat data to the corresponding terms in the Residual Mix calculation formula.

Term in RM calculation	Data field in Eurostat-data
Production	Indigenous production
Imports – Exports	Imports – Exports + Transfer from other sources – International maritime bunkers
Storage	Changes in stock and in cushion gas
Consumption	Inland consumption

The unit of measurement is million cubic meters and Terajoules (Gross Calorific Value). To utilise the data within the RM calculation, it will be needed to convert the units from million cubic meters or terajoules to multiples of MWh.

Eurostat disseminates short-term monthly data 1,5 months after the reference month, which still may show some data gaps. Within 3,5 months after the reference month, Eurostat disseminates a complete data set for the reference month.

6.2.1.2 International Energy Agency – Monthly Gas Data Service

The Monthly Gas Data Service contains monthly **natural gas** data for individual OECD countries[29], see Table 8. The IEA published, based on these data, a monthly report on OECD Natural Gas Statistics. However, it is not clear whether 'natural gas' refers to fossil gas only or covers all natural gas compatible gases (including biomethane).

Table 8: Mapping data fields in the IEA Monthly Gas Data Service and Monthly OECD Natural Gas Statistics to the corresponding terms in the Residual Mix calculation formula.

Term in RM calculation	Data field in IEA Monthly Gas Data Service	Monthly OECD Natural Gas Statistics
Production	Production	Indigenous production
Imports – Exports	Supply balances, trade (gaseous, LNG)	Imports (entries) – Exports (exits)
Storage	Stock changes	Stock changes
Consumption	Gross inland deliveries, own use and losses	Gross consumption

The units of the data are terajoules and (standard) cubic metres.

The databases, underpinning the IEA Monthly Gas Data Service, cover the period starting from January 1984 to current month with a time lag of 2 months for the most recent data (e.g. end-March data is available beginning June). The data are only available after subscription; the minimum annual fee is 930 € for one user.

28 https://ec.europa.eu/eurostat/databrowser/view/nrg_cb_gasm__custom_9509653/default/table?lang=en

29 https://www.iea.org/data-and-statistics/data-product/monthly-gas-data-service-2#data-sets

The Monthly OECD Natural Gas Statistics provide natural gas balances for the month of publication – 4 (e.g. the report, published in June 2024, contains statistics of Feb 2024). Following periods are covered by the statistical report:

- The last statistical month (e.g. Feb 2024)
- The same month of the year before (e.g. Feb 2023)
- The quarter of the previous year (e.g. 4Q2023)
- The previous year (e.g. 2023)
- The year before (e.g. 2022)

Natural gas balances are provided for most of the EU Member States; the statistics do not include Bulgaria, Croatia, Cyprus, Malta and Romania. For some EU Member States, the origin of imports is provided as well.

The Monthly OECD Natural Gas Statistics are issued free of charge.

6.2.1.3 GIE – Aggregated Gas Storage Inventory

The GIE Aggregated Gas Storage Inventory (AGSI) provides information on the storage levels of all gas storage facilities in the EU (present in 18 EU Member States), Ukraine and the UK, as shown in Table 9. A distinction is made between facilities for storing natural gas as gas and as LNG. Also aggregated data are provided per country.

The time granularity for the dataset is one day. The historical dataset allows to compare the quantity storage at the start of the year and at the end of the year. The unit of measurement for gas storage levels is TWh.

Table 9: Mapping data fields in GIE Aggregated Gas Storage Inventory to corresponding terms in the Residual Mix calculation formula.

Term in RM calculation	Data field in GIE Aggregated Gas Storage Inventory
Production	(Not provided)
Imports – Exports	(Not provided)
Storage	Gas in storage
Consumption	(Not provided)

6.2.1.4 European Biogas Association – Statistical Report

The EBA Statistical Report[30] tracks the **biogas and biomethane** deployment across Europe. The annual report provides data for the different terms in the RM calculation, except for storage, see Table 10.

Table 10: Mapping data fields in EBA's Statistical Report to corresponding terms in the Residual Mix calculation formula.

Term in RM calculation	Data field in EBA Statistical Report
Production	Production of biogas and biomethane / grid connected and off-grid (includes bio-CNG and bio-LNG)
Imports – Exports	Cross-border trade of biomethane
Storage	(Not provided)
Consumption	Renewables consumption and share of biogases

[30] EBA Statistical Report 2023 | European Biogas Association

The report provides data for 27 countries, but the geographical coverage does not overlap with the EU; it does not include Bulgaria, Cyprus, Luxembourg, Malta and Romania and covers Norway, Serbia, Switzerland UK, Ukraine instead.

The Statistical Report on 2022 was published on 5 December 2023, so eleven months after the reference year.

The report is free of charge for members of EBA and for policy makers. Others need to purchase it for € 2067.

6.2.1.5 EU Hydrogen Observatory

The European Hydrogen Observatory (EHO)[31] is an initiative from the Clean Hydrogen Partnership. Its aim is to strengthen and integrate EU scientific capacity, in order to accelerate the development and improvement of advanced clean hydrogen applications.

It publishes various reports to provide insights into the deployment of the hydrogen economy within the European Union. 'Report 1: The European hydrogen market landscape' provides statistics on 1) production and trade, 2) distribution and storage, 3) end-use, 4) costs of production and 5) technologies manufacturing. Alongside the reports that focus on key data, full datasets are made available as well. An overview of the available statistics is given in Table 11.

The datasets provide annual data on the production, trade and consumption of **hydrogen**. The production data provide details on the type of hydrogen production technology, such as Electrolysis, Steam Reforming, Steam Reforming with Carbon Capture, by-product,… Yet, it is necessary that this level of detail is also provided for trade and consumption.

Data on storage of hydrogen are currently not yet available, as there is no storage facility for hydrogen operational yet. Data are provided for all EU Member States, except for three smallest ones: Cyprus, Luxembourg and Malta.

Table 11: Mapping data fields in EU Hydrogen Observatory to corresponding terms in the Residual Mix calculation formula.

Term in RM calculation	Data field in EU Hydrogen Observatory
Production	Hydrogen production output by country with details on production technology
Imports – Exports	Imports – exports
Storage	(Not provided)
Consumption	Hydrogen demand

The data are publicly available free of charge. The statistical report on 2022 was published in November 2023, so 10 months after the reference period.

6.2.2 Data on number of energy attributes

Table 12 presents an overview of the data sources on the number of energy attributes (such as the energy source) with characteristics of the available data inputs.

Table 12: Overview of data sources and available data inputs on number of energy attributes.

SOURCE	EECS® – Guarantees of Origin	ERGaR – Certificates of Origin	Union Database – Proof of Sustainability

[31] Homepage | European Hydrogen Observatory (europa.eu)

Gas	Biogas / -methane	Hydrocarbon gases, biogas / -methane, hydrogen, other renewable gases	Gaseous fuels (biogas / -methane, hydrogen, …)
Import	X	X	
Export	X	X	
Issued	X		X
Expire	X		
Cancel	X		X
Time granularity	Monthly	Quarterly	Monthly
Geographical coverage	5 MS	6 MS	EU27
Available after	(Not yet)	2 Months	(Not yet)
Cost		Free	

6.2.2.1 EECS® – Guarantees of Origin

While all EU Member States have a fully operational scheme for Guarantees of Origin for electricity, schemes for Guarantees of Origin according to the EECS® rules[32] are in full development. Several EU Member States already have implemented such a scheme and maintain a registry, recording gas GOs that were issued, cancelled, transferred or expired, while for others implementation is ongoing. At the time of drafting this report, the gas GO issuing bodies of the following countries are part of the EECS Gas Scheme Group in AIB, which allows for cross-border transfer of GOs over the AIB Hub: Austria, Belgium Brussels, Czech Republic, Finland, Italy, Latvia and Spain (Portugal and Estonia joining in December 2024). These numbers of GOs are input data for the Residual Mix calculation formula.

However, not all gas GO issuing bodies are yet approved members of the EECS® Gas Scheme to AIB, with some still elaborating their cross-border transfer processes, though almost all are taking part in the Gas Scheme Group as observer. Aggregated statistics[33] on gas GOs categorised by energy source are still under preparation.

AIB is preparing guidelines for its Scheme Members to provide monthly aggregated data on GOs per geographical Domain, per energy source, and per activity type in a single overview monthly. This will improve the data availability in the near future.

6.2.2.2 ERGaR – Certificates of Origin

While national gas GOs Schemes following the EECS® rules are in full development, market parties gather in the European Renewable Gas Registry (ERGaR)[34] as a European association dedicated to facilitating cross-border trade in renewable gas certificates.

These Certificates of Origin can be Guarantees of Origin as stated in the Renewable Energy Directive or other national certificates. For these other national certificates, ERGaR has adopted the term Certificates of Origin (CoO) to enable documentation of renewable gas injections. These certificates may hold the same information as a GO under Article 19 RED II but may not have been created by a national registry who has been appointed a “competent body”.

[32] https://www.aib-net.org/eecs
[33] https://www.aib-net.org/facts/market-information/statistics
[34] https://www.ergar.org/

The ERGaR CoO Scheme is operated by the European Renewable Gas Registry (ERGaR) aisbl to facilitate the cross-border title transfer (ownership transfer) of CoOs between participating national biomethane registries. The Scheme provides harmonised rules on the issuance of CoOs and a protocol on the business processes for ownership transfer of CoOs from one country to another. In the scope of the Scheme are **hydrocarbon gases, hydrogen and biomethane**, as well as **other renewable gases** that have been injected into the natural gas network.

CoO registers are operational in eight countries: Austria, Denmark, Germany, Ireland, Lithuania, the Netherlands, Slovakia and the UK.

The statistics ERGaR publishes[35] only provide details on the total number of transfers per quarter and the energy quantity of biogas and biomethane these transfers represent. No details are provided on the share of GOs and CoOs. A collaboration with ERGaR is needed to collect more detailed statistics.

Note: at the time of writing this report, ERGaR doesn't publish import and export per country, only total aggregated import and export. The data can only be used if it is clear which country is importing and exporting which quantities. Currently that data is only available to the ERGaR members. ERGaR may publish such data over time but hasn't yet internally aligned on doing so.

6.2.2.3 Union Database – Proof of Sustainability

The Union Database for Biofuels (UDB)[36] is based on Clean Energy for all Europeans package and article 28(2) and (4) of the Renewable Energy Directive (RED II) to improve the traceability of gaseous and liquid fuels in Transport Sector with the objective to avoid double counting and mitigating the risks for irregularities and fraud.

For gaseous fuels, the EU gas network is considered as a single logistical facility from mass-balance perspective. Local networks are considered as a separate mass-balancing system. Any trades between networks must be reported to UDB as a trade transaction.

When injecting gaseous fuels into a network, Economic Operators (EO) or operators of a production unit must register injected monthly volume based on meter readings in their UDB account. After validation of these Proofs of Sustainability (PoS), the Economic Operators (EO) or operators of a production unit can transfer validated PoS to any trader's account, to a gas final supplier account or to a large industrial consumer (with individual account in UDB).

Registration of consumption of energy units can be triggered by any of the EOs in possession of the PoS. The PoSs' unique identifiers are marked as "consumed and transferred to the national account of the consuming Member State" in UDB.

In case GOs have been issued for whole or part of the monthly volume, a reference between the UDB and the GO registry is established through a link between the accounts of the EO in both UDB and the GO registry. Linked GOs can be cancelled only through UDB upon their registration or withdrawal from the mass-balance system.

The Union Database for gaseous fuels is currently in development; it is planned to go live in November 2024. ANNEX VII describes the interaction with the Union Database on sustainable biofuels more in depth.

[35] https://www.ergar.org/ergar-schemes/coo-scheme-statistics/
[36] Union Database for Biofuels (UDB) - About - Union Database for Biofuels Info-site - EC Public Wiki (europa.eu)

The UDB registers the quantities of gas injected in the grid with details on location and PoS and the quantities of gas consumed with details on location and PoS. This allows to generate reports on the number of PoS registered (issued) and withdrawn (cancelled). Transfer of PoS from one EU Member State to another are not registered as such. However, as the PoSs have unique identifiers, reports can be made on the number of PoS registered in one country and withdrawn in the other. PoSs do not expire, in contrast to GOs, hence, no data on expired PoS are available.

To conclude, a report with following data categories is needed from the data registered in the Union Database in order to feed the adequate calculation of the Residual Mix for gas:

- Number of PoS registered per year for production of gases, per type of gas and per network type, in each of the EU Member States with details of the energy sources, and the number of those PoSs that corresponds to energy for which a GO is issued;
- Number of PoS withdrawn per year for consumption of gases, per type of gas and per network type, in each of the EU Member States, with details of the energy sources, accompanied by and the number of those PoSs that corresponds to energy for which GOs are cancelled, and the number of those PoSs that corresponds to energy for which GOs are issued, but for which the cancellation of that GO is not (yet) registered in the UDB;
- Number of PoS registered for production of gases in one EU Member State and withdrawn for consumption of gases in another EU Member State per year and per EU Member State of production and per Member State of Consumption.

6.2.3 Data surveys to national Disclosure competent bodies

At the time of writing this report, Member States' implementation of REDIII in their national law, is still ongoing. Several Member States develop a national database which integrates GO and PoS information. When the national implementations have established, it will become clearer which information can be collected from national databases and which from the UDB, which may depend on the country. Like for the electricity residual mix, directing towards the national disclosure authority with an annual questionnaire seeking quantitative data input for the residual mix, is likely the way to collect much of the national data, once there are data collection mechanisms established at national level.

The overview of the available data on the physical quantities and number of energy attributes reveals that not all EU Member States are covered by the data sources, discussed above. To compensate for these data gaps, data can be queried from the national authorities, such as energy agencies for data on production and consumption of low-carbon and renewable gases and competent Disclosure bodies for data on issued, expired and cancelled energy attributes. This builds on experience from the data collection mechanism for the current calculation process for the electricity Residual Mix.

While at pan-European level certain data is available, it is helpful if the members states provide, to the central calculation service provider of the EAM, the input they will use for their own Residual Mix calculation in exercise of their duty under RED art. 19.

It should be noted that some countries use a different dataset for a national Residual Mix than the data that is available to AIB, in this case, there will usually be discrepancies with the numerical RM calculation results from AIB. Indeed, AIB has no mandate to enforce the use of a harmonised Residual Mix. AIB annually queries the Disclosure competent bodies for numerical data related to their state, but when not receiving response, AIB bases its calculations on pan-European statistics like Eurostat and AIB GO statistics.

6.3 Data collection and calculation timeline

The Residual Mix calculation needs to deliver a calculation result in time. As recommended by the RE-DISS and FaStGO projects and learnt from current practices, the results are ideally available by the end of May of year Y+1 at the latest, so that the figures disclosing last year's energy sources can be included in supplier Disclosure publications latest from 1 July onwards.

Backcasting from there, this implies that statistical data must be available by 31 March of year Y+1, for it to be included in the reporting and calculation procedure for the RM. The upper part of Figure 21 depicts the timeline for the data collection process feeding the calculation of the Residual Mix. While this is the generally applied timeline for the RM for electricity, the same timeline is relevant for gases, given that supplier Disclosure obligations shouldn't refer to supply periods that are too far in the past.

It is therefore recommended that the data collection process feeding the calculation of Residual Mix for gas follows a similar timeline as for electricity and that the Residual Mix and supplier mix be available by 1 July. In this way, these data would be available not too long after the period of energy supply, which is instrumental in supporting the customers in making their supplier choices.

To facilitate this supplier's publication deadline of 1 July it requires the Residual Mix to be available by June 1st of that year, and the numerical data inputs to be collected in March and April so that Residual Mix calculations can take place and be consulted and confirmed in May.

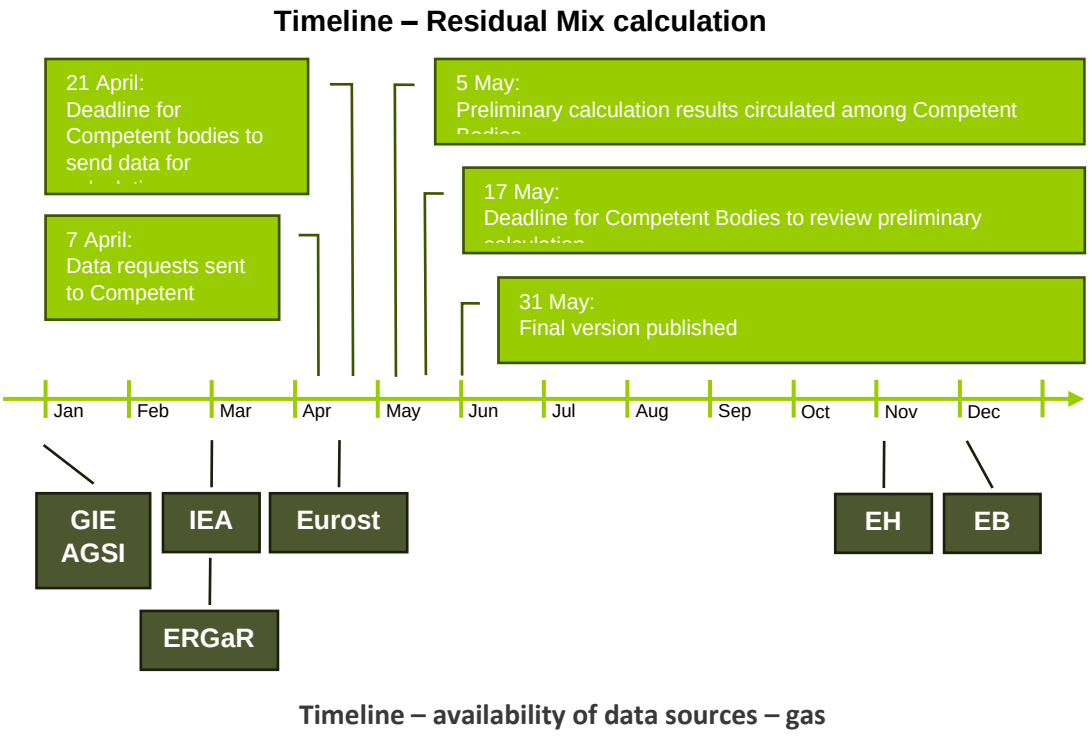

Figure 21: Timeline of the availability of data sources for RM calculation for gas versus timeline of RM calculation for electricity.

However, when comparing this timeline with when the necessary data sources are available (see Figure 21), one can observe a mismatch with the dates of publication of the statistical reports of the European Biogas Association (EBA) on the production, trade and consumption of biogas and -methane and of the European Hydrogen Observatory (EHO) on production, trade and consumption of hydrogen. Collaboration with these institutions or other providers of

statistics is hence needed to improve the data collection and statistical report generating processes.

In addition, the AIB and the operator of the UBD also must organise their data handling processes in such a way that the necessary input data for the RM calculation are available by 21 April in Y+1.

7 LEARNINGS FROM A CALCULATION EXAMPLE

7.1 Why a calculation example and where to find it

With a view to confirm the feasibility of the developed calculation methods for the Residual Mix for gas set out in chapter 5, with the data as elaborated in chapter 6, this chapter tests both the detailed method and the simplified method using a calculation example with data from a few countries.

As a disclaimer for the numerical outcome, with such limited geographical scope, the current calculation example cannot be considered to lead to a complete result. This is partly due given the interconnected gas markets from which not all data are included and partly due to lack of input data, and incomplete availability of input statistics. It however allows to draw some first learnings.

ANNEX X elaborates the calculation example and explains the assumptions made.

7.2 Inputs must equal outputs

The calculation methods build upon inputs (yield, conversion output, imports, release from storage) and outputs (consumption, conversion input, exports, storage of gas) of gas, as well as of inputs (issuance and imports) and outputs (usage/cancellation/expiry) of Tracking Instruments.

For the calculation formula to fit, the inputs must match the outputs, both for the physical quantities as for the Tracking Instruments. Imbalances in either the physical quantities or the number of Tracking Instruments result in differences in the sum of surpluses and the sum of deficits in step 4 of the detailed calculation method, see 5.6. Moreover, the mix of energy sources would alter as well. When that happens, more (or less, dependent on the imbalance) and different attributes would be redrawn from the European Attribute Mix to cover the deficits than is added by surplus countries. Similar effects occur in the simplified calculation method too. This would mean that within the calculation flow attributes either would vanish, which would not be a correct representation, or the number of attributes in the EAM would be artificially stretched, which would double-count some attributes. When reaching a balance in inputs and outputs both for the physical quantities as for the number of Tracking Instruments, this problem is proven to be prevented.

However, it is challenging with collectable data to achieve such a balance for the physical quantities as for the number of Tracking Instruments. This challenge amplifies because of time spans between the timing of issuance and cancellation of Tracking Instruments and timing of production and consumption of the physical quantities, to which the Tracking Instruments refer.

Here inspiration can be taken from the electricity disclosure rules, where in practice in almost all countries a harmonised cancellation deadline is set at 31 March of year X+1 for consumption of year X. Setting a similar cancellation deadline for gases is recommended. When having such harmonised cancellation deadline, the residual mix calculation for year X can build its data on issuance, cancellation and expiry of electricity GOs on harmonised periods from 1 April year X to 31 March year X.[37]

[37] See Grexel (2020) Issuance Based Residual Mix Calculation Methodology

7.3 Lacking availability of complete and qualitative input data

The calculation example illustrates the impact availability of input data has on the end-result. For fossil gas, two data tables from a reputed source seemed to be inconsistent, while consistent data for biomethane were hardly available and many data gaps remained in the data collection exercise. To overcome these data gaps, many assumptions had to be made, and the situation depicted by the calculation example deviates from reality.

A timely publication of consistent data on the physical trade of the energy carriers and of their Tracking Instruments is a prerequisite for an accurate calculation of the Residual Mix. Moreover, discrepancies between the quantities of biomethane injected in the grid, the number of Tracking Instruments issued, and the number cancelled were found for some of the countries. Consequently, biomethane (or renewable gases more in general), of which the use is already claimed by specific consumers, might still end up in the Residual Mix. This would be double counting.

7.4 Energy sources of imported gas

The calculation example also illustrates the significancy of gas imports and exports from outside the calculation zone. The EU-27 imported 97.6% of the natural gas consumed in 2022. This contrasts considerably with electricity, for which imports/exports account for less than 1% compared to the domestic production in the Union.[38]

The question arises what energy sources can be considered for the imported gas without double counting them. It needs assurance that these energy sources are not claimed in the originating country. Here, it may be that accounting for different purposes happens differently than in EU, which may lead to confusion or a perception of double counting. Ideally, governmental backing from the authorities from originating countries regarding the energy source and carbon footprint of the imported gases, could help overcome this, where inter-governmental relations allow for such.

The detailed method is precautious and indicates ‘unknown’ as energy source, while the simplified method assumes imported gas to consists of 100% fossil gas. This difference in approach translates into significantly different end-results for the Residual Mix. When it comes to including the carbon impact of different sources of fossil gas, this needs higher attention to detail.

7.5 Energy sources of exported gas

When exporting gas to a country outside the calculation area, the detailed calculation method considers this export to have the same mix as the Preliminary Domestic Residual Mix, in line with the currently implemented calculation method for the Residual Mix for electricity. If this Preliminary Domestic Residual Mix consists partly of gases with a known attributes (resulting from expired Tracking Instruments and renewables production for which no tracking instruments of any type were issued), a fraction of it can leak to outside the calculation area. The simplified method, in contrast, omits the need of allocating attributes to exported gas.

[38] Based on EU Energy in Figures, Statistical Yearbook 2024 and analysis of Eurostat data

Only considering net-imports[39] in the detailed calculation method could eliminate this uncontrolled leakage of environmental attributes.

7.6 The only renewables in the RM result from expired Tracking Instruments and untracked renewables

7.6.1 If all renewables are tracked, then the only renewables in RM are from expired GOs

The renewable attributes in the Residual Mix, originate from expired guarantees of origin and partly from untracked renewables. Following the assumptions made in the example, a fraction of the biomethane production was assumed to be untracked; this assumption was considered to test the effect of such an untracked production.

As guarantees of origin are the only tracking instruments that are subject to controlled expiry, including their attributes in the residual mix, this makes sense for a consistent prevention of double claims of the same renewable gas quantity, on condition that these attributes are not being claimed through other means, see next paragraph.

7.6.2 Legal framework not solid enough to prevent double counting of expired GOs in RM

Allowing expired GOs into the residual mix should only be allowed if the covered gas cannot be claimed in any other way. Indeed, it is important to note that Proofs of Sustainability do not expire in the same way as GOs, and hence expired GOs can only be included in the RM if it is ascertained that the PoS, issued for the same gas, is not separately available for consumption claims, not even after the corresponding GO expired. At the time of writing this report, this has not yet been confirmed to be the case.

The simplified calculation method does not add expired Tracking Instruments to the Residual Mix in contrast to the detailed calculation method. This leads to a difference between simplified and detailed method. However, the quantity of expired GOs is expected to be very low, given there being enough incentives for explicit tracking, which minimizes the size of such difference.

7.6.3 Do we need a Residual Mix if it has no renewables?

Yet, it is unlikely to have high quantities of expired tracking instruments, given the higher demand for renewable and low-carbon gas compared to the supply. Furthermore, as long as the market allows consumption claims based on other instruments than guarantees of origin, it is hard to full proof double counting prevention in case expired tracking instruments are included to the RM.

[39] An example to illustrate: Country A imported in year X 20,000,000 MWh from Country B outside the calculation area and exported 5,000,000 MWh to Country C outside the calculation area. Considering net-imports only would mean that a net-import of 15,000,000 MWh is used as a data input into the Residual Mix calculation and that the export is set to zero.

7.7 The redistributive effect of the European Attribute Mix is limited

In this calculation example, the redistributive effect of the European Attribute Mix is very limited. It is only a fraction of the total share of gas for which Tracking Instruments are issued, which is also very small.

In surplus countries, most of the renewable attributes are claimed domestically, and with high gas import volumes taking place, the EAM fills mostly with the fossil and unknown attributes from the countries with a surplus of attributes.

Redistributing Attributes within the calculation area in an accurate and adequate way, is the detailed calculation method's main value. But, as long as Tracking Instruments are issued to only a small fraction of total gas volumes, the added value can be questioned. In the meanwhile, the Residual Mix and the Total Supplier Mix can be calculated using the simplified calculation method.

7.8 Summary of learnings: too early for detailed RM method

In summary, the calculation example shows that it is too early for a consistent calculation of the residual mix following the detailed calculation method. The simplified calculation method is a valuable alternative.

8 HOW TO USE THE RESIDUAL MIX FOR SUPPLIER DISCLOSURE

Ensuring transparency and reliability in the Disclosure of energy sources is critical for empowering consumers and preventing double claims. A robust legislative framework is necessary to prevent multiple claims of the same attributes and to ensure the integrity of the Residual Mix Calculation.

Besides those essential high-level framework aspects, this chapter introduces guidelines for the accurate and consistent reporting of energy sources on gas supply bills, addressing the need for harmonised practices across different jurisdictions. They originate from the RE-DISS project, the AIB Disclosure Platform[40], CEER advice on trustworthy green offers[41], and practical experience from Disclosure competent bodies. While this chapter is limited to the main guidelines, a more elaborate overview can be found in ANNEX IV.

8.1 Mention energy sources on gas bills

All gas supply bills should mention all energy sources, not just limited to renewable and low-carbon gases. Such comprehensive Disclosure allows consumers to understand the fuel mix of the energy they are using. When the non-renewable energy source mix is also mentioned on the bill, consumers cannot assume they have a contract for renewable energy unless their supplier has committed to backing it with GOs.

8.2 Uniform Disclosure Statements

Domain GO schemes may provide additional rules related to the uniformity of Disclosure Statements. Several recommendations are provided in the subsections below.

8.2.1 Inform on the energy source mix per product, supplier and overall

The Disclosure Statement could inform customers on:

- **Product/contract mix:** the mix of Energy Sources in the specific energy product delivered to the customer as agreed in their contract with the supplier;
- **supplier mix:** the mix of Energy Sources for all energy of a specific Energy Carrier (e.g., natural gas), supplied by that supplier;
- **overall supplier mix:** the mix of Energy Sources for all energy supplied by the supplier, regardless of the Energy Carrier.

8.2.2 Standardize the level of detail of information on Energy Sources

It is recommended to standardize the level of detail of information regarding the Energy Source, which could be:

- **Main categories:** Renewable, low-carbon, fossil, nuclear
- **Subcategories** for each of the main categories, if applicable:
    - **Renewable:** Wind, solar, hydropower, biomass, geothermal, …
    - **Low-carbon:** (to be further specified in an upcoming delegated act related to the recast Gas Directive)

[40] https://www.aib-net.org/certification/disclosure-platform
[41] https://www.ceer.eu/documents/104400/-/-/832ddef0-87de-c539-38f8-ec4d6ce63269

- **Fossil:** Fossil natural gas, Shale gas, or in case of conversion: Hard coal, Lignite (or Brown coal), Low-carbon, Oil, Unspecified and others.
- **Nuclear:** no subcategorization.

- A full listing of all further Energy Source details as provided on the GO.
- In case no information is provided on the source of the gas, it could be explicitly mentioned as '**unknown**'. This is unfavourable to have as a long-term practice, which may trigger better data input in the process or enhanced efforts by the supplier for substantiating their supply with Tracking Instruments.

8.2.3 Mention the environmental effects

Depending on the energy source mix of the supplied gas, the greenhouse gas emissions and radioactive waste resulting from its procurement may vary.

Displaying these environmental consequences on the bill empowers customers to make informed, conscious product choices. It also supports companies in determining their climate impact and in building their climate strategies.

The greenhouse gas emissions and radioactive waste generation should be listed on supplier and product/contract levels in direct relation to the energy source mix, which is being disclosed. Furthermore, comparison or benchmark values should be provided.

Currently the detailed residual mix lacks sufficiently robust data sources, resulting in a large share of the RM being "of unknown energy source". Since suppliers must include not only the energy source but also the associated emissions in their disclosure statements it is still advisable to include "default emission data" rather than omit emissions altogether. When doing so, it needs to ensure that such default emission data would not present a cleaner picture than the actual emissions.

As such, it is recommended to fill in the "unknown" part of the calculated residual mix, with the energy source of the simplified residual mix and allocate default emission values to it, in the shape of a realistic/pessimistic fossil fuel comparator.

8.2.4 Inform on geographic origin

It is recommended to provide information on the geographic origin of the procured gas. In case all gas is covered by reliable Tracking Instruments, the actual geographic origin (or mix of origins) from those Tracking Instruments may be replicated. In case the Residual Mix is used, an indication may be given that the origin is unknown or undetermined, or an estimate can be made based on the calculation of the Residual Mix.

8.2.5 Provide transparency on public support

If (part of) the supplied gas has received public support (investment and/or production support), it should be transparently indicated.

8.2.6 Design and publish Disclosure Statements in a uniform manner

Apart from the contents, the graphical representation and means of publication may be standardized (see Figure 22).

Some options for publishing Disclosure Statements are on:

- The invoice: either any invoice or at least annually on an invoice,
- The supplier's website

- Any publicity means used by the supplier.

Additionally, general Disclosure information and aggregated figures for all suppliers may be presented on a national platform, such as the website of the Disclosure Competent Body.

Two real practical examples of gas Disclosure statements are included in ANNEX IV.4, referring to actual figures on invoices of a gas supplier in Austria.

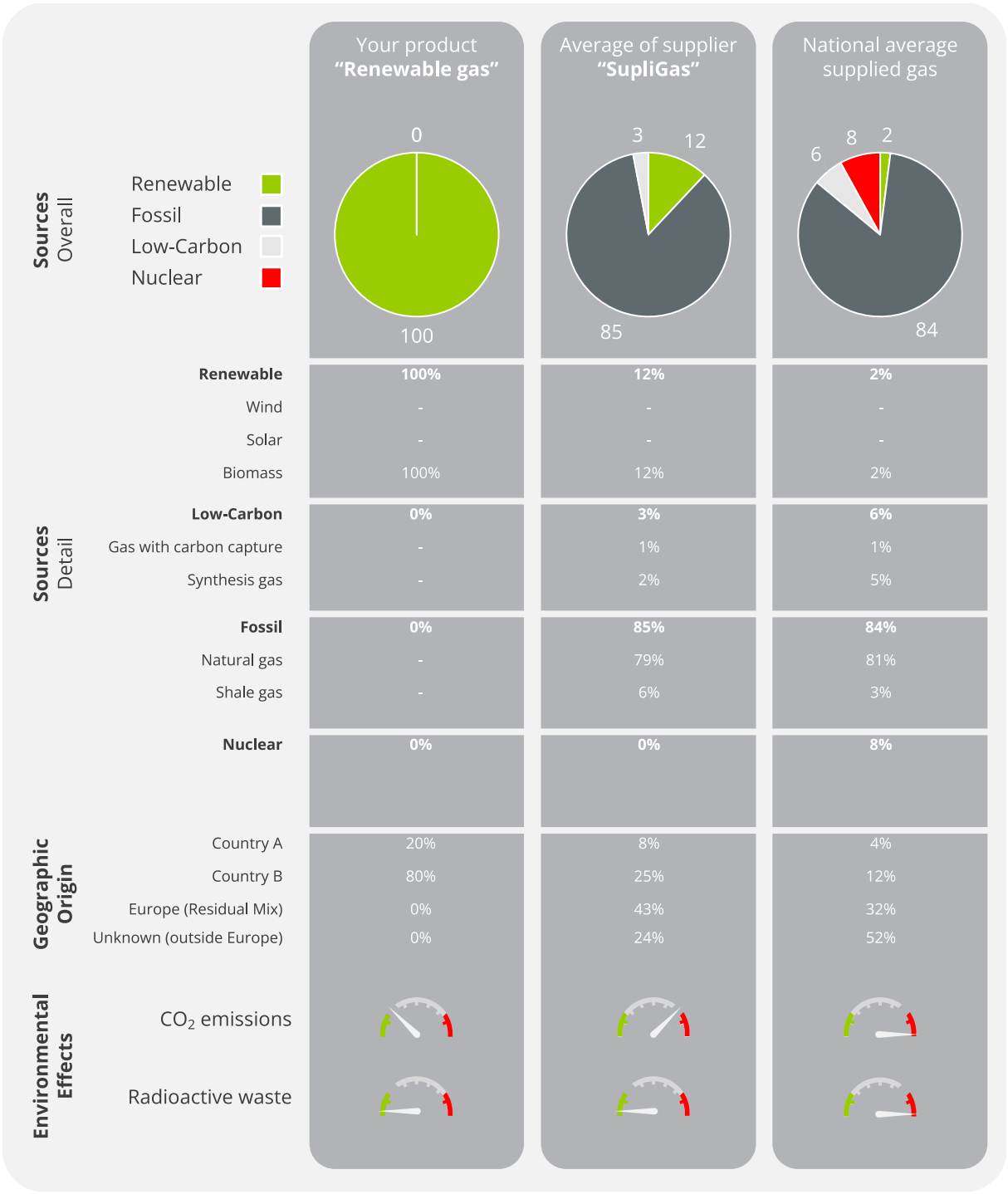

Figure 22: Mock-up for a Disclosure statement for gases.

8.3 Elements in the Disclosure framework for avoiding multiple claims

The Residual Mix needs to be based on the existing legislative and disclosure framework and enable Member States to avoid multiple claims of the same attributes. This implies:

a. Ensuring that suppliers provide fuel mix information on or with the bill and environmental information on the fuel mix at least in the form of information on reference sources, such as webpages.
b. Ensuring that the information provided by suppliers is presented in a comprehensible and, at a national level, clearly comparable manner.
c. Ensuring that the information provided by suppliers is reliable.
d. Nominating the regulatory authority or another competent national authority to supervise the reliability and comparability of this information.

Furthermore, it is recommended to set a harmonised deadline for cancellation of GOs related to claims on the attributes of energy consumption in a preceding year, which should be consistent with the broad implementation in the majority of Member States of the RE-DISS recommendation. In order to calculate a meaningful Residual Mix, which does not come with too much delay for usability and allows for practical procedures to get finalised, a harmonised cancellation deadline could be set at 31 March of year X+1 in line with the current practice for electricity.

As an alternative, Member States could consider making the use of GOs mandatory for all energy supplied to final consumers, the so-called full disclosure model. In this model, all the energy is represented by Tracking Instruments, or, in other words, none of the energy is untracked. As a consequence, there is no need to calculate a Residual Mix. Currently, Austria, the Netherlands and Switzerland apply the full disclosure model for electricity[42].

Single tracking instrument for energy suppliers: ensure that all energy products offered by suppliers with claims regarding the origin of the energy (for example “renewable” or low-carbon energy) are based exclusively on cancelled GOs. No other tracking systems than the UDB and GOs should be allowed.

[42] AIB, 2024. European Residual Mixes - Results of the calculation of Residual Mixes for the calendar year 2023

CONCLUSIONS AND RECOMMENDATIONS

9 SUMMARY ON RESIDUAL MIX CALCULATION METHOD

The Residual Mix aims to be the cornerstone in a framework for reliable energy origin tracking. It provides the mix of energy sources in untracked commercial offers. To account for non-tracked renewable energy and cross-border flows of tracking instruments, the Residual Mix calculation must be carried out per system boundary. To be relevant, such a Residual Mix calculation must be reliable, accurate and timely.

This report analysed basic design aspects of the Residual Mix calculation method, elaborated two approaches to calculate the Residual Mix, identified and analysed sources for the necessary input data and reflected on how to use the Residual Mix for Supplier Disclosure.

9.1 Methodological choices for the calculation of a reliable Residual Mix for gases

Before the Residual Mix for gases can be calculated, methodological choices must be made . These relate to:

1) the boundaries of the system for which the Residual Mix is calculated,
2) energy sources to consider and
3) which tracking instruments qualify for reliable disclosure.

9.1.1 Two system boundaries: natural gas system and hydrogen network

To determine the perimeter of Disclosure of the energy sources, system boundaries must be set first.

System boundaries consider three dimensions: first, a geographical demarcation; second, energy carriers to consider; and third, the dissemination level or the network characteristics.

The price settlement areas, used in the gas trade and coinciding with the different countries, can be used as geographical demarcation. The relevant energy carriers to consider are methane and hydrogen. Hence, two distinct system boundaries – one for the natural gas system and another for the hydrogen network – are considered, while it is deemed too early distinguish between the transmission level and the distribution level. Other Residual Mixes should theoretically apply to vehicle transported gases, but their relevance can be questioned as these supply chains are much less regulated.

Finally, the distinction between gross production and on-site consumption should be consistently applied throughout the Residual Mix calculation formula and the available data sources.

9.1.2 Energy sources: renewable, fossil and nuclear

For each energy carrier, different energy sources are considered in the Residual Mix calculation. Inspired by EU legislation, the categories renewable, fossil, and nuclear energy are considered. Renewables and fossil energy could be further subcategorised; such a finer subcategorization supports to translating energy sources into environmental impacts (GHG emission, generation of radioactive waste, …) related to energy consumption.

9.1.3 Tracking instruments: which qualify and how do they interact?

Before being able to determine the residual mix, it must be clear based on which instruments claims can be made regarding the consumption of renewable and low-carbon gas. Though the definition of the 'residual energy mix' in the Renewable Energy Directive (art.2) excludes cancelled Guarantees of Origin (GO) from the annual energy mix for a Member State, the question is whether this definition of leaves room for double counting if in reality some parties make consumption claims based on Proofs of Sustainability (PoS) if they are not backed by GOs. Double counting must be prevented if this would be the case.

National legislation determines which Tracking Instruments are allowed for claims of renewable gas consumption, as can be derived from the legislative requirements investigated in this study, and there may be differences per type of stakeholder regarding tracking instruments to be used.

This report considers two options, regarding which tracking instruments will be allowed by the national legislation:

1. only GOs qualify for reliable disclosure; (most straightforward)
2. besides GOs, also PoS registered in UDB (whether or not linked to GO) qualify for consumption claims for renewable gas (as they qualify for policy target accounting at a specific consumption point).

First a reliable framework for disclosure must be in place, before being able to arrive at a reliable Residual Mix calculation. Besides that, some hurdles concerning the interaction between GOs and PoS must be overcome. They concern, amongst other, import of renewable-claimed gases from outside the European Union, whether renewable claims can be based on UDB registered PoS, potential differences in the energy quantity represented by UDB registered PoS and GO (as auxiliary energy, transport and aggregation phase change losses might be accounted differently) and eligibility for representation by a tracking instrument in case of subsided energy production.

In addition, measures must be in place to prevent double counting.

9.2 Two calculation methods for Residual Mix for gases

In this report, two calculation methods for the Residual Mix for gases are elaborated: a detailed one and a simplified one.

9.2.1 Detailed calculation method: coping with storage and import/export

A first, detailed calculation method is inspired by the existing calculation method for a Residual Mix for electricity. However, some amendments were necessary to reflect some significant differences between the gas market versus the electricity market.

A first difference concerns energy storage. While stored quantities were so far rather insignificant for electricity RM, long-term gas storage is an important constituent in securing the energy supply for the EU. As a result, terms related to storage are added to the calculation method. In case a country has a net-release from storage, this is included in the Domestic Residual Mix. In case a country has a net-input into storage, this term is to be included in the Untracked Consumption.

A second difference concerns the significance of energy transfer between the countries for which the Residual Mix is calculated and countries outside this calculation area. While such a

trade is very limited for electricity compared to domestic production, it is very significant for gas (currently very significant for natural gas, likely very significant for hydrogen as well).

To cope with this difference, export of gas is considered as part of the Untracked Consumption, in contrast to electricity where this is considered part of the Domestic Residual Mix.

9.2.2 Simplified calculation method: coping with unclarity about tracking instruments and unavailable input data

At the time of writing this report, disclosure legislations are still under development in the member states, for which there are still too many hurdles that hamper an accurate and timely calculation of the Residual Mix according to this detailed calculation method: the lack of clarity on an exhaustive list of the tracking instruments qualifying for reliable disclosure by all stakeholders, and how they should interact, the lack of necessary input data and - if available – the delays in their publication.

Hence, a simplified calculation method for the Residual Mix for gases was elaborated as an alternative for the detailed one. This simplified calculation method assumes the Residual to consist of the incumbent fossil energy carrier, which is (fossil) natural gas for methane and unabated Steam Methane Reforming-based hydrogen for hydrogen.

9.3 Search for data sources confirm concerns about their availability

9.3.1 Data needed on physical quantities of gas and on number of Tracking Instruments

To calculate the Residual Mix for gases according to the detailed calculation method, data on physical quantities of gas and on the number of Tracking Instruments for every system boundary for which the Residual Mix must be calculated is required. Yet, the data input needs can be reduced when considering the simplified instead of the detailed calculation method.

The time granularity is annual in line with the current practice for the Residual Mix calculation for electricity. For Tracking Instruments, a shift of 3 months (data covering 1 Apr X – 31 Mar X+1) can be considered to cope with the timespan between physical gas handling and administering the corresponding Tracking Instruments.

9.3.2 Not all data sources are operational yet

In this report, various data sources that can provide input to the calculation method have been identified.

However, analysis of the availability of these data sources demonstrates that not all of these data providers are operational yet. If operational, the timing of their publication does not allow a timely calculation of the Residual Mix.

9.4 Learnings from testing calculation methods

9.4.1 A calculation example confirms the lack of complete and qualitative data

To test the elaborated calculation methods, a calculation example was carried out for methane. It considered fossil gas and biomethane as energy sources and covered six countries: Belgium, Denmark, France, Germany, Luxembourg and the Netherlands.

The calculation example confirmed the lack of a complete and consistent dataset to accurately and timely calculate the Residual Mix. Although data from 2022 were taken, many of data gaps remained, mainly for biomethane. To cope with these data gaps, a lot of assumptions have been made, and therefore, the calculation example depicts a hypothetical market condition that deviates from the actual market conditions. Yet, the assumptions allowed to test the calculation flow for the Residual Mix for gases.

Further, some data turned out to hold inconsistencies, such total imports and exports statistics of natural gas versus detailed import and export statistics split by partner countries.

9.4.2 Inputs must equal the outputs

The calculation example exercise teaches that the inputs must match the outputs for the calculation formula to fit. This is a requirement for both for the physical quantities as for the Tracking Instruments.

Imbalances, in either the physical quantities or the number of Tracking Instruments, could lead to vanishing attributes, or to the number of attributes in the European Attribute Mix being artificially stretched. The latter would double-count some attributes and also the first would not be a correct representation. When reaching a balance in inputs and outputs both for the physical quantities as for the number of Tracking Instruments, this problem is proven to be prevented. As such, the calculation exercise stimulates a continuous quest for completeness and accuracy of data, which is helpful for a correctness confirmation, yet time-consuming and with the currently available data sources not yet leading to a satisfactory result.

9.4.3 Unknown energy source of gas import: main difference between calculation methods

An important influence on the RM result is the lack of proven energy source of imported gas. The detailed method is precautious and indicates ‘unknown’ as energy source of imported gas, while the simplified method assumes imported gas to consists of 100% fossil gas. This difference in approach translates into significantly different end-results for the Residual Mix. When it comes to including the carbon impact of different sources of fossil gas, this needs higher attention to detail.

The renewable attributes in the Residual Mix, originate from expired Guarantees of Origin and partly from untracked renewables. One can question to what extent renewable gases would not be covered by Tracking Instruments or that market participants would allow these to expire. If all renewable and low-carbon gases would be covered with Tracking Instruments, the share of renewable and low-carbon attributes in the Residual Mix will be limited.

Finally, the calculation example demonstrates that the European Attribute Mix has a still a limited redistribution effect. Hence, the added value of the detailed calculation method, which is built on this redistributional effect, can be questioned.

Note: Though hard to establish with the high quantities of imported gases, once all energy would be accompanied by tracking instruments, the residual mix calculation would become redundant.

9.5 Conclusion: simplified calculation method is currently the best option

9.5.1 The EU not ready for a detailed calculation method for a Residual Mix for gases

Today, the actual implementation of many of the rules in recent legislation impacting claims on renewable gas consumption, is not yet fully established, for which it's the consistency cannot yet be confirmed by practice.

Developing the Residual Mix can only be done in a consistent manner, where there are sufficient controls over the tracking instruments used for renewable energy consumption. An overarching legislative framework needs to ensure consistency in the tracking instruments for different purposes, and/or the implementation of the rules must be such that this consistency is there in practice. Different legislative provisions on the various Tracking Instruments and on disclosure obligations interact and would strongly benefit from further harmonisation, whether top-down or bottom-up.

Also, currently the numerical data is not yet systematically available to cover accurate Residual Mix calculation over all Member States of the full European Union and interacting natural gas and hydrogen market. Even where it is available, ensuring timely access still requires improvement.

Furthermore, practice has shown that coming to consistent implementation of Residual Mix calculation methods in all Member States, can take time, and lacks a formal organisation that can ensure such consistency and coordinated roll-out.

Currently, it hence cannot yet be confirmed that the EU is ready for a detailed calculation method for a Residual Mix for gases.

9.5.2 Simplified calculation method until necessary conditions are established

Therefore, the simplified calculation method can serve until the conditions are established for a more detailed approach. This means the Residual Mix for gaseous Energy Carriers to be assumed constituting from fossil natural gas or unabated Steam-Methane Reformed hydrogen.

The main reasons for opting for the simplified calculation method are:

1. It prevents double counting of renewables without a doubt, as the Residual excludes all renewables;
2. The market generally assumes that renewable gases will almost always be tracked with explicit tracking towards consumers, so the share of renewables in the Residual Mix is anyway assumed to be very low for gases;
3. It is simple and easy to explain to consumers.

When translating the energy sources into the carbon footprint of the Residual Mix, it will however need further subcategorization of the fossil energy sources, especially where there would be a big share of fossil gases with higher emission intensity than methane. Especially for imported hydrogen based on coal-based electricity, this is an attention point. As long as volumes for those are negligible, this may be considered marginal.

To conclude, one can assume that the Residual Mix in practice will predominantly consist of fossil natural gas or unabated Steam-Methane Reforming-based hydrogen,

hence the proposed simplified approach works until the conditions for the more detailed Residual Mix calculations are fulfilled.

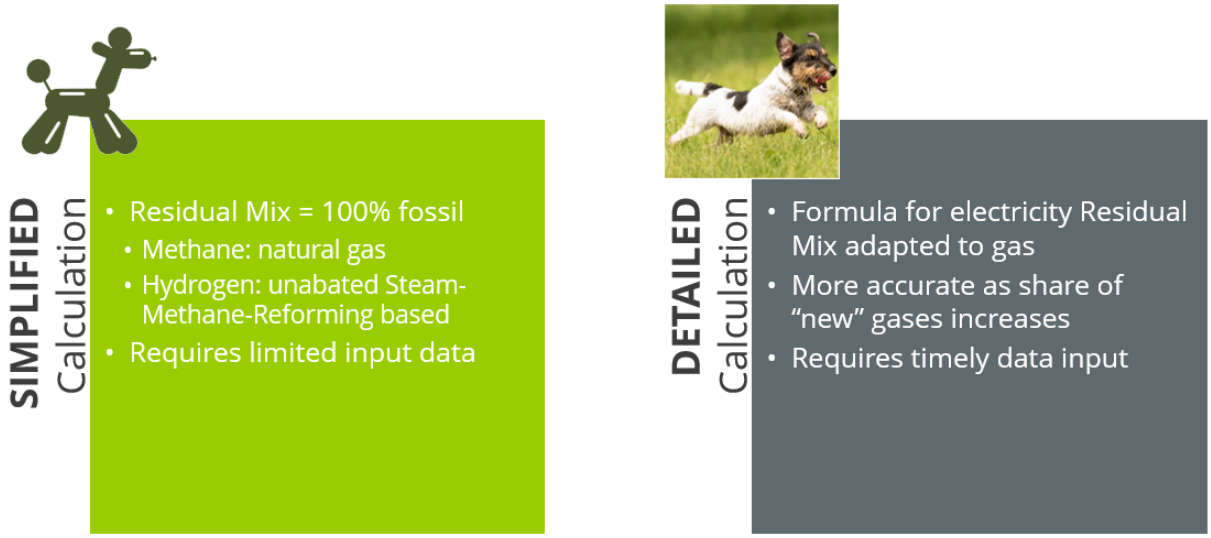

Figure 23: Illustration of the conclusion: Simplified methodology for residual mix calculation until data sources are complete and timely available and national frameworks on gas disclosure are completed

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusion

The Residual Mix is a crucial element in establishing a reliable framework for tracking the origin of energy, particularly for untracked commercial offers. Its primary purpose is to account for non-tracked renewable energy and cross-border flows of tracking instruments. A detailed Residual Mix calculation is necessary to ensure accuracy, reliability, and timeliness, with a specific focus on system boundaries and consistent regulatory implementation.

This report has outlined a method for calculating the Residual Mix, emphasizing the need to navigate complex regulatory requirements and define data flows that support an accurate calculation. Two main approaches for calculating the Residual Mix for gases have been identified: 1) a detailed, system-boundary-based calculation, and 2) a simplified approach, assuming that the Residual Mix consists solely of the incumbent fossil energy source (fossil natural gas for methane; unabated steam-methane reformed-based production for hydrogen). The report has elaborated on both approaches, illustrating their feasibility through an example calculation, although the results depend on assumptions due to data limitations. These calculations suggest that in the short term, the simplified approach can serve as an acceptable approximation, with the understanding that the actual calculation requires more robust data.

Key design criteria for a detailed Residual Mix calculation were identified, including the need to develop a Residual Mix for each system boundary, namely the natural gas network, hydrogen networks and other gas supply systems. The calculation should also follow established formulas and ensure consistency across energy carriers. Moreover, it is crucial to ensure that tracking instruments are legally sound and consistent, preventing double claims and enabling accurate emission calculations.

Several challenges were highlighted, including the need for consistent implementation of regulatory frameworks, reliable data sources, and consistent handling of energy carrier conversions. Legal requirements, such as those governing Guarantees of Origin (GOs) and Proofs of Sustainability (PoS), must be carefully coordinated to avoid discrepancies that could affect the accuracy of the Residual Mix. Data must also be available in a timely manner to ensure transparency and to empower informed consumer choices.

The development of a harmonized tracking system for gas attributes is essential to support the Residual Mix calculation. National legislation and EU-wide frameworks must work together to ensure consistency in tracking renewable and low-carbon gas consumption. The differences between GOs and tracking of policy targets through PoS registrations in the Union Database, particularly in how they handle energy quantities, expiry of tracking instruments, and transport losses, need to be addressed to improve the reliability of Residual Mix.

Given the current status of legislation and data availability, it is clear that the EU is not yet fully prepared for the detailed calculation of the Residual Mix for gases. Therefore, it may be prudent to adopt a simplified approach, assuming the Residual Mix consists of fossil natural gas, until the necessary data and regulatory frameworks are fully implemented. This approach offers simplicity, reduces the risk of double counting, and is easily understandable for consumers.

In conclusion, while a more detailed and accurate Residual Mix calculation is the long-term goal, the current state of implementation and data availability suggests that a temporary, simplified approach—assumed to be fossil gas—can serve as a practical solution until the conditions for a detailed calculation are met.

10.2 Recommendations for further harmonizing tracking system for gas attributes

While EU Member States are implementing gas disclosure rules and a GO scheme for gas, market players are developing commercial tracking systems. Following actions help to harmonise and/or synchronise these different systems with the view to prevent double counting and gain efficiency:

10.2.1 Facilitating the coordination between tracking systems

Action:

Enhance interaction of tracking systems across EU Member States, facilitating a common approach to tracking energy sources and preventing double counting of 1) the tracking instruments and 2) the claims of consumption that could be made with the same renewable or low-carbon gas.

Converge the implementation of tracking mechanisms, such as GOs and the tracking of PoS in other databases like UDB, to consolidate the purposes of the Tracking Instruments related to the same energy quantities.

Rationale:

Coordination and synchronization of tracking systems will ensure greater transparency and consistency across borders, which is essential for preventing double counting and only then achieving accurate Residual Mix calculations and preventing discrepancies in renewable energy claims. It will remove complications in how these Tracking Instruments are accounted and will prevent double claims of renewable gas consumption (see section 3.3).

10.2.2 Improving data availability and quality

Action: Further develop and standardize data sources at the EU level, ensuring consistent reporting of gas production, consumption, storage, and conversion statistics, including import/export data.

Rationale: Timely and accurate data are critical for calculating the Residual Mix and supporting transparent energy disclosure practices. Efforts should be made to close gaps in data availability, particularly with regard to cross-border energy flows and tracking instruments.

10.2.3 Ensuring access to used tracking instruments at national level

Action: Enable national bodies and authorised private supervisors and verifiers of disclosure statements to access information from the used tracking instruments.

Rationale: Aggregated statistics on issued and used tracking instruments, per energy source and per geography and system boundary, should be available to all parties involved in RM calculations. Relevant authorised parties can currently access data tracked in GO registries. Similar access rights should be implemented at national level in the Union Database for sustainable biofuels. Disclosure supervisors need this data at individual company level, while RM calculators need them aggregated at the level of the disclosure system boundaries.

10.2.4 Establishing clear disclosure system boundaries and definitions

Action: Define clear disclosure system boundaries (geographical and energy system boundaries) and ensure consistent categorization of energy sources (e.g., renewable, low-carbon, fossil, nuclear) across all data collection and reporting processes. Aim for harmonization of such system boundary definitions across nations and reflect these in the usage registration of the tracking instruments (like cancellation statistics of GOs and PoS usage registration in UDB).

Rationale: Consistent categorization and boundaries will prevent confusion and inaccuracies in energy disclosure and Residual Mix calculations.

10.2.5 Refining the Residual Mix calculation methodology

Action: Continue testing and refining the Residual Mix calculation formula, ensuring that it accounts for the full range of energy carriers (e.g., natural gas, hydrogen, vehicle transported gas) and energy source categories (renewables, low-carbon, fossil, nuclear).

Rationale: The methodology needs to be further validated and improved as more data becomes available and as tracking systems evolve, particularly with respect to energy conversion and storage, and the treatment of imported energy.

10.3 Concluding Remarks

To sum up, achieving an accurate and transparent Disclosure framework for gases, including a Residual Mix, will require concerted effort across multiple stakeholders, including regulators, market participants, and disclosure bodies. While the framework and methodology presented in this report provide a solid foundation, there is still much to be done in terms of data development, data availability, and system harmonization..

ANNEXES

ANNEX I STAKEHOLDER INPUT

I.1 Stakeholder Survey on high-level methodology for Residual Mix for gases

A survey was conducted from 9 March 2024 until 20 April 2024, aiming to collect preliminary stakeholder views on how a Residual Mix Calculation Methodology should be construed. This Annex provides an overview of the survey questions and summarizes the received feedback.

I.1.1 Survey Questions

1) Your name
2) Your organization
3) Country you operate from
4) The area of activity of your organization *(select one or more)*
    a. Supply of energy/Certificates to end consumers
    b. Legislator/policy development contributor
    c. Consumer of energy
    d. Trader
    e. Grid Operator (TSO/DSO)
    f. Issuing body for GOs
    g. Competent body for supervision of Disclosure
    h. Consultancy/academic/research
    i. Other, please specify
5) Do you feel that a residual mix for gases is relevant? (Yes/No)
6) Explain your reasoning to your above answer
7) Will it impact your work if there is a residual mix for gases? (Yes/No/Not sure)
8) Please explain how would it impact, why it would not, or why you are unsure
9) There are different distribution reaches for gases, depending on the means of transport and the type of gas. (transport through an interconnected pipeline system, transport by vehicle, transfer of renewable characteristics without physical connection ...)
   Do you feel that for a gases a separate residual mix need to be determined within different distribution system boundaries? (Yes/No/it depends)
10) Please elaborate on your response
11) Do you feel that a separate residual mix should be calculated specifically within the following system boundary (in terms of distribution reach): (select one or more)
    a. for gases taken from all European regulated natural gas grids?
    b. for every single non-interconnected natural gas grid? (= separately for local grids and for gases taken from the European interconnected natural gas grid)?
    c. as wide as gas GOs (all gases including hydrogen) are accepted in EU?
    d. for every single hydrogen grid?
    e. aggregated for all hydrogen grids
    f. aggregated for all hydrogen transported to their consumers by vehicle
    g. all hydrogen, irrespective of way of transport
    h. single RM for all gases including hydrogen, irrespective of the way of transport

i. Other, please specify

12) Which energy sources need their own category in the Residual Mix for gases? (Multiple refers to further subcategorizing, e.g., Multiple Renewable Sources in this context could mean subdividing into Wind/Solar/Hydropower/Biomass/Other) (select one)
    a. Renewable / Fossil / Nuclear
    b. Multiple categories of Renewable Sources / Fossil / Nuclear
    c. Multiple Renewable Sources / Multiple Fossil / Nuclear
    d. Multiple Renewable Sources / Fossil / Multiple Nuclear
    e. Multiple Renewable Sources / Multiple Fossil / Multiple Nuclear
13) In case you selected a category with “multiple”, which exact subcategories would you propose?
14) When calculating a separate residual mix per type of gas, how would you define categories of relevance to refer to the type of gas, for which a separate residual mix calculation is needed ? (considering natural gas / hydrogen / methane / propane / butane / ... or welcome to phrase such categories in any other way)
15) Optional: provide more information about which categories would be needed in your answer above.
16) Which data sources do you recommend, as an input for calculating the Residual Mix?
    a. natural gas consumed in your country from the natural gas grid
    b. the consumption of natural gas that is delivered to consumers by vehicle
    c. the consumption of hydrogen delivered through a pipeline system
    d. the consumption of hydrogen delivered to consumers by vehicle
    e. the production of renewable gas excluding hydrogen
    f. the production of hydrogen from renewable sources
    g. the production of hydrogen that complies with the criteria of the RFNBO Delegated act
    h. (number) the quantity of issued / expired/ exported/ imported/ cancelled gas GOs for a certain year of production/consumption
    i. the quantity of issued / expired/ exported/ imported/ cancelled hydrogen GOs for a certain year of production/consumption
    j. the quantity of issued / expired/ exported/ imported/ cancelled gas attributes covered with other Reliable Tracking Systems (= other than GO) for a certain year of production/consumption
    k. the quantity of issued / expired/ exported/ imported/ cancelled hydrogen attributes covered with other Reliable Tracking Systems (= other than GO) for a certain year of production/consumption
    l. the physical import of natural gas in your country the physical import of hydrogen in your country
    m. proofs of sustainability

    Welcome to add only a single data source or multiple sources you are aware of (if you just know data sources for one, just mention those you know)
17) What are the recommended data sources for the production of renewable gas in your country? (with reference to source, if possible)
18) What are the main challenges and potential solutions you see in calculating the residual mix for gases?
19) Do you feel that Proofs of Sustainability should entitle for claiming the renewable characteristics of the origin of gases to end consumers? (Yes/No/Not sure)
20) Do you feel that Proofs of Sustainability should entitle for claiming the low-carbon characteristics of the origin of gases to end consumers? (Yes/No/Not sure)

21) Please elaborate on your response to the above two questions
22) What general advice do you have for developing a residual mix calculation method for gases?
23) My responses may be displayed in the report that elaborates a proposal for a Residual Mix calculation methodology (Yes/Yes but without displaying my identity/Yes but without displaying the identity of myself and of my organisation)

I.1.2 Survey Report

I.1.2.1 Stakeholder readiness for a Residual Mix for gases

Survey question:
Is Residual Mix for Gases relevant?

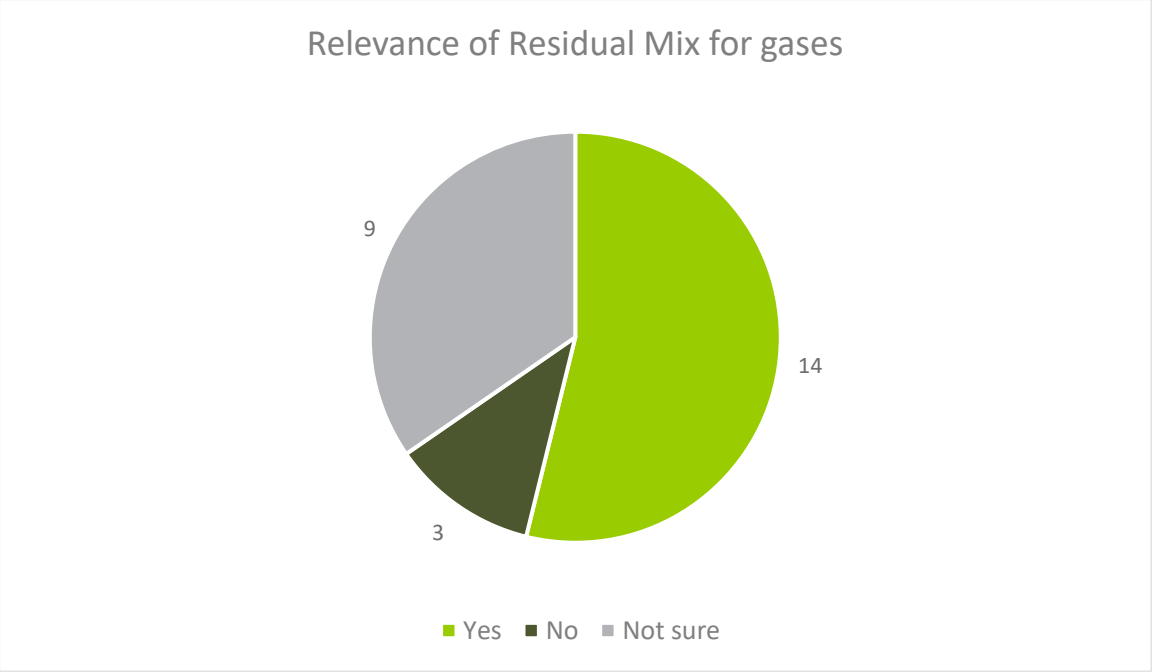

Figure 24: Is Residual Mix for gases relevant?

More than half of the respondents highlight the relevance of a Residual Mix for gases based on following arguments:

- The Residual Mix for gases is a key tool to inform end-consumer about the attributes of gas, such as the associated upstream emissions, and to make them aware of the decarbonisation potential.
- The purpose of the Residual Mix is to indicate the composition of sources of the provided energy for which no GO were cancelled, such as low carbon gases.
- When a country imports GOs for renewable gas, it exports at the same time attributes of fossil gas, and these should be allocated to the GO exporting country.
- The Residual Mix is instrumental in avoiding double counting.
- It helps to harmonize a common calculation methodology for all Member States.
- Public data on the Residual Mixes is important to make the energy attribute flows in Europe transparent.

The arguments of the respondents, indicating that the Residual Mix for gases is not relevant are:

- The quantities of renewables are currently too low and the introduction of a Residual Mix for gases is too premature; the costs would outweigh the benefits.
- Any renewable gas will be labelled with GO and/or PoS. So, there will not be amounts of non-labelled green gas.
- Today the GO system for electricity does not capture all the renewable electricity can be considered as a shortcoming of the system.

I.1.2.2 Impact of Residual Mix for gases for respondents

Survey question:
Will it impact your work if there is a Residual Mix for gases?

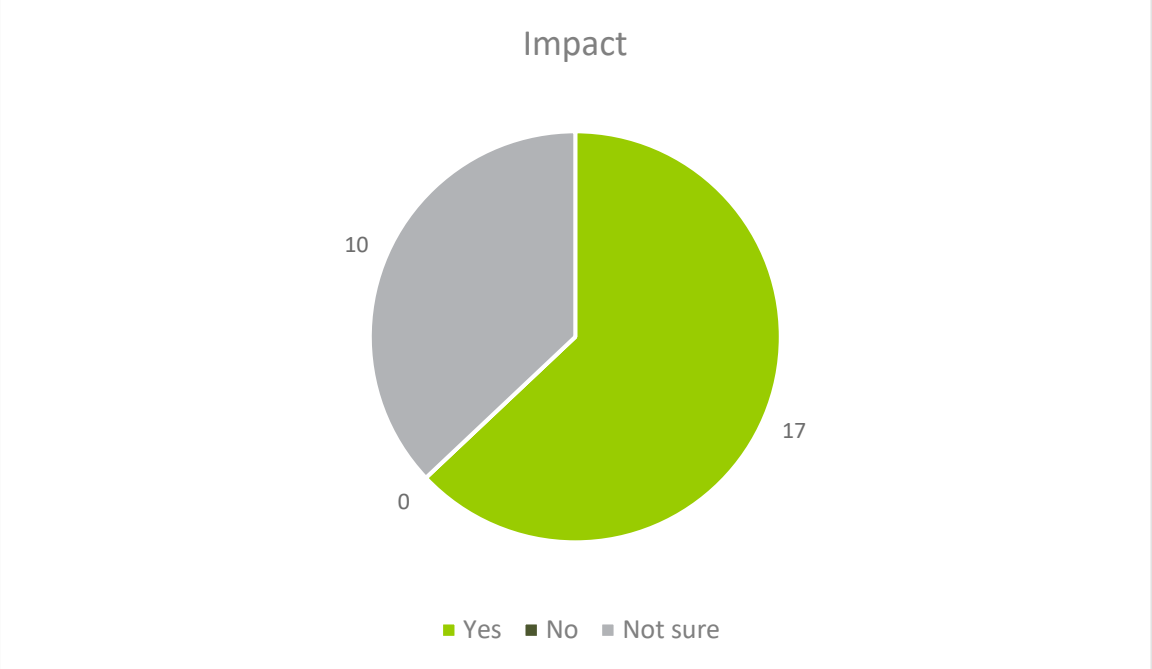

Figure 25: Impact of Residual Mix for gases on respondents

The majority of respondents indicated that the Residual Mix of gas will impact their work. Most indicated that it would lead to additional work and responsibilities.

Some energy consumers refer to the impact on the consumer choice as a positive outcome of the Residual Mix:

- The Residual Mix will encourage many end-users, such as local authorities, to seek Guarantees of Origin for their gas supply and will be challenged to decarbonise their gas supply from the operation of the GO system and the Residual Mix.
- We are a natural gas consumer interested in adopting a market-based approach for our gas consumption in order to reduce our scope 3 emissions and the product carbon footprint of the H_2 we produce from natural gas.

The respondents, indicating to be unsure about the impact of the Residual Mix, need more details on its implementation before they can make an assessment.

I.1.2.3 Residual Mix – distribution system boundaries

Survey question:
There are different distribution reaches for gases, depending on the means of transport and the type of gas. (transport through an interconnected pipeline system, transport by vehicle, transfer of renewable characteristics without physical connection ...).
Do you feel that for gases a separate Residual Mix need to be determined within different distribution system boundaries?

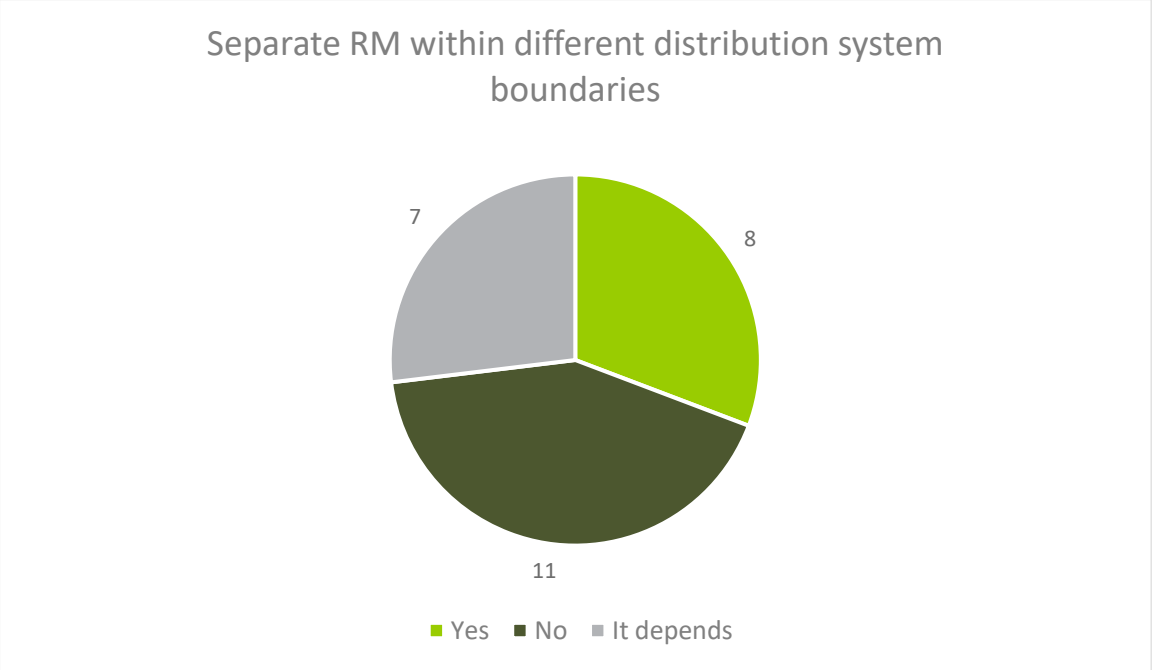

Figure 26: Need for a separate Residual Mix for different distribution system boundaries

The responses regarding whether a separate Residual Mix should be calculated within specific distribution reach boundaries reveal a spectrum of perspectives with an almost equal distribution between the respondents in favour for a separated Residual Mix for different distribution systems, not in favour, and undecided. Interestingly, opposite opinions can be observed concerning the separation based on interconnections of grids and for off-grid gases versus grid-injected gases. Moreover, there is no correlation between the type of respondent (issuing body, regulator – supervising body, …) and the preference indicated.

The proponents raise a variety of arguments:

- Any gas that is transported by vehicle without being injected into the interconnected gas grid, shouldn't be counted for the residual gas mix.
- A distinction makes sense from the end consumer's point of view, as it is only relevant from his point of view what he receives from the respective distribution channel.
- The condition is to allow to distinguish between the different distribution reaches. The mass balance shall be respected. Also, the network characteristics shall be respected (RED III): local distribution grid, distribution grid, transmission system...

The arguments, raised by opponents, are:

- Some indicate that tracking would be too difficult when separated Residual Mixes would be considered for different distribution systems, which may lead to confusion or omissions.

- If there is an exchange of gas and GOs between the different systems, a single Residual Mix method would make sense.
- A German respondent refers to the high number of operators of distribution systems in this country (700) and recommends Disclosure at the European level as the European gas grid is well connected.
- Both grid-connected and off-grid projects are part of the gas system, and considering one single Residual Mix would favour the promotion of renewable gas injection projects due to their geographical scope, which is independent of the grid.

The respondents who are undecided, state:

- The Residual Mix for networks that are not connected to the interconnected gas system shall be determined for all the isolated networks of the same gas as a whole. On the opposite side, the Residual Mix for off-grid supply (transported by vehicle) can be included within the same Residual Mix as for the interconnected gas system, as most of the off-grid supply comes from the LNG terminals (so supplied by the same suppliers operating at the gas networks).
- Separate Residual Mix should be determined for the natural gas network and the hydrogen network at the national level. The origin of off-grid gas should be based on the physical gas molecule.
- As a transitory measure, having separate Residual Mixes for smaller isolated systems is probably cheaper and easier to implement to begin with.

Survey question:
Do you feel that a separate Residual Mix should be calculated specifically within the following system boundary (in terms of distribution reach)? (selection of multiple answers was allowed)

This question does not reveal one most preferred option for segregating between system boundaries. The following options have the highest preference:

- For gases taken from all European regulated natural gas grids
- For every single non-interconnected natural gas grid (= separately for local grids and for gases taken from the European interconnected natural gas grid)
- For every single hydrogen grid

The answers indicate a preference for interconnectivity of grids as a basis to demark system boundaries, although a mix opinion for local grids versus pan-European grid for natural gas can be observed.

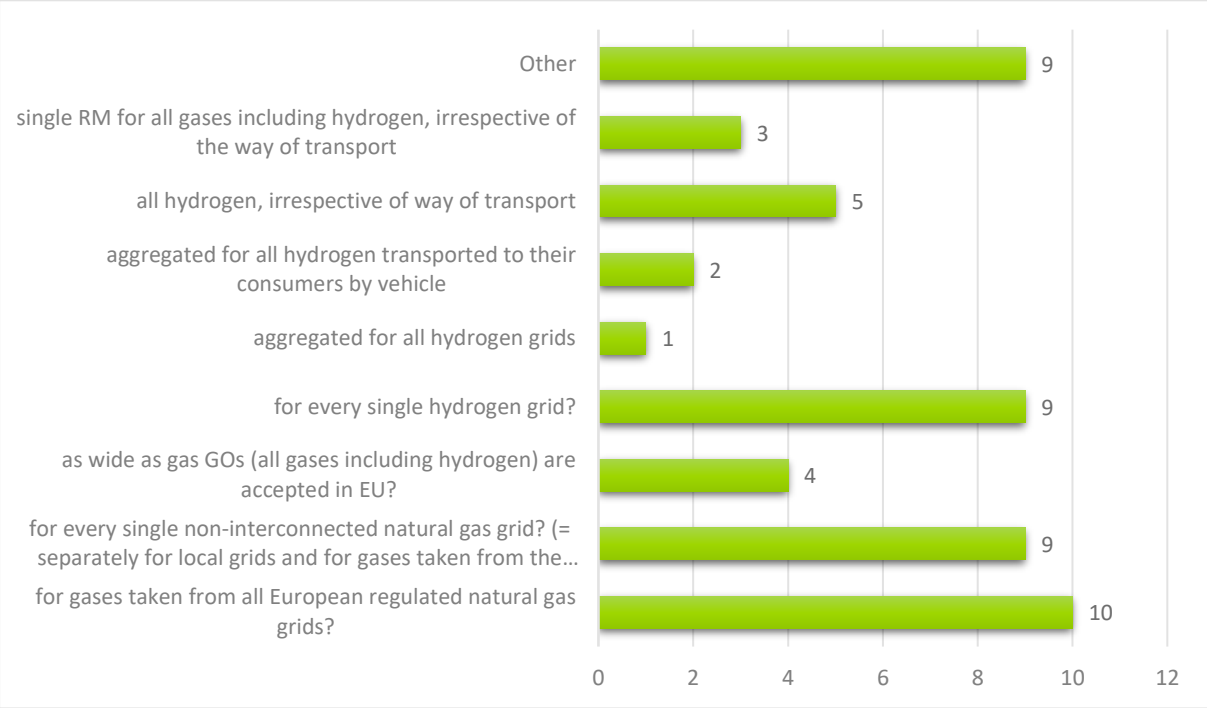

Figure 27: Different distribution reach

I.1.2.4 Residual Mix – energy source

Survey question:
Which energy sources need their own category in the Residual Mix for gases?

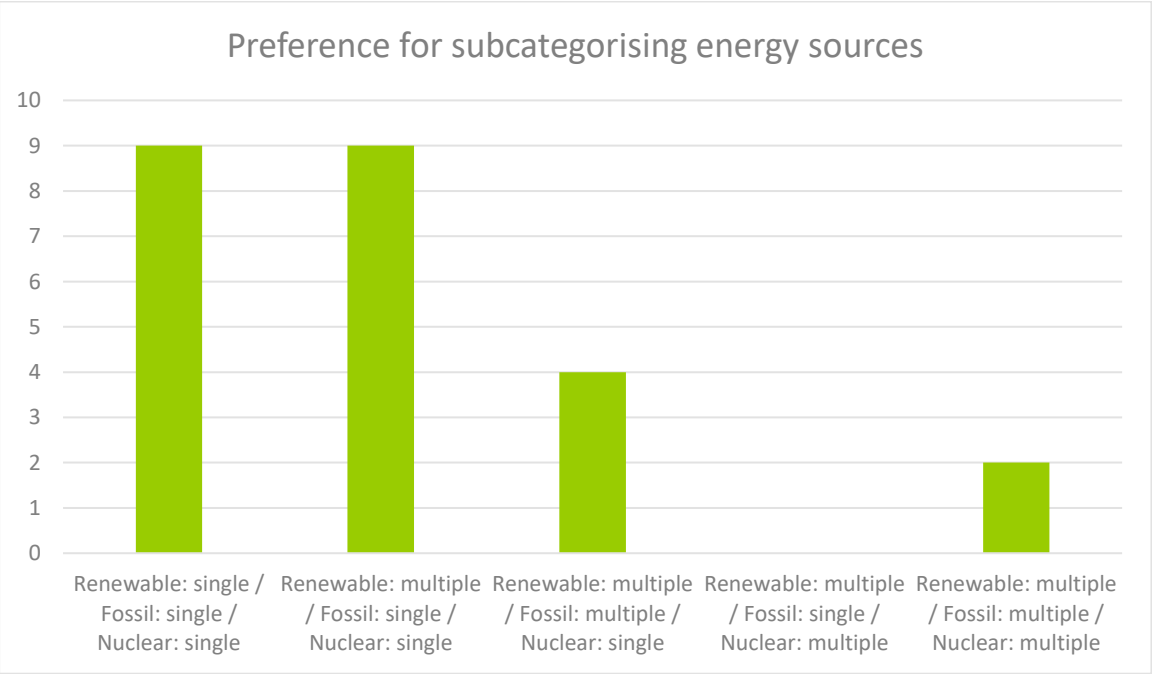

Figure 28: Categorisation of energy sources for determination of Residual Mix

In total 15 out of the 24 respondents are in favour of distinguishing multiple categories for renewable energy sources, while 18 out of 24 are in favour of considering fossil gases as one

source of energy. Most respondents (22 of the 24) are in favour of considering nuclear as one source of energy.

Survey question:
In case you selected a category with "multiple", which exact subcategories would you propose?

The respondents, in favour of subcategorising energy sources, suggested various subcategories, the one more detailed than the other:

- Renewable split between: Waste (bio) / Other (bio) / solar / wind / hydro
- Wind/Solar / Hydropower / Biomass / other
- Energy Crops / Agricultural Residues / Sewage Sludge / Municipal Waste / Food & Beverage Waste / Landfill / No Info
- Biomethane / hydrogen / other renewable gases
- Renewable sources: green hydrogen / biomethane / synthetic gas from wind/solar / Multi fossil: natural gas, grey hydrogen
- Renewables: Biomethane, E-methane and Hydrogen.

Some respondents suggested aligning the categorisations with existing legislation and standards, such as the Renewable Energy Directive (RED) or EN 16325 standard, to ensure compliance and consistency. Others highlight the need to add the category ‘low-carbon’. One respondent referred to the level of detail required of national Disclosure obligations. For example, in the Netherlands 'renewables' must be broken down into at least wind, biomass, solar, etc. And 'fossil' into coal, gas, etc.

Survey question:
When calculating a separate Residual Mix per type of gas, how would you define categories of relevance to refer to the type of gas, for which a separate Residual Mix calculation is needed?

Most correspondents propose to define two categories of relevance: natural gas (compatible gas) and hydrogen, in line with Art 19.8 of RED III: "Member States shall ensure that the Guarantees of Origin that are cancelled correspond to the relevant network characteristics” and with the categorisation included in the draft EN16325 standard “Guarantees of Origin related to energy - Guarantees of Origin”.

A few add not to expect other gas markets to develop next to natural gas and hydrogen and recommend limiting the number of gas types to reduce the complexity of the calculation and for the sake of clarity.

Another suggested making a distinction between fossil gas from the EU and from outside the EU.

I.1.2.5 Claiming renewable and low carbon characteristics of the origin of gases?

Survey question:
Do you feel that Proofs of Sustainability should entitle for claiming the renewable characteristics of the origin of gases to end consumers?

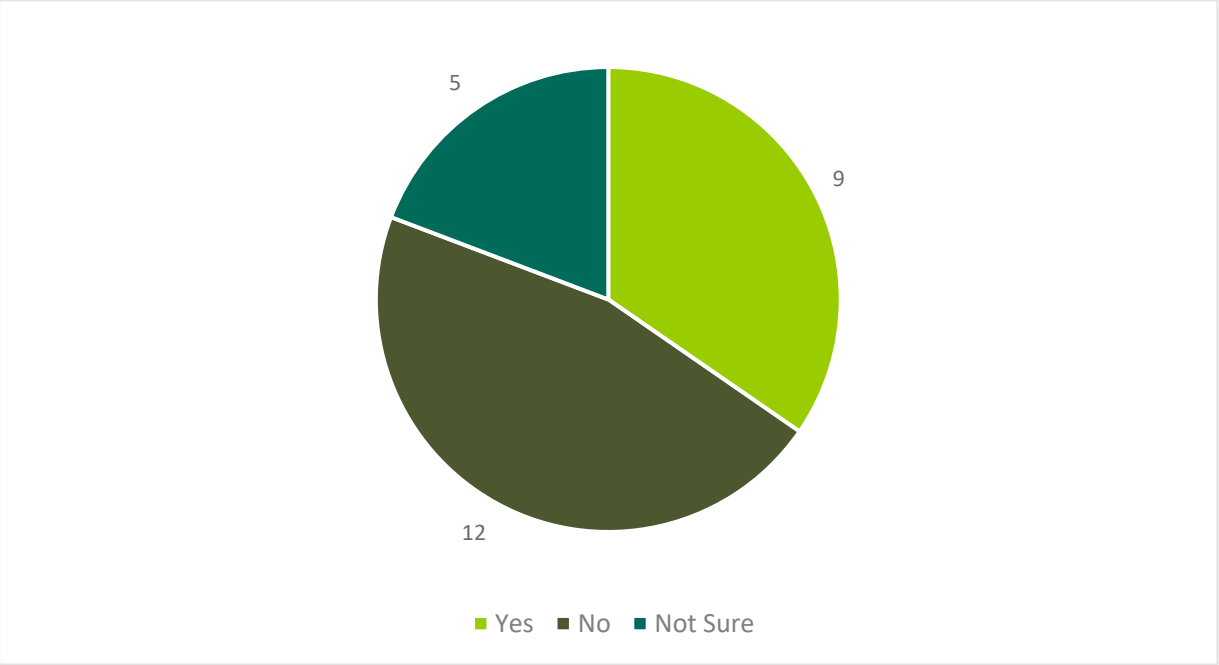

Figure 29: Should PoS be entitled to claim renewable characteristics of the origin of gases?

Almost half of the respondents indicated that Proofs of Sustainability should not entitle for claiming the renewable characteristics of the origin of gases to end-consumers. This group includes the majority of the issuing bodies and of competent bodies for supervision of Disclosure. About one third of the respondents indicated to be in favour of PoS as a tool to claim the renewable characteristics; this group includes most of the suppliers and consumers of energy.

Survey question:
Do you feel that Proofs of Sustainability should entitle for claiming the low-carbon characteristics of the origin of gases to end consumers?

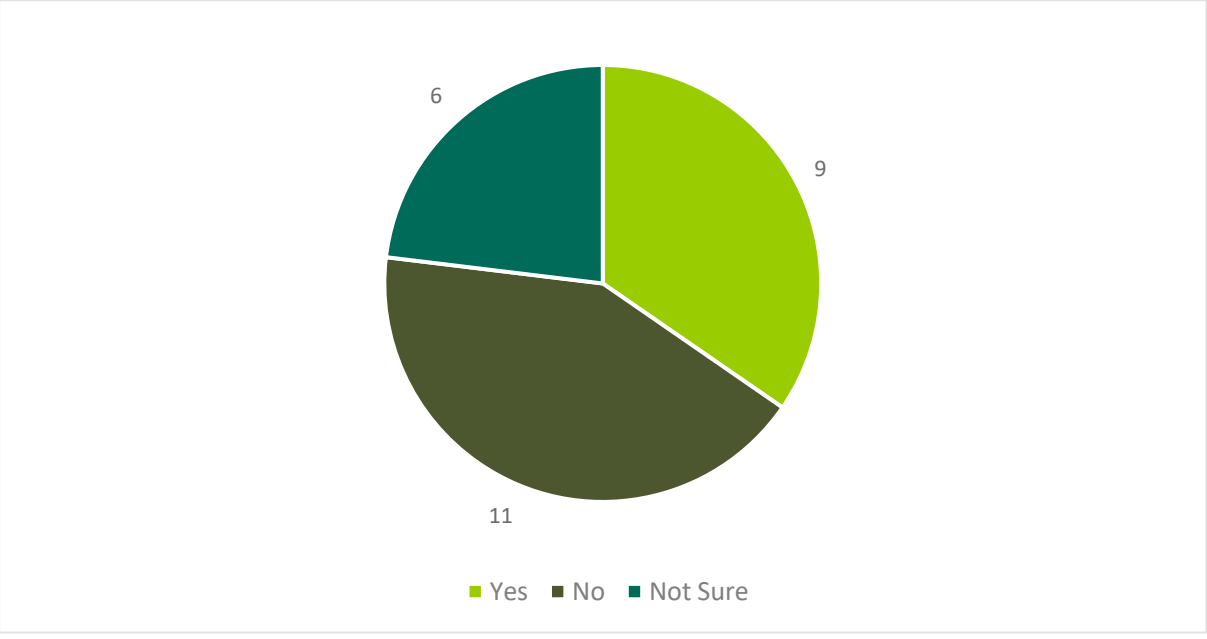

Figure 30: Should PoS be entitled to claim low-carbon characteristics of the origin of gases?

The survey reveals a divided opinion on both questions regarding the entitlement of claiming renewable and low-carbon characteristics of gases based on Proofs of Sustainability.

For both questions, almost half of the respondents indicated that Proofs of Sustainability should not entitle for claiming the renewable characteristics of the origin of gases to end-consumers. This group includes the majority of the issuing bodies and of competent bodies for supervision of Disclosure. About one third of the respondents indicated to be in favour of PoS as a tool to claim the renewable characteristics; this group includes most of the suppliers and consumers of energy.

The close split in responses highlights the need for further discussion and clarification on the criteria and implications of Proofs of Sustainability.

Similarly, respondents provided insights into their views on whether Proofs of Sustainability should entitle the claiming of the renewable and low-carbon characteristics of the origin of gases to end consumers:

Support for Entitlement of PoS for renewable gas consumption claims (Yes):

- Yes, BUT it shall be limited to the PoS from production from countries where the Art.19 has not been implemented. As long as producers have the possibility of having GOs, in order to avoid double counting, the PoS from this country shall no longer entitle claims.
- Guarantees of origin only contain information on GHG intensity on a voluntary basis. In the case of Proofs of sustainability, the focus is on GHG intensity and should therefore be usable as proof.
- The PoS is already recognised in combination with the proof of mass balancing for accounting towards the RES targets and also serves as proof towards the end customer.
- Yes, for target-compliance end-use. It is important that we ensure that the same energy is not claimed through GOs. This could be done by cancelling the GOs that have been used or not issuing a GO to start with.
- Because customer ask for POS to fulfil their compliance requirements, there is no economic advantages for GO and they would only lead to bureaucratic burdens.

Opposition to Entitlement of PoS for renewable gas consumption claims (No):

- Legally it is only a GO and should be used as basis.
- PoS should be used alongside GoO.
- GOs should only be issued if sustainability criteria are met (renewable=sustainable). Proof of sustainability needs to be integrated on the GO certificate and cannot be transferred separately.
- There is no standardized PoS format according to the EN standard, as is the case with GO. GOs are issued on the basis of output from a verified measurement device by an independent issuing body. For gaseous biofuels and LNG, there should be only one document, the GO with sustainability information, which would bring considerable simplification and order to the system.
- The purpose of the PoS should only be to demonstrate that RES and low carbon gases have been produced sustainably and with what emissions savings and that the energy entering the gas grid is certified.

- Information on the renewable gaseous fuel compliance with the EU sustainability criteria (also GHG emissions data and heating values) should be attributes of a GO as they are the characteristics of the gaseous fuel.

Uncertainty (Not sure):

- "Proofs of Sustainability" is an additional requirement of the source and is not directly related to whether it is renewable or not.
- They should be linked and be usable for any kind of purpose (target compliance, ETS market, voluntary market, ...). There should be only one climate value instrument: GO+PoS.

I.2 Stakeholder Consultation on the draft version of this report (Task 3)

Upon publication of the draft version of this report, the REGADISS project team presented it in a publicly accessible webinar and conducted a stakeholder consultation. This Annex reports on the results of the consultation.

Though the webinar was attended by a significantly higher number (69 participants, including 7 presenters) of people than the number of respondents to the consultation, the general feedback on the proposed approach was similar.

I.2.1 Feedback on consultation

I.2.1.1 Profile of the respondents

Survey questions:
Please state your organisation or affiliation.

From which country do you operate?

What is the area of activity of your organisation (multiple answers possible)?

In total 7 respondents replied to the survey.

Despite this low number, the respondents represent a variety of activities for their organisation – see Table 13, multiple answers per respondent possible.

Table 13: Summary of activity areas of the respondents to the consultation.

Activity of the organisation	Number of respondents
Competent body for supervision of Disclosure	3
Network/grid operator (TSO/DSO)	3
Supplier of energy / certificates to end-consumers	2
Consumers of energy	2
Issuing Body for gas	1
Trader	1

Following stakeholder groups were not represented by the respondents

- Legislator / policy developer
- Consultant / Academic / Research

The respondents were organisations from the Czech Republic (ERU), Denmark (Energinet), France (Air Liquide), Germany (EnBW Energie Baden-Württemberg AG), Portugal (ERSE) and included two Brussels-based European associations (ERGaR and ENTSOG).

I.2.1.2 Opinions on the calculation of a simplified Residual Mix for gases

Survey question:
In your opinion, is the presented draft methodology for the calculation of a simplified Residual Mix for gases (cf. Chapter 4 of the Task 3 Report) a good idea?

Respondents were asked to share their opinion on whether the draft methodology for calculating a simplified Residual Mix for gases, as outlined in Chapter 4 of the Task 3 Report, is a good idea. The Figure 31 summarises the responses, indicating diverse views.

Yet, the analysis of their arguments indicated a consensus among respondents that the simplified Residual Mix for gases is a good temporary solution, especially in view of the low quantities with energy tracking certificates and the immaturity of the reliable tracking systems for gas. Also, the relationship between the information tracked and its usefulness for carbon accounting is discussed.

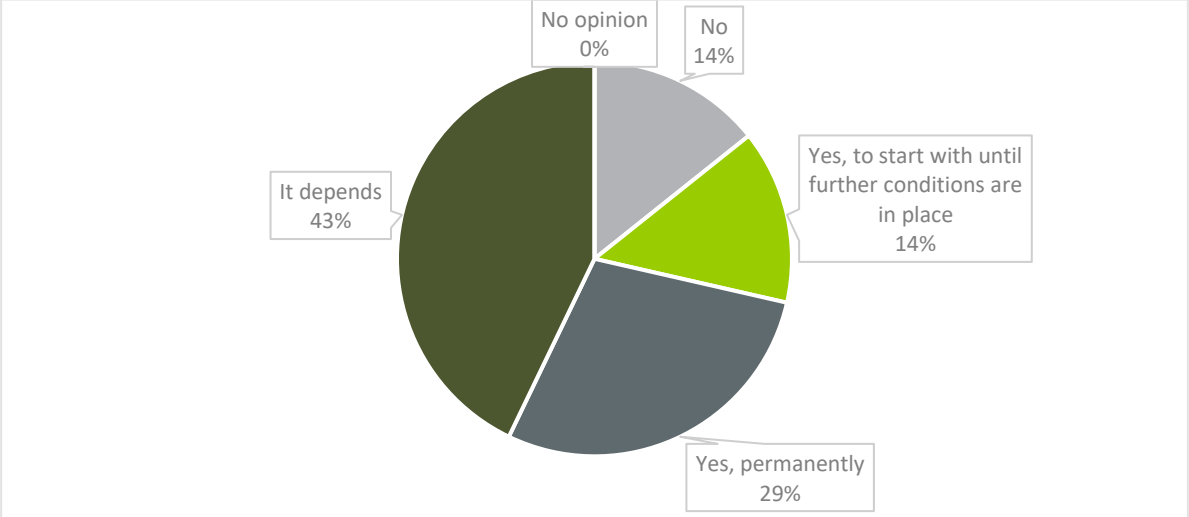

Figure 31: Distribution of consultation responses to the question if the simplified Residual Mix calculation is a good idea.

Survey question:
Please motivate your response to the above question on a simplified Residual Mix for gases (cf. Chapter 4 of the Task 3 Report).

The arguments of the respondents, in favour of a permanent application of the simplified methodology, are:

- For the sake of simplicity, as the respondent sees still some pitfalls with the more sophisticated methodology on the power market today, which leads to more confusion than help for the consumers.
- There is no demonstrable reason to distinguish the origin of the different fossil gases in the residual mix; EU legislation sets benchmarks for emissions savings (e.g. transport: 94 gCO_{2eq}/MJ) against which emissions savings are calculated relative to the fossil alternative, regardless of the origin of the fossil alternative.

The respondents, indicating that the simplified methodology is a good one start with, motivate their opinion with following arguments:

- It could be a good starting point until reliable tracking systems together with UDB, National Registries and data exchange systems between EU MSs are established.
- Rules for the recognition of imported gases should be set first, considering the importance of export/import for the gas and hydrogen market. There are currently only a few registries for gas GO in operation and the requirements for cross-border trade and disclosure of renewable and low-carbon gases are very fragmented with national requirements.
- There will be very limited renewable gas produced without a certificate as prices are relatively high.
- It is only a good idea when the observability and auditability of all the necessary physical quantities is established and published.

The arguments of the opponent of the simplified Residual Mix methodology are:

- The simplified Residual Mix methodology should distinguish between the Residual Mix calculations of the hydrogen and natural gas systems as both commodities do not have the same carbon content.
- Residual Mix calculations shall not be used to calculate direct CO_2 emissions (scope 1) which shall rely on the actual carbon content of consumed products. The residual mix shall only concern the emissions and other attributes related to the manufacturing of the products such as the origin of the feedstocks or energy used to manufacture them. It must not include any information related to the physical or chemical composition of the products which are defined by the actual specifications of the product.

I.2.1.3 Opinions on the calculation of a detailed Residual Mix for gases

The questions concerning the calculation of the Residual Mix for gases according to the detailed methodology asked about the appropriateness, the correctness and the completeness of the proposed methodology.

Survey question:
In your opinion, is a methodology for the calculation of a detailed Residual Mix for gases (cf. Chapter 3.5 of the Task 3 Report) a good idea?

Respondents were asked to provide their opinion on whether a detailed methodology for the calculation of a Residual Mix for gases, as outlined in Chapter 3.5 of the Task 3 Report, is a good idea. The responses offer a mix of support; see Figure 43 for a distribution of opinions regarding the detailed Residual Mix methodology.

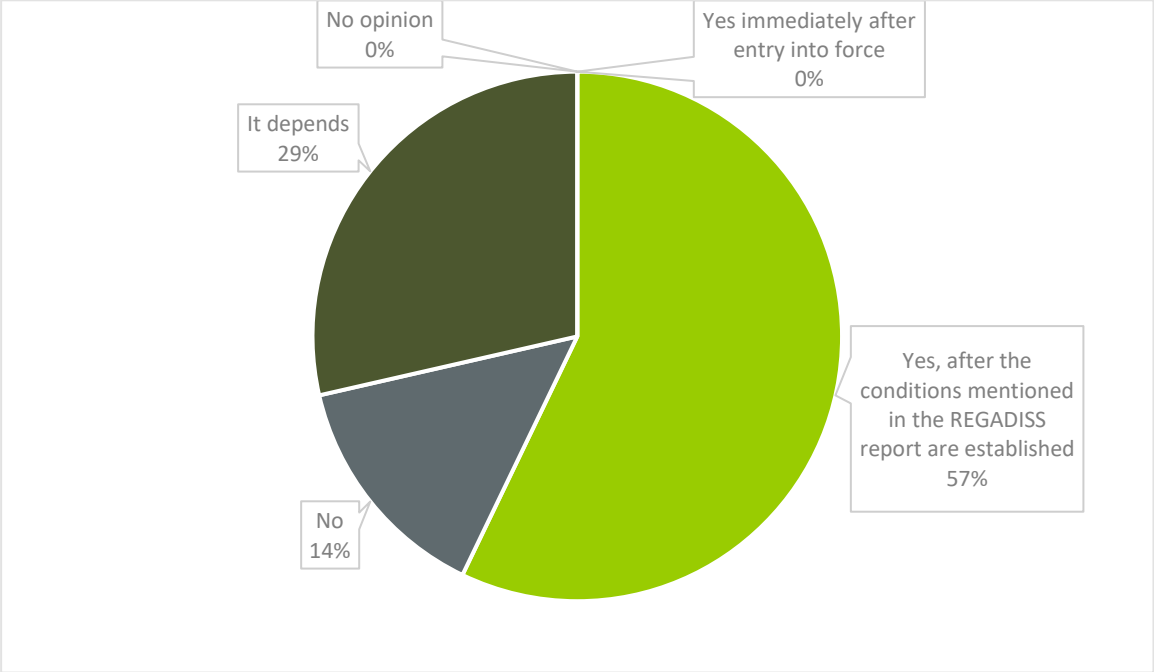

Figure 32: Distribution of responses to the question if the detailed Residual Mix calculation is a good idea.

Survey question:
Please motivate your response to the above question on the detailed Residual Mix for gases (cf. Chapter 3.5 of the Task 3 Report).

While two respondents explicitly indicated that the detailed Residual Mix calculation is the desired end goal, a majority highlighted the preconditions for a successful implementation:

- Proper systems and data exchange must be developed within MSs to avoid double claims, especially since the Residual Mix includes expired GOs that may be linked to a Proof of Sustainability that has no time limitation. That PoS could be sold and counted as renewable consumption by a specific end-user. That renewable volume would be counted two times: in the residual mix and as a specific consumption.
- A residual mix approach can be put in place only if the Carbon Full Disclosure can't be deployed. Each delivery of gas or hydrogen should have a carbon footprint attached. This approach shall be deployed in parallel of other regulations which would have to oblige the stakeholders (producers, suppliers) to disclose certain types of information.
- The "relevant network characteristics" need to be described in more detail. Yet, the distinction between hydrogen and natural gas grid will not be that relevant, as there are yet no public hydrogen grids in Europe and as the only marginal quantities of hydrogen will be injected into natural gas grids, which – if that would occur – would be allocated to natural gas.

Survey question:
In your opinion, is the presented draft methodology for the calculation of a detailed Residual Mix for gases (cf. Chapter 3.5 of the Task 3 Report) correct?

The collected responses highlight a range of views, from support to scepticism, see Figure 33.

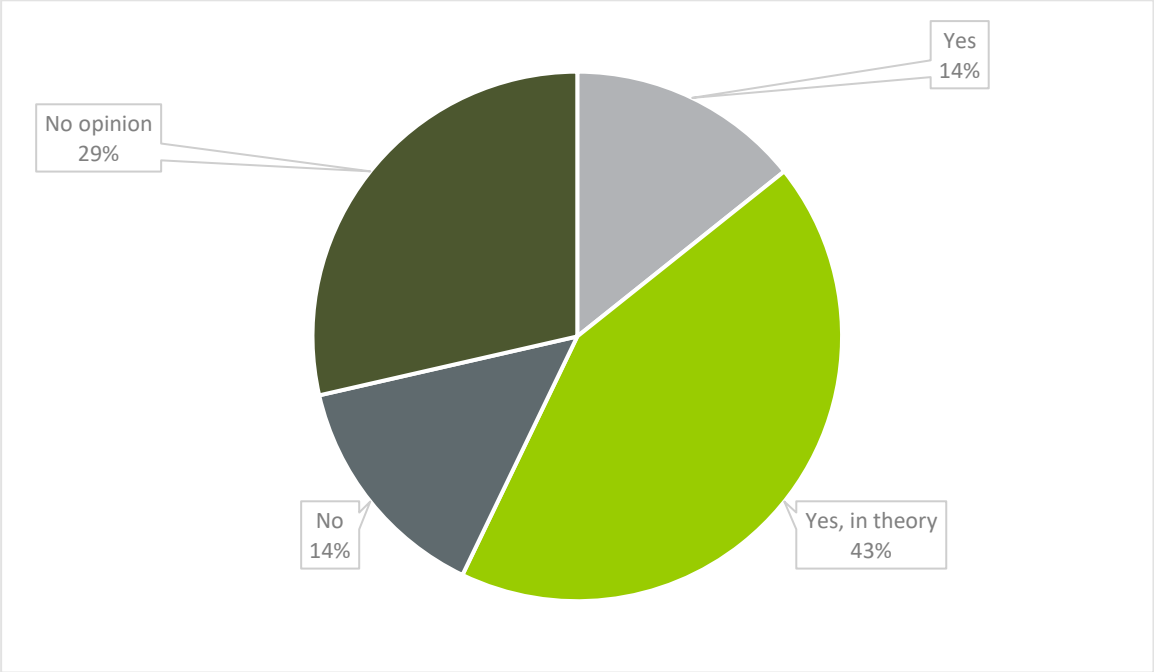

Figure 33: Distribution of responses to the question if the detailed Residual Mix calculation presented in the draft methodology report is correct.

The respondents showing reservations against the detailed Residual Mix calculation emphasized the practical challenges and complexities that need to be addressed for successful implementation. Some of them suggest developing a semi-detailed Residual Mix methodology: a simplified residual mix calculation in which some of the factors from the detailed calculation are included, such as imports/export of energy tracking certificates.

The one respondent expressing their scepticism arguing that the detailed calculation of the residual mix lacks a clear distinction between the residual mix, GOs which is a novel tracking instrument for gases, and mass balancing, which is already well established for gases. The draft methodology could create confusion and complicate compliance for market participants in case no clear guidelines for integrating these existing systems are given.

Survey question:
Are there parts of the reasoning regarding the Residual Mix calculation that should be adapted or supplemented?

Respondents were asked to identify any aspects of the reasoning behind the Residual Mix calculation that may need adaptation or supplementation.

Three respondents felt that the tracking instruments, other than GOs, are missing in the calculation methodology and called to include Proofs of Sustainability and Certificates of Origin into the equation.

One respondent pointed to the lack of harmonisation with the SHARES methodology. This SHARES methodology allows to allocate injected biomethane to a specific consumption sector without tracking it for the purpose of counting towards the national targets (statistical tracking without the need for a certificate). As some countries have combined GO and PoS in one certificate (GO+), the RM calculations should take the segment into account in which the energy is claimed to be consumed for the purpose of demonstrating both mandatory targets

and disclosure in one aggregated certificate. In case the GOs would not be cancelled to reflect the amount of energy, reported in SHARES, there is a risk of double counting if the GOs are applied for another sector.

Another respondent discussed the applicability of the Residual Mix for GHG accounting. He pointed out that there is no legal option to disclose the gas produced from outside the EU and that the GHG footprint associated with the imported gas or hydrogen may be much higher than the one of the Residual Mix. As a solution, this respondent suggested using default values for the GHG footprint of imported gases or hydrogen depending on its geographical origin in absence of a reliable disclosure.

In addition, the respondents proposed differentiating between public/regulated and private infrastructure and considering private infrastructure as a separate mass balancing perimeter. Private infrastructures should be able to establish a residual mix at the border of their operations, while gas flowing from private to public networks should be subject to the same conditions as if they were imported from outside the EU.

As a last point, the respondent highlighted that the suggested fall-back option, i.e. considering that the Residual Mix consists of fossil natural gas only, only applies to the natural gas-type of gas and not to other gases, such as hydrogen.

I.2.1.4 Opinions on the evolution of the Residual Mix calculation methodology

Survey questions:
Which methodology do you prefer on the short term?

Which methodology do you prefer on the long term?

If you answered "Simplified Residual Mix" in question 11 and/or 12: after how long, or on which conditions should the transition to the Detailed Residual Mix be made?

There is a consensus amongst the respondents that the simplified Residual Mix calculation methodology is the preferred one on the short term, see Figure 34. On the long term, the views are more diverse; a small majority is in favour of moving to a more detailed methodology, while a minority is in favour of sticking to the simplified calculation methodology.

The respondents, in favour of transitioning from the simplified to the detailed calculation methodology for the Residual Mix, outlined following conditions for such a transition:

- The operation of gas GO registries in all EU MS and the assurance of reliable cross-border trading (also with non-EU countries) of renewable and low-carbon gases
- Rules for the recognition of imported gases
- The availability of reliable and timely production data
- The operation of a robust and functional UDB
- Well-established and audited physical balances validated with the commercial balance
- A high enough amount of renewable gas in the residual mix (which the respondent finds rather unlikely)

The respondents, in favour of sticking to the simplified calculation methodology for the Residual Mix first want to see clear economic and environmental benefits before considering the detailed methodology.

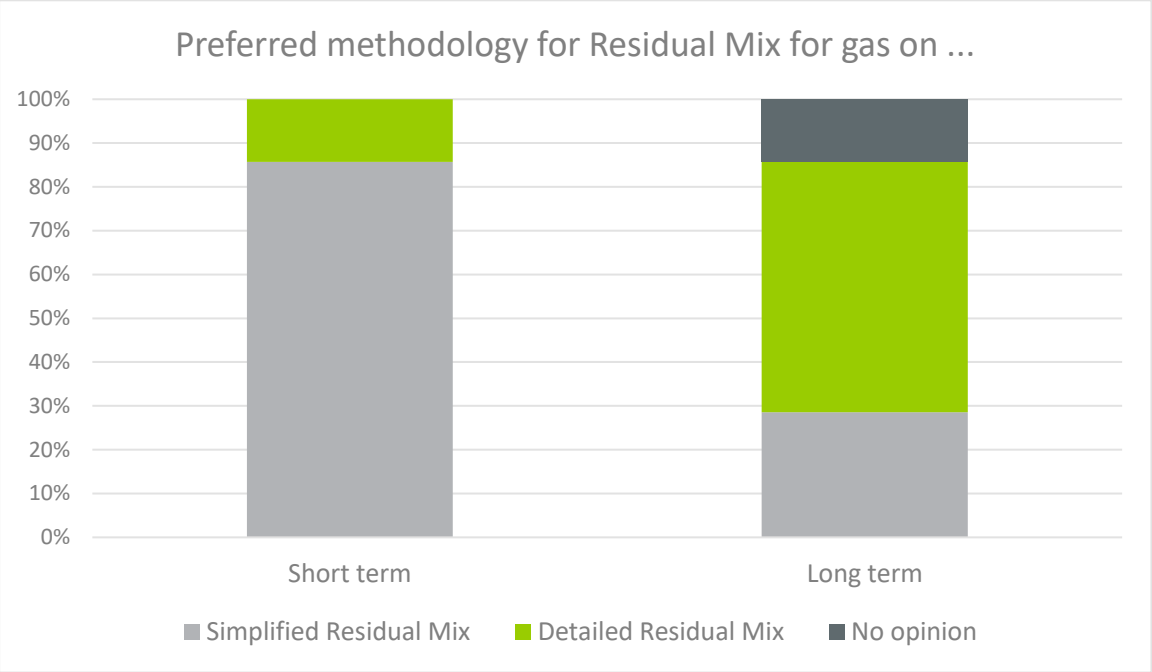

Figure 34: Distribution of responses to the questions which methodology would be preferred on the short and long term.

I.2.1.5 Additional feedback

Survey question:
Do you have any other feedback?

Respondents provided a range of feedback regarding the Residual Mix calculation methodologies, highlighting various concerns and suggestions for improvement. Below are the key themes derived from the responses:

1. **Complexity of the EU Regulatory Environment**
   One respondent pointed out the current complexity of the EU regulatory framework, which allows for inconsistent approaches among different Member States. This inconsistency can lead to double counting of energy produced for various consumption segments. They emphasized that any effective calculation of the Residual Mix must take into account all systems that contribute to compliance with national targets, including international transfers of Guarantees of Origin (GO) and Proof of Sustainability (PoS). This perspective underscores the need for a harmonised approach to reduce confusion and improve transparency across the EU.
2. **Importance of Accurate GHG Footprint Disclosure**
   Another respondent highlighted the importance of accurately disclosing the greenhouse gas (GHG) footprint associated with the Residual Mix. He argued that using a simplified approach, if it incorporates GHG footprint data, could convey misleading information to market players. Given that targets in RED III may be expressed in terms of carbon intensity reductions, having a proper calculation for the Residual Mix is essential for market functionality. This feedback illustrates the critical role that transparency and accuracy play in regulatory compliance and market trust.
3. **Consideration of all tracking instruments**
   A third respondent highlighted once more that the Residual Mix calculation methodology should consider all tracking instruments for gases and especially the

Union Database; if not, double counting would occur. A prerequisite, however, is that the UDB should be fully established as interfaces between national (GO) registries and transfer from the GO registries to the UDB must be taken into account.

4. **Discrepancies in Stored Gas Tracking**
   The proposed methodology for the Residual Mix calculation does not consider an inventory of tracking instrument for stored gas. A respondent warned that this may create discrepancies if the gas goes in and out of the storage during different balance time period.

ANNEX II GUARANTEES OF ORIGIN: LEGISLATION AND STANDARDISATION FRAMEWORK

II.1 GOs as a mandatory instrument for Disclosure of renewable gases: RED III

The Renewable Energy Directive mandates the issuance of Guarantees of Origin (GOs) for renewable gases upon request of a producer. It empowers consumers to stimulate demand for energy from renewable sources.

II.1.1 Status

On 18 October 2023 the recast of the Renewable Energy Directive, (EU) 2023/2413[43], here referred to as REDIII, was approved, and entered into force on 20 November 2023. It modifies the Directive (EU) 2018/2001[44] and shall be implemented by Member States by 20 May 2025.

II.1.2 Excerpts

Art. 2 of REDIII defines the legal definition of the Residual Mix:

"Residual Energy Mix" means the total annual energy mix for a Member State, excluding the share covered by cancelled Guarantees of Origin (GO).

This definition is an essential orientation point for the focus of this report. If no additional measures are taken that enforce the GO as the sole instrument for disclosing the origin of energy sources, the definition may have to be widened to prevent a risk of double counting the renewable origin of consumed gas.

The purpose of GOs is clarified in Art. 19 of REDIII.

Art. 19 §1: *For the purposes of demonstrating to final customers the share or quantity of energy from renewable sources in an energy supplier's energy mix and in the energy supplied to consumers under contracts marketed with reference to the consumption of energy from renewable sources, Member States shall ensure that the origin of energy from renewable sources can be guaranteed as such within the meaning of this Directive, in accordance with objective, transparent and non-discriminatory criteria.*

(…)

In short, we consider the purpose of GOs to be informing consumers of the origin of the energy supplied to them.

REDIII introduces the obligation on Member States to publish the Residual Mix. This is to be done annually:

Art.19.4. For the purposes of Disclosure referred to in paragraphs 8 and 13, Member States shall ensure that energy undertakings cancel guarantees of origin at the latest six months after the end of the validity of the guarantee of origin. Furthermore, by 21 May 2025, ***Member States***

[43] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302413
[44] http://data.europa.eu/eli/dir/2018/2001/oj

***shall ensure that the data on their Residual Energy Mix are published on an annual basis**.'*;

Where GOs are issued that are not cancelled before their expiry date, the energy they represent gets included in the Residual Mix. The expiry date of GOs however varies between Member States:

Art.19.3. For the purposes of paragraph 1, guarantees of origin shall be valid for transactions for 12 months after the production of the relevant energy unit. Member States shall ensure that all guarantees of origin that have not been cancelled expire at the latest 18 months after the production of the energy unit.

Member States shall include expired guarantees of origin in the calculation of their Residual Energy Mix.

This varying expiry date poses a challenge on the calculation of the RM: GOs can only be included in the RM after they have formally expired, otherwise they risk being double counted. It, however, involves production of 12-18 months before. This implies that there will always be a discrepancy between total production and expired GOs. The fact that there are expiries on a continuous basis, however, reduces this discrepancy, and the effect balances out over the years. Therefore, it is seen to be acceptable to include expired GOs in the Residual Mix in the subsequent year if the expiry takes place too late for taking it into account in the year closer to the production period of the expired GO. In practice, the type of GOs that expire are rather constant. This inaccuracy is hence seen as acceptable.

The EN16325 standard on Guarantees of Origin has become binding for Member States to implement since 1 July 2020. As this standard has been under revision from February 2020, not all Member States have done so, so far. Key aspects of the latest available draft under revision will be touched upon in Section II.2.

Art.19 §6 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.

REDIII clarifies that the Residual Mix is for non-tracked commercial offers:

Art. 19 §8: *(…) 'Where gas is supplied from a hydrogen or natural gas network, including gaseous renewable fuels of non-biological origin and biomethane, the supplier is required to demonstrate to final consumers the share or quantity of energy from renewable sources in its energy mix for the purposes of Annex I to Directive 2009/73/EC.* ***The supplier shall do so by using guarantees of origin except****:*

a) *as regards the share of its energy mix corresponding to* ***non-tracked commercial offers, if any, for which the supplier may use the Residual Energy Mix****;*
b) *where a Member State decides not to issue guarantees of origin to a producer that receives financial support from a support scheme. (…)*

It also introduces an obligation on Member States to ensure that for gas, the cancelled GOs shall correspond to the relevant network characteristics.

Art. 19 §8: *(…) When a customer consumes gas from a hydrogen or natural gas network, including gaseous renewable fuels of non-biological origin and biomethane, as demonstrated*

in the commercial offer by the supplier, Member States shall ensure that the guarantees of origin that are cancelled correspond to the relevant network characteristics.

II.2 Standardised operation of GO systems: CEN EN16325 and EECS®

As mentioned above in the previous section, RED Art.19.6 mandates that Member States shall ensure that the Guarantees of Origin they issue comply with the draft EN16325 GO standard. This standard is under revision at the time of writing this report. The below excerpts are from a draft that holds a significant status of consensus but is yet to be submitted to the formal voting process at the time of writing this report.

II.2.1 EECS

In the meantime, the GO system in practice is standardised under the European Energy Certificate System (EECS®)[45] framework. The EECS® Standard is publicly available and has largely been the basis of the certificate scheme requirements in EN16325. EECS® however goes beyond EN16325 where it includes cooperation engagements between issuing bodies and detailed standardisation of formatting requirements. Those are essential for efficient cooperation between national GO Domain Schemes, but need more frequent updating than is feasible under the CEN – CENELEC framework. The members of the Association of Issuing Bodies (AIB) have a joint decision-making process that enables them to update the EECS® Standard based on jointly agreed adjustment needs. As such, they ensure that the EECS® Standard will align with EN16325 as soon as the revision is finalised, and on the other hand, that EECS® may go further than CEN EN16325 e.g. where needed for efficient system functioning.

While the CEN requirements are mandatory through legislation, the below section lists main takeaways from Excerpts of the draft EN16325 from April 2024. Those are mostly aligned in EECS®.

II.2.1.1 Double claim prevention principles in EECS®

EECS® Rules sections A2.1, C3.3.1 and E3.3.14 mention GOs are issued for output that has not been disclosed in any other way, including through the issuance of any other type of certificate. An excerpt of the EECS® Rules related to prevention of double claims, is in ANNEX II.2.1. If the Product Rules for an EECS® Product contain a Legislative Disclosure Scheme, Scheme Members are required to put in place appropriate procedures. These procedures should ensure that GOs are used as the sole proof of the qualities of the associated output according to the relevant Product Rules.

II.2.2 CEN-CENELEC EN16325 Standard for Guarantees of Origin

II.2.2.1 The purpose of GOs is Disclosure

The draft revision of the legally binding EN16325 standard, clearly defines the purpose of Guarantees of Origin, to be Disclosure, and it defines what Disclosure means.

[45] See www.aib-net.org/eecs

4.9.2.1.4 A *GO shall only be cancelled for the purpose of Disclosure, and to demonstrate the origin of energy consumed:*

(a) During a period starting within 12 months after the last day on which the output to which the GO relates was produced; and
(b) Before the date of cancellation of the GO, or in the consumption period during which the Cancellation takes place.

II.2.2.2 Definition of Disclosure: informing consumers

While the purpose of GOs is to be mentioned on GOs, and is fixed to be "Disclosure", the EN16325 clarifies the definition of this concept. This is in line with the phrasing of RED Art. 19.1.

"Disclosure" means provision of information to a final customer on the share or quantity of the energy supplied to them as having specific Attributes.

II.2.2.3 Cancelled GOs as basis for Disclosure Statements

Section 4.10 of the draft revision of the EN16325 standard mentions the purpose of calculation and preparation of Disclosure Statements. It also gives basic principles for the Residual Mix calculation.

4.10 A Domain GO Scheme should contain provisions for Disclosure Statements with regard to the timing of their publication and their visual presentation. Disclosure Statements for the share or quantity of energy should be calculated and prepared based on, as appropriate:

(a) GOs cancelled by the relevant Account Holder;
(b) Where applicable, the Residual Mix, which shall adjust the national production mix for the relevant Energy Carrier to take into account imported and exported GOs representing energy conveyed by this Energy Carrier;
(c) Where the provision of Domain GO scheme excludes the Issuance of GOs for Production Devices and/or units of energy in receipt of Public Support: statistical information on the origin of energy so supported or another mechanism specified in the Domain GO Scheme which avoids the same Attributes from being Disclosed more than once; and/or
(d) Where import of energy occurs "from a Domain outside the calculation area of the Residual Mix, or where import of energy occurs towards a Domain where no Residual Mix is available," aggregate figures or unambiguous proof; and/or
(e) such other sources of data as section 5.2.9 of this standard provides, while ensuring that the Attributes of the same Energy are only Disclosed once to a final customer.

As part of the Residual Mix calculation methodology for a given Energy Carrier, Competent Bodies shall ensure that multiple claims of the Attributes of energy are prevented. This implies that the consumption of energy with the same Attributes can only be claimed with either GOs, or possible other energy tracking systems in use in their country or the Residual Mix.

The requirements on electricity Disclosure are more specific regarding data to be used.

5.2.9 For the purpose of calculation and preparation of Disclosure Statements only reliable and publicly available data shall be used, such as Residual Mix as calculated by the Disclosure Authority. Where a GO has been issued, only its cancellation shall for the purpose of Disclosure permit a claim to be made in relation to its Attributes.

II.2.2.4 Cancellation requests for gas GOs to inform on network characteristics of consumption

5.3.9 The cancellation request shall indicate whether the Gas GO cancelled correspond to the relevant network characteristics. (…)

The information on a cancellation request may help the Disclosure Competent Body interpret whether the obligations under Art. 19.8 are fulfilled, regarding the usage of gas GOs of which Member States shall ensure that the usage corresponds with the relevant network characteristics. On the other hand, Member States may set out procedures for making this interpretation beyond that of the GO cancelling account holder.

II.2.2.5 What can be tracked: available data on GOs

Info on all electricity, gas, hydrogen, heating and cooling GOs

The Section 4.5.2.1 of the draft EN16325 standard sets out obligatory information that should be present on all GOs.

4.5.2.1 The GOs should contain at least the following Attributes:

a) the Energy Carrier;
b) the unique number assigned to the GO by the Issuing Body that issued it, see normative Annex C;
c) the nominal capacity of the Production Device as specified in subclauses 5.2, 5.3, and 5.4 in kW;
d) the date when the Production Device first became operational;
e) the first day on which the Output to which the GO relates was produced;
f) the last day on which the Output to which the GO relates was produced;

NOTE This day is at the latest one month after the first day on which the Output to which the GO relates, was produced.

g) the Source Type (see Annex A);
A GO may only refer to a single Source Type category which is allocated to it in accordance with 4.5.5 and 4.5.6 respectively.
h) the Technology Type (see Annex B);
i) the identity of the Originating Production Device, being the unique number which has been assigned to that Production Device by the relevant Competent Body;
j) the country in which the relevant Production Device is situated;
k) k) the location of that Production Device, being its geographical location either by latitude and longitude; and/or postal code, city and country;
l) the identity (and country or region) of the originating Issuing Body;
m) the date when the electronic Issuance of the GO took place;
n) an indication, as appropriate, as to whether
  a. the Originating Production Device has received Public Support relating to investment in it;
  b. the unit of energy to which the GO relates has benefited from Public Support;
  c. both the Originating Production Device and the unit of energy have benefited from Public Support; or
  d. neither the Originating Production Device, nor the unit of energy have benefited from Public Support; and the type of support scheme;
o) the purpose of the GO;
p) such additional information as is required in subclauses 5.2.5, 5.3.5, 5.4.4; and

q) dissemination level of the physical energy for which the GO is issued, as set out in Annex E
r) the Face Value, indicating the unit of energy represented by the GO.
s) an indication whether or not the GO was issued following Conversion Issuance.
t) *an indication whether or not the Certificate was issued following release from a Storage System in accordance with the provisions of section 4.5.7*

NOTE The Energy Type a GO relates to is represented on the GO by expression of the Energy Carrier as noted in a)

The above information is on all GOs. Optionally, also the following data may be mentioned on GOs.

4.5.2.2 Optional information on a GO

(…) a Domain GO Scheme may provide that a GO contains

(a) Where applicable, the capacity of the relevant production element of the Production Device and the date when this production element became operational;
(b) subject to the agreement of the Registrant, the name of the Production Device;
(c) where the GO has been issued in respect of the Production Device or an Input which is compliant with a Label Scheme and the Issuing Body is supporting that Label Scheme, the identifier of the relevant Label; More than one label can be mentioned on the GO;
(d) a quantification of carbon footprint of the output covered by the GO, and a reference to the methodology used for this quantification;
(e) such Energy Carrier-specific information;
(f) The start time of the production period to which the GO relates, expressed in local time, accompanied by the offset to UTC time in hh:mm;
(g) The end time of the production period to which the GO relates, expressed in local time, accompanied by the offset to UTC time;
(h) Where the Source Type relates to nuclear energy, a quantification of the radioactive waste produced per MWh of output to which that GO relates, and a reference to the methodology used for this quantification.

Additional information on a Gas GO

Along with the above information, Section 5.3.5 of draft EN16325 lays out additional mandatory information on a Gas GO (that is not available on electricity GOs):

(…) when a GO has been issued for an Energy Carrier for which the gas composition has been used to establish the proportion of that Energy Carrier of a Gas mix which contains more than one Energy carrier, then the GO shall contain the gas composition of that Gas mix expressed by the Fuel Index of the final Output. Where the Energy Carrier is unspecified Gas, the Fuel Index need not be specified.

The above applies only for where there would exist issuance of different GOs for separate components of a gas mixture. At the time of writing this report, this is not the case in any Domain.

The project team does not recommend making use of this option of the standard, as issuing separate GOs for separate components of gas mixtures would make it fairly impossible to calculate a meaningful Residual Mix and come to a complete overall Disclosure overview at macro level. On top, it risks confusing consumers.

More importantly, Section 5.3.6 of draft EN16325 presents additional optional information on a Gas GO.

5.3.6 Additional optional information on a GO for Gas

A GO for Gas may also contain the following information:

(a) Information on compliance of the Gas with applicable sustainability requirements;

a. Specified:

i. A reference to the legislative or other sources that sets sustainability requirements;
ii. A reference to the relevant sustainability certification scheme(s);
iii. Whether the abovementioned sustainability requirements are complied with; and
iv. A reference to the relevant reports, certificates or other documents produced by the sustainability certification scheme(s);

Or

b. unspecified

(b) if Output is produced from a mixture of Inputs, consisting of other than only the Input from the Source Type indicated in 4.5.2.2 g), in addition to the Attribute recorded as the Source Type for which the corresponding GO was issued, information on those Inputs, Source Type, and their share in total energy Input. This share shall be determined in accordance with the Energy Input Factor;
(c) in accordance with 4.5.2.2 d), where the Production Device consists of separate modules of which there is a plant which upgrades the Gas quality. the date on which the plant(s) became operational that produced the raw Gas and its/their capacity; and
(d) where the Output complies with specific requirements relating to the characteristics of the produced Gas, a reference to the relevant requirements.

Information in these optional fields, especially whether sustainability criteria are met, hold a key to the bridge between tracking for accounting of compliance towards policy targets elaborated in REDIII (e.g. Art. 25).

II.2.2.6 Energy source categories

It must be noted that the categories of energy sources mentioned on the GOs, as in Annex A of the draft EN16325 standard, don't display detailed feedstock information for all energy source categories. The optional tag on compliance with the advanced biofuel criteria is a relevant item to mention.

II.2.2.7 GO Cancellation

4.9.2.1.3 Cancelling a GO

The provisions of each Domain GO Scheme shall be such that where a GO has been issued for the Output of a Production Device, then the Attributes of such Output may only be Disclosed through Cancellation of the GO. The Attribute of GOs that expire will be included in the Residual Mix. (…)

The GO standards don't allow just any GO cancellation for just any other consumption Domain. This is equally the case in the already applicable EECS® Standard as in the draft CEN Standard:

4.9.2.1.4 Limitations for Cancellation

An Issuing Body may Cancel a GO solely:

a) for use in its own Domain; or

b) for use in any country or destination Domain, provided each of the following conditions is met:

1) such country or Domain is part of the European Economic Area or a country outside the European Economic Area for which

i. there is export of energy of the corresponding Energy Carrier from the cancelling Domain to the destination Domain; and

ii. an assessment report as in 4.11.2 proves compliance of the destination Domain GO Scheme with this EN 16325 standard; and

iii. a system for verification of Disclosure Statements as in 4.11.5 is in place in the GO Scheme of the destination Domain, of which, for the Energy Carriers for which section 5 foresees in the calculation of a Residual Mix, the Residual Mix is calculated in connection and in balance with the system for calculation of the Residual Mix of the Domain where the cancellation takes place; and

iv. for Energy Carriers for which Clause 5 does not foresee in the calculation of a Residual Mix, a mechanism is in place to ensure that the total quantity of cancelled GOs for the destination Domains per year does not exceed the total direct export of energy of that Energy Carrier to that Domain in that year; and

2) automated Transfer of GOs is temporarily impossible due to technical difficulties; and

3) the relevant Competent Body, being either the Issuing Body or, where existing, the Disclosure Authority in the Domain where the cancelled GOs will be used for Disclosure and the Issuing Body operating the registry where the cancellation is to be made, have agreed to such a cancellation; and

4) the Cancelling Issuing Body provides information on the cancelled GOs to the Issuing Body of the country/Domain for whom the GOs are cancelled; and

5) the inclusion on any related Cancellation Statement of the identity of the country/Domain for whom the GOs are cancelled. A GO may be cancelled until eighteen (18) months after the last day on which the Output to which the GO relates was produced, or until such earlier deadline as the relevant Domain GO Scheme provides.

A GO shall only be cancelled for the purpose of Disclosure, and to demonstrate the origin of energy consumed:

i. during a period starting within 12 months after the last day on which the Output to which the GO relates was produced; and
ii. ii. before the date of cancellation of the GO, or in the consumption period during which the Cancellation takes place

Maximum length of a consumption period being one calendar year. (…)

These restrictions imply that Ex Domain Cancellations, being the cancellation of a GO to cover a consumption claim in another country, are not allowed by default. They are only allowed as a transition measure while technical connections are still being established and on condition

there exists a so-called Ex-Domain Cancellation agreement between the involved Issuing Bodies. that EDC agreement shall ensure that information on the cancelled GOs is provided to the relevant Competent Body for the receiving Domain.

This restriction becomes of relevance when considering data availability on cancelled GOs per consumption Domain.

II.2.3 Handling GOs across Energy Carrier conversion

II.2.3.1 Input from EECS® and REGATRACE

The draft revision of EN16325 built its rules for handling GOs across Energy Carrier conversion on the developed ideas amongst issuing bodies in AIB as adopted in the EECS® Rules in 2019 and the logic built up in the REGATRACE project in the deliverables on integration of GOs across multiple Energy Carriers, being D4.3 and D4.4[46].

II.2.3.2 Cancel GOs for measured input, issue GOs for measured output

Section 4.5.6 of the draft revision of the EN16325 states that during Energy Carrier Conversion, the Energy Input and Output from the Production Device are measured. The Attributes of an Input amount are determined by the Registrant's cancellation of a corresponding amount of GOs. GOs are cancelled for measured input into conversion and GOs for the Output Energy Carrier are issued for the output from conversion.

II.2.3.3 Data on post-conversion GOs

The energy source is conveyed from the input GOs to the output GOs, in accordance with 4.5.6.2.2, while the other information on the post-conversion GOs refers to the conversion device, except for the list of optional data on GOs:

4.5.6.2.3 Optional Data to be mentioned on GO after Conversion Issuance

On GOs issued following Conversion Issuance, additional data fields may be recorded, relating to the Input into the Energy Carrier Conversion Production Device, that inherit the following Attributes from the cancelled pre-conversion GOs

(a) The production period of the pre-conversion energy, (as in 4.5.2.2 e and f and 4.5.2.3 f and g);
(b) Identity of the pre-conversion production Device (as in 4.5.2.2.i);
(c) The location of the pre-conversion Production Device (in the format as in 4.5.2.2.k);
(d) The date when the pre-conversion Production Device became operational (in the format as in 5.25.2.2.d);
(e) An indication as to whether the pre-conversion Production Device or the Output of the pre-conversion Production Device has benefited from public support (in the categories set under 4.5.2.2.n);
(f) A quantification of carbon emissions related to the pre-conversion energy, taking into account the energy efficiency of such conversion, together with a reference to the methodology used (in the format as in 4.5.2.3d);
(g) A quantification of the radioactive waste related to the energy pre-conversion, taking into account the energy efficiency of such conversion, together with a reference to the methodology used (in the format as in 4.5.2.3h);

[46] https://www.aib-net.org/news-events/aib-projects-and-other-news/regatrace

(h) Where the relevant Label Operator supports this, a label related to the pre-conversion energy (in the format as in 4.5.2.3 c).

This optional data, when available, provides a comprehensive understanding of the energy source and its environmental impact. This data can help for evaluation of compliance with RFNBO DA. Note also that post-conversion GOs (being GOs that are issued for output from an Energy Carrier conversion device, after GOs have been cancelled to prove the origin of the input to that device) hold a Conversion Tag. It will be important to distinguish between GO cancellations for conversion and for final consumption to ensure prevention of double counting by misinterpreting statistics.

Further, it is to be seen what the impact on the market of this concept of GO Conversion Issuance will be.

II.2.3.4 System boundaries: dissemination level of the energy for which a GO is issued

Annex E of the draft EN16325 sets out the possible dissemination levels that can be mentioned on the GO, in accordance with where the energy is made available.

Annex E (normative)

Dissemination level of the physical energy for which the GO is issued

The parameter value for the Attribute on the GO that indicates the dissemination level of the produced physical energy for which the GO is issued, as in 4.5.2.2.q, is one of the following:

1. *Consumed by the operator of the production device [this applies for Electricity, Gas and Heating and Cooling];*

The parameter value for the Attribute on the GO that indicates the dissemination level of the produced physical energy for which the GO is issued, as in 4.5.2.2.q, is one of the following:

1) *Consumed by the operator of the production device [this applies for Electricity, Gas and Heating and Cooling];*
2) *Disseminated over a Distribution or Transmission System:*
   a. *for Electricity;*
   b. *for Natural Gas;*
   c. *for Hydrogen;*
3) *Disseminated over a Closed Distribution System:*
   a. *for Electricity;*
   b. *for Natural Gas;*
   c. *for Hydrogen;*
4) *Disseminated over any other network than a Distribution or Transmission System or Closed Distribution System:*
   a. *for Electricity;*
   b. *for Natural Gas;*
   c. *for Hydrogen;*
   d. *another Gas system;*
5) *Disseminated over a heating or cooling Grid [this applies for Heating and Cooling];*
6) *Disseminated by vehicle [this applies for Gas and Heating and Cooling];*
7) *Dissemination unspecified – not consumed by the operator of the Production Device [this applies for Gas].*

This is a crucial data element on which statistics can be based that enable to categorize GOs issued per system boundary. With this as a basis, it has an opportunity to calculate the Residual Mix per system boundary.

II.2.3.5 GO Cancellation categories: for end-consumption or for conversion

The GO framework allows GO issuance for energy converted from another Energy Carrier, on condition that a GO is cancelled for the energy input. This follows from both the EECS® Rules and in the draft of the mandatory GO Standard CEN EN16325, as mentioned before. In this case, the energy source of the input Energy Carrier can be conveyed to the output Energy Carrier of the conversion.

It will need attention for some specific topics.

A risk would be that an original quantity of renewable energy production is counted as being consumed twice: at the time when converted into another Energy Carrier and at the time of consumption of that Energy Carrier. E.g. biomethane from agricultural biomass, for which GOs are cancelled to prove that biomethane is fed into a gas engine which produces electricity. For such electricity production, GOs can then be issued for electricity from agricultural biomass: the energy source is conveyed across Energy Carrier conversion. This is a logical principle, yet it needs measures to prevent that the cancelled gas GOs in this case would statistically be accounted as green gas consumption.

In order to prevent misinterpretation of GO cancellation statistics, it is important have transparency on which type of energy consumption a GO actually is cancelled for: end consumption or Energy Carrier conversion.

GO cancellation statistics are used in (at least annual) national Disclosure supervision exercises. They are interpreted by the national supervisory authority to evaluate the accuracy of supplier's Disclosure and to calculate the national Residual Mix. Where the statistics of cancelled GOs would relate to other claims than visible to this authority, there is risk of confusion, and potentially double claims of the represented Attributes of these cancelled GOs.

To avoid confusion and prevent double claims, cancellation statistics need to display a category of the cancellation. While "direct end consumption" of the respective Energy Carrier is one such category, another cancellation category is "Cancellation for conversion into another Energy Carrier".

II.3 Building blocks for a Residual Mix methodology

II.3.1 Inspiration from the formula for the electricity Residual Mix

Section 5.2.10 of the draft EN16325 elaborates on the main formula for determining the Residual Mix, albeit for electricity.

5.2.10 Residual mix calculation
In calculating the Residual Mix of their country for electricity, Competent Bodies shall deduct the volume of issued GOs for electricity and add the volume of GOs for electricity which are expired for cancellation, from the domestic electricity generation mix of a calendar year. When after this calculation, there is a deficit of Attributes in the domestic Residual Mix in order to cover total domestic electricity consumption, this deficit shall be complemented with Attributes from the European Attributes Mix.

In the geographic area where GO trade is facilitated, as determined under 4.7.3, Competent Bodies should cooperate in order to adjust their Residual Mixes in reflection of cross border transfers of physical electricity, GOs and other legal energy tracking systems in use in their country. Hereto they shall cooperate to determine the European Attribute Mix, which consists of the surplus of Attributes from the domestic Residual Mixes of all participating countries which are not domestically used for claims on the origin of consumed energy.

II.3.2 A Residual Mix formula to be applied per dissemination system boundary for gases

The elaborated formula for the Residual Mix for electricity in EN16325 Section 5.2.10 provides inspiration for the general formula for elaborating the Residual Mix for gases. At the time of drafting the standard revision, the gas Disclosure requirement was not yet effective in Europe, for which the experts in CEN felt it to be too early to adopt a similar text for gas. For the purpose of this report, however, the same principle can be used.

On top of that comes that REDIII Art. 19.8 requires that Member States shall ensure that gas GOs at cancellation correspond to the relevant network characteristics:

REDIII Art.19.8: (*…) When a customer consumes gas from a hydrogen or natural gas network, including gaseous renewable fuels of non-biological origin and biomethane, as demonstrated in the commercial offer by the supplier, Member States shall ensure that the guarantees of origin that are cancelled correspond to the relevant network characteristics.*,

Section 5.3.9 of the draft EN16325 has been elaborated to support implementation and transparency at the level of Member States Domain GO Schemes:

5.3.9 Information on a cancellation request and a cancellation statement for the Gas GO
The cancellation request shall indicate whether the Gas GO cancelled correspond to the relevant network characteristics. (…).

This suggests that a Residual Mix for gases would best be calculated per perimeter of gas consumption that has the same network characteristics.

Using statistics of issued GOs per dissemination level, especially where the dissemination level categories accord with categories of network characteristics, enable then to determine a Residual Mix per system boundary that accords with the dissemination level categories.

ANNEX III MASS BALANCING VERSUS BOOK AND CLAIM, AND REQUIREMENTS FOR MULTI-PURPOSE TRACKING INSTRUMENTS

III.1 Chain of custody tracking mechanisms

Gases consist of molecules of which the origin characteristics are not physically visible or sensible. Chain of custody tracking mechanisms need to be deployed when making statements on the energy source of the gas.

It has occurred in discussions on the GO system and the certification of sustainability criteria that confusion came up on terminology regarding chain of custody tracking. Sometimes the purpose of a tracking system is confused for its tracking mechanism or the criteria on which the purpose is based.

The purpose of a GO is Disclosure, informing consumers on the origin of energy. The GO instrument can be used in a book-and-claim way, where the GO is sold separately from the energy of which it represents certain Attributes; yet is can also be sold together with this energy, generally called “bundled sale” in electricity, or “mass balancing” in the gas sector.

In order to account for EU policy targets and confirm certain criteria are met, sustainability characteristics and emissions of gases need to be tracked following the concept of mass balancing.

While the purposes of Disclosure and target accounting come together where they both relate to consumption of renewable gas at a certain consumption point, the relation between tracking mechanism deserves some discussion.

The below visual shows the various terms with the aim to clarify that tracking purposes, methods, instruments and tracked information can relate to each other in various ways, depending on tracking system design choices.

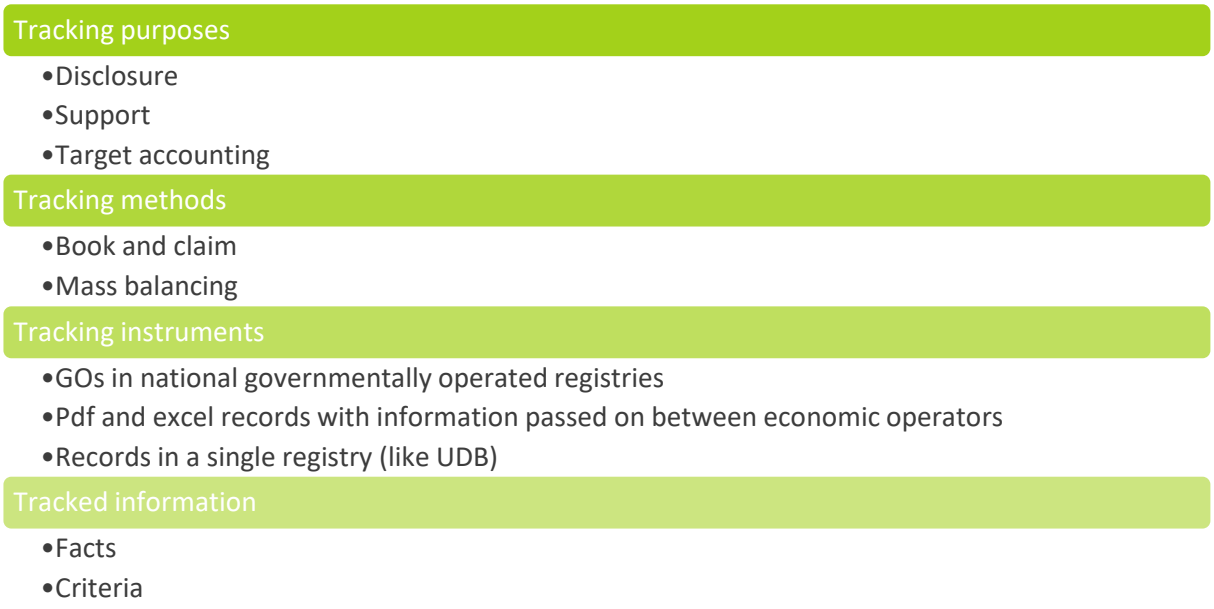

Figure 35: Tracking methods, tracking instruments versus tracking purposes

This chapter discusses the concepts of book-and-claim and mass balancing and their optional touchpoint.

III.2 EU rules for mass balancing and Voluntary Schemes

Only energy that complies with the RED criteria can be counted towards the mandatory policy targets like the transport target in Art.25 of the RED. The RED in Art. 30 establishes EU Voluntary national or international schemes to ensure standards for the production of renewable and recycled carbon fuels, provide accurate greenhouse gas emission savings data, and demonstrate that consignments of biofuels, bioliquids, and biomass fuels meet the sustainability criteria.

The Commission Implementing Regulation (EU) 2022/996[47], outlines the requirements for Voluntary and National Schemes. These requirements include rules for verifying sustainability, greenhouse gas emissions saving, and criteria for low indirect land us change risk. It builds its chain of custody tracking on a mass balancing principle.

Art. 19.1 of Regulation 2022/996(EU) states:

Voluntary schemes *shall require the economic operators participating in the scheme to* ***use a mass balance system****, in accordance with Article 30(1) of Directive (EU) 2018/2001 that* ***allows the mixing*** *of raw material or fuels that differ in their sustainability and GHG emissions saving characteristics.*

III.3 GOs may track energy through book-and-claim or through mass balancing

Guarantees of Origin, through the standards they comply with, may track the energy they represent in a book-and-claim manner. Through the system design, they remain standing as a unique instrument for origin claims of energy consumption, even if they are disconnected from the energy they represent in the course of their lifetime. On the other hand, certain energy suppliers or consumers make a proposition of selling or using the GOs together with the energy they represent. This concept of bundled sale of GOs and energy could be seen as an implementation of the mass balancing principle. At any point in time, they remain a unique, transferrable, instrument that entitles for a claim. EU legislation does not fix the chain of custody tracking mechanism under which it is to be transferred and used.

[47] Commission Implementing Regulation (EU) 2022/996 of 14 June 2022 on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land-use change-risk criteria: https://eur-lex.europa.eu/eli/reg_impl/2022/996/oj

ANNEX IV EXISTING GUIDANCE ON DISCLOSURE BY SUPPLIERS

IV.1 CEER Advice on Green Offers

CEER advises in its recent advice "Guidelines of Good Practice for Trustworthy Information on Green Offers and Consumer Protection Against Misleading Marketing ("Greenwashing")48" on Disclosure of renewable gas (Recommendation 4-5-6-7 (p21-24) in Section 6.2) to base consumer information on the origin of gases on gas GOs under the supervision responsibility of the Member States. CEER has developed recommendations involving the Disclosure system and its main instrument, the GO. This paragraph highlights the aspects that are most relevant for the scope of REGADISS.

IV.1.1 GOs should be used as the only instrument for tracking renewable characteristics

Recommendation 4:

MS should have a GO system for: (i) electricity; (ii) gas, including hydrogen; or (iii) heating or cooling. For this purpose, national GO system convergence should be encouraged so that GOs are easily tradable across MS. When and where available, GOs should be used as the only instrument for tracking the characteristics of energy sources in offers within Disclosure systems, in particular those marketed as "green," including in the framework of a PPA or any contract with a renewable production plant (e.g. EU solar energy). In the absence of a certified GO, the offer cannot be marketed as "green".

IV.1.2 The cooperation of competent authorities for Disclosure should be enhanced

Recommendation 5:

GOs should be used as a basis for further harmonisation of Disclosure systems. An assessment of the use of GOs in electricity should be done at national and European level to identify improvements that could be made to the existing GO system in electricity, as well as best practices that can be applied to: (i) gas, including hydrogen; or (ii) heating or cooling. Good practices identified in the electricity Disclosure system should be extended to other energy Disclosure systems. The cooperation of competent authorities for Disclosure should be enhanced irrespective of the form of energy disclosed. The use of a common platform should be investigated.

IV.1.3 Make customers aware

Recommendation 6:

Further harmonisation of the existing Disclosure systems for electricity, and the introduction of a harmonised system for all types of energy on a European level, should make the systems more reliable and efficient. The competent bodies for Disclosure should ensure that the utmost is done to make customers aware of the information that is available to them regarding the energy with which they are supplied. To foster trust in Disclosure systems, customers should easily be able to find clear information about the functioning of these systems. The publication

[48] https://www.ceer.eu/documents/104400/-/-/832ddef0-87de-c539-38f8-ec4d6ce63269

of an annual Disclosure report by the relevant competent body is a good practice that can further increase transparency in terms of the origin of supplied energy at national level.

IV.1.4 Full Disclosure: Cancelling GOs for all consumption is more consistent and reliable

Recommendation 7: In order to make the Disclosure information for customers more coherent, efficient and reliable, it is worth considering whether the issuing of GOs should be extended to all sources of electricity, including non-renewable sources. Full Disclosure, meaning the cancellation of GOs for all consumption, would help to make the Disclosure system more consistent and reliable, as well as to provide opportunities for marketing energy products based on specific non-renewable sources in a trustworthy manner. A single, coherent and properly designed system addressing all energy generation, from all sources (renewable and non-renewable), has the potential of reducing administrative burdens and costs. In order to avoid imposing an administrative burden and costs on energy producers, it could, as a first step, be introduced on a voluntary basis.

IV.1.5 Residual Mix needs to be calculated in harmonised way

Recommendation 7 (continued): Where full Disclosure is not technically feasible or cost-efficient, a Residual Mix should be determined at national level. The methodology to calculate the Residual Mix should be harmonised across all participating countries in the interconnected energy market, per Energy Carrier.

Another positive step would be to collect the different existing methodologies used to calculate the Residual Mix, so that a common harmonised methodology per Energy Carrier could be selected or built that could be shared and used across all participating countries.

Reflection

Harmonising methodologies for calculating the Residual Mix over the different European countries taking part in the single market, will ensure improved data quality, consistency and accuracy in energy reporting. It enhances the transparency in the energy market by providing a consistent method for calculating the Residual Mix.

IV.1.6 Considerations for Implementing Full Disclosure Systems

CEER observes "*flaws of having different GO and Disclosure systems functioning all together within a common European electricity market*".

CEER further elaborates:

Although the Electricity Directive leaves it up to MS to implement, having a full Disclosure system would help guarantee the consistency and reliability of the Disclosure system and should be considered as a goal to aim for. However, as it may require major changes and time for a MS to adopt a full Disclosure system, where full Disclosure is technically not feasible or not cost-efficient, the MS should take into consideration the opportunity to have a Residual Mix defined at national level.

IV.1.7 Challenges for energy Disclosure identified by CEER

CEER identified several challenges for energy Disclosure. A representative from CEER presented these at the meeting of the Disclosure Platform on 13 March 2024, and identified the following challenges:

- Inconsistencies in Disclosure timeframes and deadlines across MS lead to delay and lack of transparency. These differences can delay the calculation of the cross-border supplier mix for up to two years.
- The lack of a publicly accessible official list of Disclosure authorities impedes consumer access. CEER feels such a list could facilitate cooperation and information exchange among authorities (DG ENER website).
- The methodologies used for the energy Disclosure vary, thereby posing challenges. Certain MS mandate the matching of production and consumption years, while other do not impose such requirements.
- The methodologies for assessing the environmental impact of electricity supplied are also different.
- Categorisation of the energy sources provided in Disclosure figures lacks harmonisation.
- EU legislation does not define or outline the methodology for Residual Mix. Some MS discard the renewable fraction of the Residual Mix, while others do not.
- Low-Carbon gases do not systematically receive GOs, how to treat them consistently in the Residual Mix, given the RED definition of Residual Energy Mix that only excludes GOs?
- Regarding on-site (self) consumption, some MS issue GOs for renewable energy produced and consumed on the same site. However, most MS do not issue GOs for self-consumed energy. Several MS don't allow import of GOs issued for self-consumed energy.

IV.2 RE-DISS: Best Practice Recommendations for Disclosure

IV.2.1 What is RE-DISS

The first report of this REGADISS project, analysing the current legal framework and methodologies, elaborates on the RE-DISS project, its history and its main outcomes. Here below we list some main takeaways of this electricity Disclosure focused project that are also relevant for gases.

IV.2.2 Best Practice Recommendations for Disclosure from RE-DISS

The section outlines the Best Practice Recommendation (BPR) from the Reliable Disclosure Systems for Europe (RE-DISS). These BPRs serve as guidelines for the issuance, tracking, and cancellation of GOs. They also address the calculation of Residual Mix and the role of Reliable Tracking System (RTS).

Important takeaways from electricity Disclosure recommendations that are equally relevant for gases, are listed here:

RE-DISS BPR §2

a) If possible, the issuing of GOs should be done without delay after the end of each production period.
b) Wherever possible, the issuing of GOs for energy produced in year X should be done at the latest by 31 March X+1.

Note that the draft EN16325 revision installs the obligation on issuing bodies to issue the GOs within one month after the end of the production period or after receipt of the issuance request, whichever is the latest. The point is that GO issuance is recommended to take place as soon as practicable possible, with a view of making GOs available to the market in accordance with the consumption period that corresponds to the Disclosure supervision period.

RE-DISS BPR §3

a) The lifetime of GOs should be limited to a maximum of 12 months after the end of the production period.

Note that the draft EN16325 revision clarifies the option that is foreseen in REDII & III to have 12 months transferability of GOs while allowing 18 months cancellability after the end of the production period of the underlying energy.

RE-DISS BPR §3 (continue)

b) GOs which have reached this lifetime should be considered as being "expired" and be collected into the Residual Mix.

Through inclusion of expired GOs in the Residual Mix, the respective Attributes are not lost.

RE-DISS BPR §5

a) Cancellations of GOs which take place until a given deadline in year X+1 should be counted in Disclosure for year X. Later cancellations should be counted in Disclosure for year X+1.

This enables to close down a Disclosure period and provide Disclosure figures that don't have to wait eternally for their availability. That in itself enhances the trust in the Disclosure figures. (Consumers would find it weird to receive Disclosure figures of years in the past.)

RE-DISS BPR §9

a) Market participants of the respective Domain should be provided the possibility to export their GOs and thus participate in the European internal market for [energy].

RE-DISS BPR §16

a) GOs should be the only "tracking certificate" used. Any other tracking systems of a similar purpose and function as GOs should be converted to GOs

Also, for gas Disclosure it needs to be ensured that every tracking instrument uniquely represents the environmental Attributes of the represented energy.

RE-DISS BPR §17

b) Besides GOs, only Reliable Tracking Systems and the Residual Mix should be available for usage for Disclosure. No other mechanism should be accepted.

Note: It needs clarification which other RTS are there for gases. Especially the tracking framework of Proofs of Sustainability in the UDB benefits from clarification on whether it legally entitles for gas Disclosure.

RE-DISS BPR §26

a) *The calculation of the Residual Mix should follow the methodology developed in the RE-DISS project.*

Note: some updates have been developed in the electricity Residual Mix since the closure of the RE-DISS project and for gases some additional challenges apply (different gaseous Energy Carriers, different system boundaries with different levels of regulation and the purpose of tracking for target accounting has an interaction with the GO system that is still being clarified).

b) *As part of this methodology, competent bodies should ensure that double counting between GOs they have issued, other Reliable Tracking Systems in use in their country and the Residual Mix is excluded.*

IV.2.3 Time considerations

Cancellations of GOs which take place until a given deadline in year X+1 should be counted in Disclosure for year X. Later cancellations should be counted in Disclosure for year X+1.

The timing of the calculation of the Residual Mix should be coordinated across Europe:

- *By 30 April X+1 all countries should determine their preliminary domestic Residual Mix and whether they have a surplus or deficit of Attributes.*
- *By 15 May X+1, the European Attribute Mix should be determined.*
- *By 31 May X+1, the final national Residual Mixes should be published.*
- *As of 1 July X+1 the Disclosure figures relating to year X can be published by suppliers*

Coordinating the timing of the most crucial steps for calculating Disclosure data across Europe is necessary. This coordination helps prevent market distortions and opportunities for arbitrage deals between different countries with varying deadlines. It also serves as a prerequisite for the suggested cooperation among European competent bodies in calculating their Residual Mixes (refer to RE-DISS BPR §26).

IV.2.4 Handling of Expired GOs and Ex-Domain Cancellations

IV.2.4.1 Expired GOs

The Disclosure information from expired GOs can be allocated either to the production year of the corresponding energy unit or to the year when the GOs have expired, depending on the methodology used for Residual Mix calculation in the respective Domain.

IV.2.4.2 Ex-Domain Cancellations

So-called ex-Domain cancellations of GOs, where a GO is cancelled in one registry and a proof of cancellation is then transferred to another country in order to be used there for Disclosure purposes, should only be used if a secure electronic transfer is not possible and if there is an agreement on such ex-Domain cancellations between the competent bodies involved.

Recommendation: Besides statistics on GO issuance (in the country of production) and GO cancellation (in the country of consumption), statistical information on all ex-Domain cancellations relating to a Disclosure year should be made available differentiated by energy source in order to support Residual Mix calculations.

IV.3 Added recommendations based on learnings from practice since the RE-DISS BPR

Ever since the RE-DISS BPR had been last updated in 2015, they have been THE blueprint for national implementation of Disclosure regulations. As such, almost a decade of experience was gained, of which learnings from practice can be drawn. Many of those have been raised in informal conversations with parties who work in the area of national supervision of suppliers' Disclosure obligation. The Disclosure Platform, as introduced in the report of Task 1, is a place where such thoughts are collected. This section elaborates on two major topics that are systematically returning in discussions amongst Disclosure supervision experts.

IV.3.1 Supervise claims by other than suppliers

In this Disclosure Platform it has been raised multiple times that the BPR would benefit from elaborating requirements, monitoring and supervision on cancellation of GOs by/for consumers that are other than regulated suppliers. Ideally, these should be included in the overall Disclosure supervision exercise organised by Member States. This way all Disclosed origin of consumed energy is subject to supervision and not only the share supplied by licensed suppliers.

IV.3.2 Strengthen legislation to prevent double claims

Legislation strengthens double claim prevention if it:

1. assigns a unique instrument that is allowed to be used for Disclosure, like a Guarantee of Origin,
2. sets out that that unique instrument can only be used once, including that it ends its lifetime at usage, and only in relation with the usage for Disclosure, like the cancellation of a GO,
3. forbids origin claims that are not based on the legally assigned unique instruments (as there are Guarantees of Origin),
4. supervises all claims on the above principles, and
5. includes quality assurance measures to manage the uniqueness of the instrument, ensuring it can only be issued by a single competent body in each geography, for each Energy Carrier, and that it can only be cancelled in a single place that clarifies the country of destination.

IV.4 Example of gas Disclosure statements in Austria

Austria is the first country that has long enough experiences so far with actually supervising gas Disclosure on supplier invoices. Here below is an illustration how the energy sources of gas supply are displayed on invoices of gas suppliers in Austria.

Gaskennzeichnung
Versorgermix für den Zeitraum vom 01.01.2023 bis 31.12.2023 für [redacted] gemäß § 130 Gaswirtschaftsgesetz 2011 (GWG 2011) und Gaskennzeichnungsverordnung (G-KenV).

Erdgas unbekannter Herkunft: 99,87 %

Erneuerbare Gase (Biomethan): 0,13 %

Als Umweltauswirkungen fallen 200,74 g/kWh CO_2-Emissionen und keine radioaktiven Abfälle an.

Gaskennzeichnung

Energieträger	Versorgermix [redacted]	Ihr Produkt [redacted]"
Erdgas unbekannter Herkunft	99,35 %	80,00 %
Biomethan	0,65 %	20,00 %
CO_2-Emissionen:	199,69 g/kWh	160,80 g/kWh

Gaskennzeichnung der [redacted] den Zeitraum 1. Jänner bis 31. Dezember 2023 gemäß § 130 Abs. 9 GWG 2011 und Gaskennzeichnungsverordnung.

Das Produkt „[redacted]" wurde zu 20 % von kleinen Biogasanlagen in [redacted] eingekauft.
Es ist im Versorgermix von [redacted] enthalten.

Gaskennzeichnung

gem. § 130 GWG 2011 und Gaskennzeichnungs-VO idgF über den gelieferten Gasmix im Zeitraum vom 1. Jänner 2023 bis 31. Dezember 2023.

Versorgermix

Erdgas unbekannter Herkunft ..... 99,83 %
Erneuerbare Gase ..... 0,17 %

Umweltauswirkungen

CO_2-Emissionen ..... 200,66 g/kWh
Radioaktiver Abfall ..... 0,00 mg/kWh

Die eingesetzten Herkunftsnachweise von erneuerbaren Gasen stammen zu 100 % aus Österreich.

Produktinfo – [redacted]

Ihr Produkt setzt sich aus einem Biogasanteil aus österreichischer Produktion zusammen.
Erdgas unbekannter Herkunft ..... 40 %
Erneuerbare Gase ..... 60 %

Umweltauswirkungen

CO_2-Emissionen .....80,40 g/kWh
Radioaktiver Abfall ..... 0,00 mg/kWh

Gaskennzeichnung

der [redacted]

Periode

01.01.2023 - 31.12.2023

Rechtsgrundlagen

§ 130 GWG 2011, BGBl I 107/2011 idgF und
Gaskennzeichnungsverordnung – G-KenV, BGBl 275/2019 idgF

Versorgermix

Energieträger	Aufschlüsselung
Erdgas unbekannter Herkunft	100,00%
erneuerbare Gase	0,00%
sonstige Gase	0,00%

Umweltauswirkungen

CO2-Emissionen in Gramm je kWh 201,00 g/kWh

GASKENNZEICHNUNG

Gemäß § 130 Gaswirtschaftsgesetz 2011 (G-KGWG 2011) sowie gemäß Gaskennzeichnungsverordnung (G-KenV) für den Zeitraum von 1.1.2023 bis 31.12.2023

Energieträger	Versorgermix[1] in Prozent
1. Erdgas unbekannter Herkunft	99,86
2. Erneuerbare Gase aus Österreich	0,14
Summe	**100,00**
Bei der Erzeugung entstanden folgende Umweltauswirkungen	
CO_2-Emissionen	200,71 g/kWh

Energieträger	Produktmix[2] in Prozent
1. Erdgas unbekannter Herkunft	99,97
2. Erneuerbare Gase aus Österreich	0,03
Summe	**100,00**
Bei der Erzeugung entstanden folgende Umweltauswirkungen	
CO_2-Emissionen	200,93240 g/kWh

[1] Versorgermix: gesamte [redacted]

[2] Produktmix: [redacted]

ANNEX V MEMBER STATES' REPORT ON RES CONSUMPTION AND GO

V.1 Reporting obligation

Member States are obliged to report to the European Commission the resulting annual national renewable energy consumption based on GOs. This obligation comes through Annex XVI of the Commission Implementing Regulation (EU) 2022/2299.[49]

Reporting element	Specification	Unit	Year	
			X-3	X-2
Electricity				
Guarantees of origin – issued (1)	M_{iap}	Number		
Guarantees of origin – canceled (2)	M_{iap}	Number		
Guarantees of origin - resulting annual national renewable energy consumption (3)	M_{iap}	GWh		
Gas				
Guarantees of origin - issued	M_{iap}	Number		
Guarantees of origin - canceled	M_{iap}	Number		
Guarantees of origin - resulting annual national renewable energy consumption (4)	M_{iap}	GWh		
Heating/cooling				
Guarantees of origin - issued	M_{iap}	Number		
Guarantees of origin - canceled	M_{iap}	Number		
Guarantees of origin - resulting annual national renewable energy consumption (4)	M_{iap}	GWh		
Measures taken to ensure reliability	M_{iap}	n/a		
Measures taken to protect against fraud of the system	M_{iap}	n/a		

Notation: X = reporting year; M_{iap} = mandatory if applicable

Notes:

(1) The number of guarantees of origin issued for energy that is produced from renewable energy sources in the Member State during the reporting period, based on the time of production of the energy.

(2) The number of guarantees of origin from renewable energy sources cancelled for energy that is consumed in the Member State during the reporting period.

(3) The quantity of energy consumption for which the origin has proven to originate from renewable energy sources, being determined as the cancelled guarantees of origin for energy consumption from renewable energy sources in the reporting period + the renewable share of the residual mix multiplied by the total energy consumption for the reporting period that is not covered with guarantees of origin cancellation.

(4) The quantity of energy consumption for which the origin has proven to originate from renewable energy sources, being determined as the cancelled guarantees of origin for energy consumption from renewable energy sources in the reporting period + the energy consumption from renewable energy sources through other reliable tracking mechanisms that avoid double counting (which may include "the renewable share of the residual mix multiplied by the total energy consumption for the reporting period that is not covered with guarantees of origin cancellation nor other reliable tracking mechanisms").

Figure 36: Reporting template for Member States to supply data to the European Commission on national renewable energy consumption statistics, following Annex 16 of (EU) 2022/2299

Citing from the Reporting Guidelines, the resulting annual national renewable electricity consumption for year X_i, is to be determined as the sum of the number of GOs for renewable energy sources cancelled for consumption during that year in the Member State, and the renewable fraction of energy consumed in that Member State and during that year, for which

[49] Link to Commission Implementing Regulation: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R2299

no RES-GOs were cancelled, based on the renewable fraction of the Residual Mix. For gas and heating/cooling, this definition is extended with other Reliable Tracking Mechanisms for renewable energy, assuming a Residual Mix calculation would be in place for these energy carriers, too.

V.2 Consistency of different reporting on annual renewable electricity consumption per MS

An analysis of the reported data, in comparison to the total supplier mix per country as collected by AIB from the Disclosure supervisory authorities, shows there is confusion on which statistics to report. Aside from obvious data inconsistencies (wrong unit prefix, statistics not filled in…) comparison of the different MS teaches us there's a wide variety in interpretations of the statistics. Figure 37 and Figure 38 show the statistics for electricity per MS, and for 2020 and 2021, respectively.

Although the statistics are not enough to conclude the exact calculation principles per MS, it is clear that the number of GOs cancelled matches with the declared RES consumption in some MS (2021: BE[50], CZ, HU, NL, RO and SE), but in the other MS the reported consumption is higher than the number of cancelled GOs.

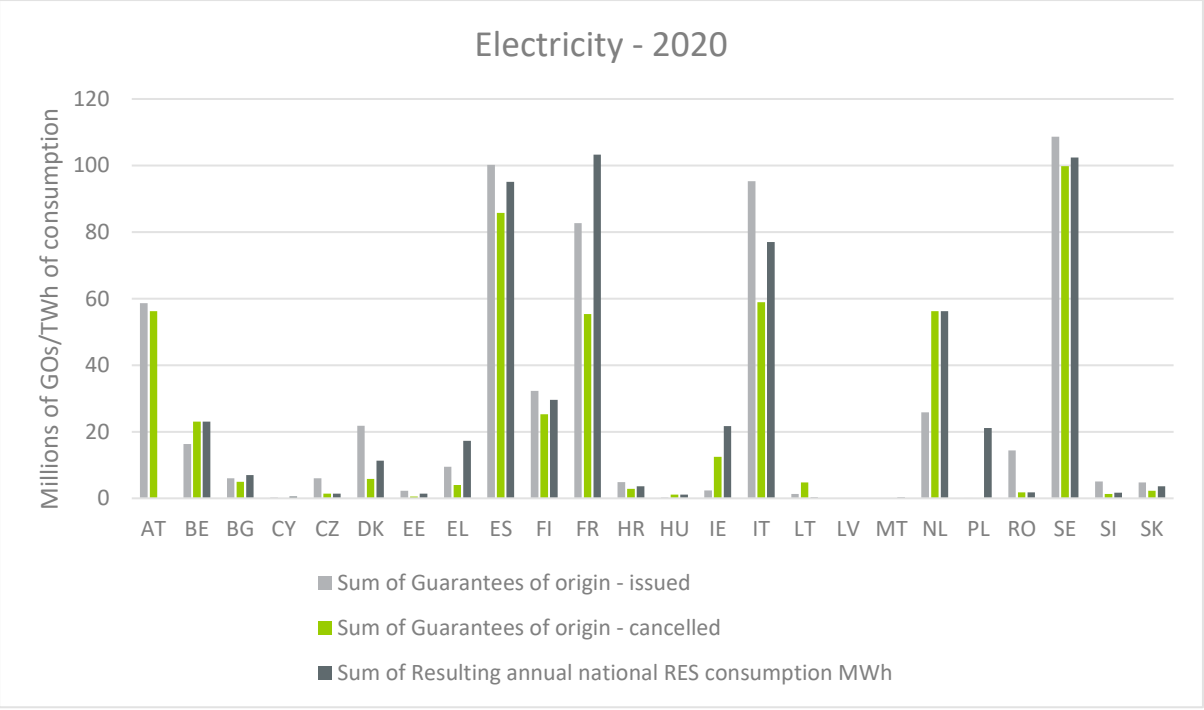

Figure 37: Summary of statistics, reported by Member States on electricity for 2020.

[50] Two-letter codes following ISO 3166-1 alpha-2, see https://en.wikipedia.org/wiki/ISO_3166-1_alpha-2

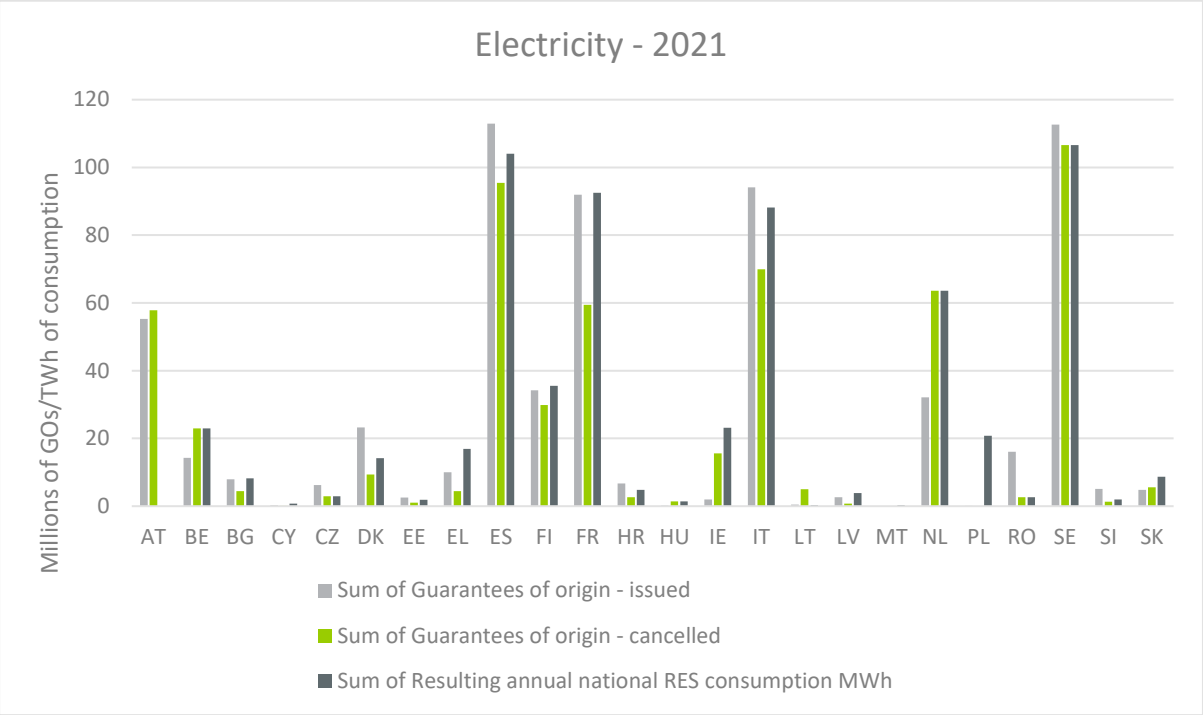

Figure 38: Summary of statistics, reported by Member States on electricity for 2021.

There are three likely clarifications for the RES consumption exceeding the volume of cancelled GOs:

1) The **renewable fraction in the Residual Mix** is not counted towards cancelled GOs – indeed, this fraction is the result of GOs expiring – but it is counted towards renewable consumption.[51]
2) **Self-consumed energy** is not eligible for GO issuance in all MS. However, self-consumption of energy from RES may be included towards the national RES consumption.
3) Somewhat related to self-consumption, **small production devices** (mostly residential solar PV installations) cannot apply for GOs in many MS. Their production might however be counted towards national RES consumption.

It may of course also be the case the national RES consumption in reality is higher than what some MS report, but the MS chooses only to consider the volume of cancelled GOs and nothing more.

In addition, the graphs in Figure 37 and Figure 38 reflect the fact that some countries have a surplus in issued GOs compared to consumption of renewable energy, while others have a deficit. Making the total sum of statistics for all MS, we expect to see an approximate balance between GOs Issued and Cancelled.

[51] A known example where this is NOT the case, is Flanders (Belgian region). Here, disclosure legislation requires that GOs are cancelled to prove the consumption of renewable energy. In that sense, expired GOs are not counted towards the consumption of renewable energy and the renewable fraction from the Residual Mix is discarded.

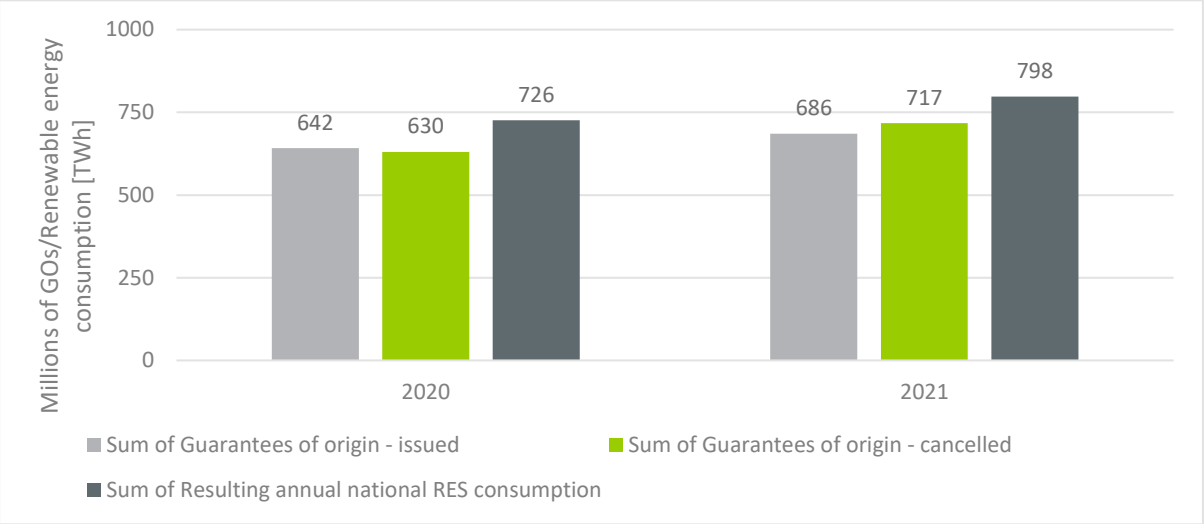

Figure 39: Total of issued and cancelled GOs, and resulting RES consumption for all reporting MS.

This sum is shown in Figure 39. Indeed, the statistics for issuance and cancellation of GOs are more or less balanced. Deviations can be explained by discrepancies between the time of issuance and cancellation. Still, the reported EU RES consumption in 2020 and 2021 exceeds the number of cancelled GOs by 15 and 11%, respectively. Note that this percentage should be higher, given that Austria has a full Disclosure system, but has not reported national RES consumption statistics.

V.3 Consistency between MS reported data and Residual Mix Calculation for electricity

Next, consistency between the reported national RES consumption to the European Commission and the Total Supplier Mix in the Residual Mix calculations is verified. We use the following statistics, derived from the annual Residual Mix calculation:

- **RES fraction in Total Supplier Mix:** the RES fraction in the total supplier mix is calculated as the Total Supplied Volume multiplied by the sum of the renewable energy percentages in the total supplier mix.
- **RES fraction in Untracked Volume:** the RES fraction in the Untracked Volume is calculated as the Total Supplied Volume, multiplied by the fraction of untracked energy (i.e. the supplied volume for which the Residual Mix is used), multiplied by the fraction of RES in the Residual Mix. This is the supplied volume that is considered to be originating from RES sources based on expired RES GOs.
- **RES fraction tracked with GO:** this is the RES fraction in the Total Supplier Mix, diminished with the RES fraction in the Untracked Volume. This is the fraction from which the expired GOs have been deducted, and which should be tracked with GOs.

The resulting calculated values are shown in Figure 40 and Figure 41, and compared with the reported statistics under the Implementing Regulation. It appears that most countries have reported a RES consumption to the EU Commission that lies between the RES volume in the Total Supplier Mix and the number of cancelled GOs. It would be expected that the reported national RES consumption would be equal to the RES fraction of the total supplier mix, and that the number of cancelled GOs would be equal to the RES fraction tracked with GO (i.e., the RES fraction of the Total Supplier Mix minus the RES fraction in the untracked volume).

Some interesting cases:

- *Germany:* the reported RES consumption is close to the number of cancelled GOs, which is much lower than the RES volumes in the total supplier mix (tracked and untracked). This may result from the fact that Germany does not issue GOs for supported energy.
- *France:* the reported RES consumption exceeds the RES volume in the total supplier mix, and is considerably higher than the volume of cancelled GOs.
- *Italy:* in 2020, the reported RES consumption is higher than the number of cancelled GOs, which is in turn far higher than the volume of RES that should be tracked with GOs, according to the Residual Mix.
- *Sweden:* number of cancelled GOs and the reported RES consumption exceed the RES fraction in the Total Supplier Mix (both tracked and untracked).

Note that for Austria (country with full Disclosure), the number of cancelled GOs equals the RES fraction of the total supplier mix, and the reported RES consumption is only slightly higher.

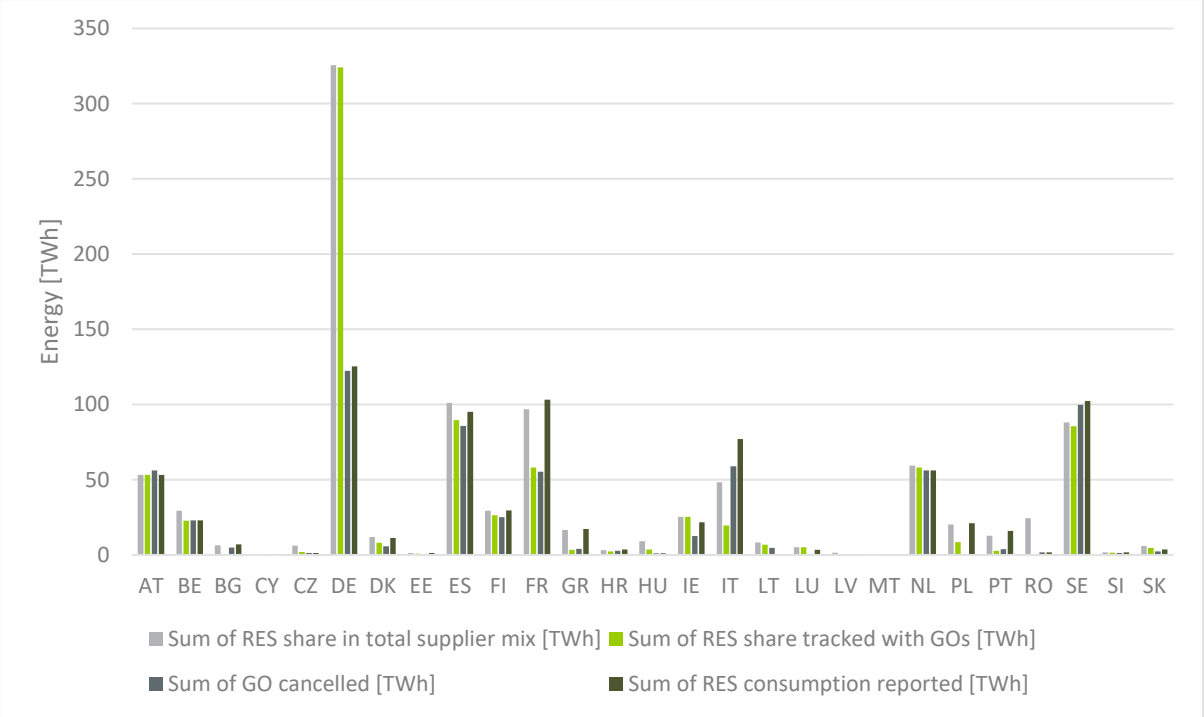

Figure 40: Comparison for 2020 of 1) the calculated RES fraction in the total supplier mix, 2) the remaining RES fraction after the RES fraction from the Residual Mix has been subtracted, 3) the energy volume corresponding with the reported number of cancelled GOs.

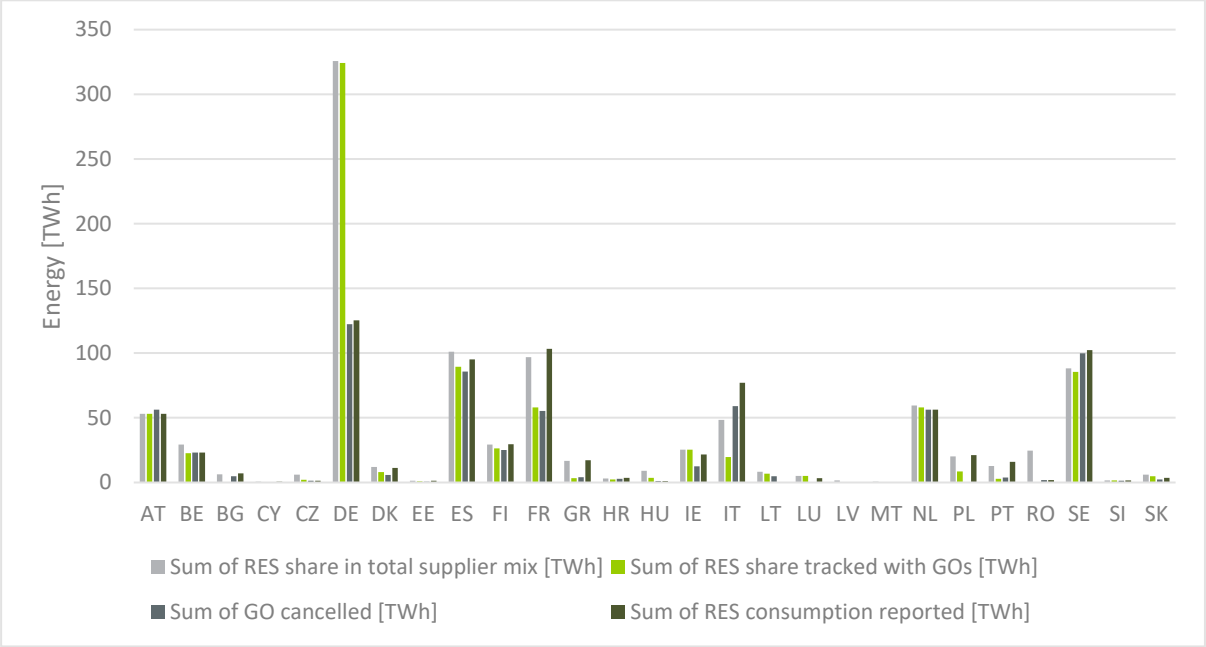

Figure 41: Comparison for 2021 of 1) the calculated RES fraction in the total supplier mix, 2) the remaining RES fraction after the RES fraction from the Residual Mix has been subtracted, 3) the energy volume corresponding with the reported number of cancelled GOs and 4) the reported national RES consumption.

Checking the sum over all MS, we see that the RES volume in the total supplier mix (both the fraction including and excluding expired GOs in the untracked part) was higher than the reported RES consumption in both years, as shown in Figure 42.

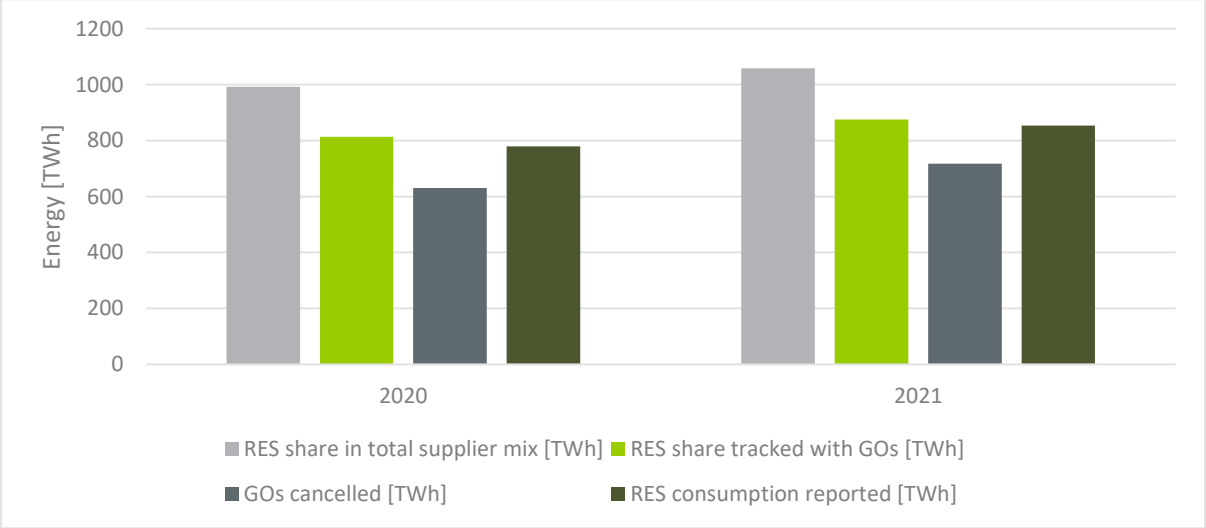

Figure 42: Comparison of the sum over all reporting Member States of 1) the calculated RES fraction in the total supplier mix, 2) the remaining RES fraction after the RES fraction from the Residual Mix has been subtracted, 3) the energy volume corresponding with the reported number of cancelled GOs and 4) the reported national RES consumption.

This leads us to conclude that there are clear opportunities to improve the quality of reporting, both towards the Residual Mix calculation and the EU Commission. Better guidance and harmonization are needed to reduce the discrepancies between the various reporting processes.

V.4 Questions from MS reporting GO and RES Statistics

In early 2023, AIB members discussed how to interpret the statistics to be reported to the European Commission. At the time, it was clear that due to differences in national law and regulations, it would be difficult to report consistent statistics, given the instructions. Also, at the time it was not clear what the purpose of the reporting obligation was.

A subgroup discussed ways to understand the requested statistics. The following discrepancies were identified:

- **Self-consumption:** mostly for residential PV installations; not all MS issue GOs for (all or any) production from small PV installations. It was not clear whether self-consumption was to be accounted for in the national RES consumption figures.
- **Time discrepancy between issuance and cancellation:** some MS require that only GOs from the same year of production be cancelled for consumption in that year; others allow a longer cancellation window (up to 18 months after production).
- **Reporting year:** whether the statistics referred only to GOs issued and cancelled during the reporting year, or for the reporting year.
- **Energy receiving support is not always eligible for GOs:** most prominently in Germany, the rule is that no GOs are issued for energy from production devices that have received support. Question whether to include energy from these devices under national RES consumption.
- **Expired GOs:** if GOs are not cancelled within their lifetime, they expire and are included in the national Residual Mix. Some MS do not count this renewable fraction in the RM as consumption from RES. The reason for this is that energy may only be disclosed as energy from RES if GOs are cancelled for that consumption. Expiry does not count as a cancellation. Other countries may apply the same rule, to encourage as much cancellation of RES GOs as possible.
- **Ex-domain cancellations:** when electronic transfer of GOs between two domains is not possible, ex-domain cancellations (EDCs) may be used as a solution. In that case, GOs are cancelled in one domain, to prove consumption in another. It is unclear which Member State should report the cancellation of such GOs, and which domain should report RES consumption resulting from the EDC. The risk is that both domains report, resulting in double counting in the statistics.
- **Reporting parties:** the authorities who are responsible for the reporting don't always have a deep knowledge of the national GO system and statistics on renewable energy consumption using GOs. In practice, they have to reach out to either the issuing body and/or the Disclosure responsible body.

Overall, AIB Members agree that the key to providing clarity on these questions is the purpose of the reporting obligation.

V.5 Conclusion

The data confirms the confusion that was signalled by AIB Members in 2023. The data reported under Implementing Regulation (EU) 2022/2299 by itself does not provide a lot of insight. In order to be conclusive, it must be combined with data from the Residual Mix calculation. Doing so shows a large degree of variation in the interpretation of what should be reported, depending on the Member State.

In addition, summing the statistics over all MS shows further discrepancies:

- The Issued and Cancelled GOs do not match;
- The reported RES consumption by the MS is lower than the RES fraction in the Total Supplier Mix, as calculated in the Residual Mix calculation; and
- The reported GO cancellations do not add up to the RES volume to be tracked with GOs, as calculated in the Residual Mix calculation.

While the intended interpretation of the Commission Implementing Regulation (EU) 2022/2299 is that the resulting renewable consumption is based on the renewable share of the residual Mix, from this analysis it can be concluded that most countries have used a different methodology.

Lastly, the collection of data lags too far behind to be of much use, other than to check the reported statistics and the Residual Mix calculations ex-post.

V.6 Recommendations for clarification to MS on the reporting requirements

Judging from the conclusions in the previous section, it is recommended that the European Commission provides **further clarification to the Member States on the general goal of the MS report**, and **on the details of the required data**:

- GO Issuance statistic should be based on date of issuance, in line with the timings for the Residual Mix calculation (1.4.Y – 31.3.Y+1);
- GO Cancellation statistic should be based on date of cancellation, in line with the timings for the Residual Mix calculation (1.4.Y – 31.3.Y+1);
- Ex-domain cancellations should only be included in the statistics of the Member State for which the GOs have been cancelled;
- Clarify that supported energy and self-consumption, for which no GOs may have been issued, or GOs may have been immediately cancelled upon issuance, need to be considered in the national RES consumption;
- Repeat that the RES fraction in the Residual Mix must be included, even if it may be discarded on a national level;
- National RES consumption should include production from RES, for which no GOs have been issued.

Lastly, we recommend collecting the data sooner after the reporting period, in line with the deadline for submitting statistics for the Residual Mix Calculation, being 20 April of year Y for collecting data of year Y-1.

ANNEX VI RELEVANT EXCERPTS FROM CSRD AND ESRS

VI.1 Links to the legislation

CSRD: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022L2464
ESRS: Delegated regulation - EU - 2023/2772 - EN - EUR-Lex (europa.eu)

VI.2 Disclosure of energy consumption and mix

Disclosure Requirement E1-5 – Energy consumption and mix, imposes the following:

35 The undertaking shall provide information on its energy consumption and mix.

36 The objective of this Disclosure Requirement is to provide an understanding of the undertaking's total energy consumption in absolute value, improvement in energy efficiency, exposure to coal, oil and gas-related activities, and the share of renewable energy in its overall energy mix.

37 The Disclosure required by paragraph 35 shall include the total energy consumption in MWh related to own operations disaggregated by:

(b) total energy consumption from fossil sources (footnote 33);
(c) total energy consumption from nuclear sources;
(d) total energy consumption from renewable sources disaggregated by:
i) fuel consumption for renewable sources including biomass (also comprising industrial and municipal waste of biologic origin), biofuels, biogas, hydrogen from renewable sources (footnote 34), etc.;
ii) consumption of purchased or acquired electricity, heat, steam, and cooling from renewable sources; and
iii) consumption of self-generated non-fuel renewable energy.

38 The undertaking with operations in high climate impact sectors shall further disaggregate their total energy consumption from fossil sources by:

(a) fuel consumption from coal and coal products;
(b) fuel consumption from crude oil and petroleum products;
(c) fuel consumption from natural gas;
(d) fuel consumption from other fossil sources;
(e) consumption of purchased or acquired electricity, heat, steam, or cooling from fossil sources;

39 In addition, where applicable, the undertaking shall disaggregate and disclose separately its non-renewable energy production and renewable energy production in MWh (footnote 36).

Footnote 33

This information supports the information needs of financial market participants subject to Regulation (EU) 2019/2088 because it is derived from a mandatory indicator related to principal adverse impacts as set out by indicator #5 in Table I of Annex I of Commission Delegated Regulation (EU) 2022/1288 with regard to Disclosure rules on sustainable investments ("Share of non-renewable energy consumption and production"). The breakdown serves as a reference for an additional indicator related to principal adverse impacts as set out by indicator #5 in Table II of the same Annex ("Breakdown of energy consumption by type of non-renewable sources of energy").

Footnote 34

Compliant with the requirements in delegated acts for hydrogen from renewable sources: Commission Delegated Regulation of 10 February 2023 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin; and Commission Delegated Regulation of 10 February 2023 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a minimum threshold for greenhouse gas emissions savings of recycled carbon fuels and by specifying a methodology for assessing greenhouse gas emissions savings from renewable liquid and gaseous transport fuels of non-biological origin and from recycled carbon fuel.

Footnote 36

This information supports the information needs of financial market participants subject to Regulation (EU) 2019/2088 because it is derived from a mandatory indicator related to principal adverse impacts as set out by indicator #5 in Table I of Annex I of Commission Delegated Regulation (EU) 2022/1288 with regard to Disclosure rules on sustainable investments ("Share of non-renewable energy consumption and production").

ESRS – Appendix A – Application Requirement 32 further specifies:

When preparing the information on energy consumption required under paragraph 35, the undertaking shall:

(…)

(j) adopt a conservative approach when splitting the electricity, steam, heat or cooling between renewable and non-renewable sources based on the approach applied to calculate market-based Scope 2 GHG emissions. The undertaking shall only consider these energy consumptions as deriving from renewable sources if the origin of the purchased energy is clearly defined in the contractual arrangements with its suppliers (renewable power purchasing agreement, standardised green electricity tariff, market instruments like Guarantee of Origin from renewable sources in Europe (footnote 50) or similar instruments like Renewable Energy Certificates in the US and Canada, etc.).

Footnote 50

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

VI.3 Disclosure of Emissions

Companies are obliged to disclose their emissions according to "Disclosure Requirement E1-6 – Gross Scopes 1, 2, 3 and Total GHG emissions".

This implies they shall report Scope 1, 2, 3 gross emissions and total GHG emissions. The Scope 2 GHG gross emissions intended to provide an understanding of the indirect impacts on climate change caused by the undertaking's consumed energy whether externally purchased or acquired. The reporting on gross Scope 2 GHG emissions required shall include both methods:

- The gross **location-based** Scope 2 GHG emissions in metric tonnes of CO_2eq; **and**
- The gross **market-based** Scope 2 GHG emissions in metric tonnes of CO_2eq,

also known as "dual reporting."

These reporting methods are described as follows:

- ***Location-based** method quantifies Scope 2 GHG emissions based on average energy generation emission factors for defined locations, including local, subnational, or national boundaries.*

and

- ***Market-based*** *method quantifies Scope 2 GHG emissions based on GHG emissions emitted by the generators from which the reporting entity contractually purchases electricity bundled with instruments, or unbundled instruments on their own.*

The calculation guidance in Application Requirement 45 (Appendix A) states:

When preparing the information on gross Scope 2 GHG emissions required under paragraph 49, the undertaking shall:

(d) (…) Market-based method quantifies Scope 2 GHG emissions based on GHG emissions emitted by the generators from which the reporting entity contractually purchases electricity bundled with instruments, or unbundled instruments on their own (GHG Protocol, "Scope 2 Guidance", Glossary, 2015); in this case the undertaking may disclose the share of market-based scope 2 GHG emissions linked to purchased ***electricity bundled with instruments such as Guarantee of Origins*** *or Renewable Energy Certificates. The undertaking shall provide information about the share and types of contractual instruments used for the sale and purchase of energy bundled with Attributes about the energy generation or for unbundled energy Attribute claims.*

ANNEX VII INTERACTION WITH UNION DATABASE ON SUSTAINABLE BIOFUELS

VII.1 What is the UDB?

The information about injection and withdrawal of renewable gaseous fuels shall be provided in the Union Database (UDB) (Art. 31a, RED III) to qualify for target accounting and financial support. Economic operators are obliged to provide information on sustainability criteria, emission savings and other information up to the point of injection into the gas network as the interconnected gas system shall be considered as single mass balance system. This information shall be certified under National or Voluntary Schemes.

While the data on the gaseous fuel transactions shall be entered into the UDB, the commercial aspect of such transactions are handled completely outside of UDB (in the same manner as they are handled outside of the Guarantees of Origin registries). UDB, in the same spirit as GO issuing bodies, registers transactions – but is in no means an intermediary for concluding those transactions, neither a contracting party. The transactions themselves are being concluded within the gas market as established today in Europe: either via organised markets, either over the counter – direct bilateral, or via brokers.

The UDB for the gaseous fuels value chain is expected to be operational by 21 November 2024, i.e. the legal deadline in the RED III.

Further national integration of the requirements as a consequence of the UDB will depend on the specific implementations the Member States apply with their transposition of RED III. Thus these will only be fully specified by 21st May 2025[52]

The set-up deadline and the creator of the UDB, being the European Commission, are set in the REDIII.

REDIII Art. 31a §1. *By 21 November 2024, the Commission shall ensure that a Union database is set up to enable the tracing of liquid and gaseous renewable fuels and recycled carbon fuels (the 'Union database').*

The actors for entering data into the UDB are the economic operators. They shall enter in the UDB, regarding the fuels they trade, data on:

(a) transactions made
(b) sustainability characteristics, and
(c) life-cycle greenhouse gas emissions.

REDIII Art. 31a §*2. Member States shall require the relevant economic operators to enter in a timely manner accurate data into the Union database on the transactions made and the sustainability characteristics of the fuels subject to those transactions, including their life-cycle greenhouse gas emissions, starting from their point of production to the moment they are placed on the market in the Union. (…)*

This information inserted in the UDB is hence a self-declaration by the economic operators, yet subject to audits under National or Voluntary Schemes.

At the time of drafting this report, the integration of registration processes for tracking the gaseous value chain in the Union Database is under development. The part of the database

[52] Deadline for the Member States transposition of the relevant articles in RED III

for liquid biofuels is in a further stage than that for gaseous biofuels. A significant difference with the liquid biofuels sector is that in that sector no GOs exist, while for gases, Member States are obliged to issue them on producers' request if the production isn't supported, as described before.

This chapter considers the interaction between data registered in the UDB, and data used in Disclosure of the origin of energy by/for consumers. It aims at recognising the objective and design of the UDB having its prime purpose in tracking fuels for policy target accounting and not oriented towards Disclosure and takes the UDB design in its current status as an input. From there onwards, it considers design aspects of the interaction between the UDB and the GO system as they are known at the time of drafting this report.

VII.2 Consideration on system boundaries – Mass balancing

The RED relates the accounting of policy targets to the tracking mechanism of mass balancing.

REDIII Art.30 Verification of compliance with the sustainability and greenhouse gas emissions saving criteria

§1 *Where renewable fuels and recycled carbon fuels are to be counted towards the targets referred to in Article 3(1), Article 15a(1), Article 22a(1), Article 23(1), Article 24(4) and Article 25(1), Member States shall require economic operators to show, by means of mandatory independent and transparent* ***audits****, in accordance with the implementing act adopted pursuant to paragraph 8 of this Article, that the sustainability and greenhouse gas emissions saving criteria laid down in Article 29(2) to (7) and (10) and Article 29a(1) and (2) for renewable fuels and recycled-carbon fuels have been fulfilled. To that end, they shall require* ***economic operators to use a mass balance system*** *which (…)*

It also clarifies how to treat the gas network in this target accounting framework when interpreting the mass balancing mechanism.

REDIII Art. 31a § 2 *(…) For the purpose of entering data into the Union database****, the interconnected gas system shall be considered to be a single mass balance system****.*

(…)

A consideration in the scope of this report, is whether this "interconnected gas system" shall be a system boundary for the Residual Mix calculation. Alternatively, the RM boundary shall be wider, e.g. as broad as where the GOs are legally allowed to flow. Restricting it to the "interconnected gas system" would exclude local gas grids e.g. in the north of Scandinavia, and gases that are transported by vehicle, while gas GOs from disconnected grids are allowed to be cancelled for gas consumption in that region.

VII.3 Interaction between UDB and GO system

VII.3.1 Goal: preventing double claims

GOs, as the instrument for Disclosure, have a separate legal basis from the tracking system for sustainable liquid biofuels for target accounting. On top of that, the management of the GO system is delegated to the Member States (through RED Art. 19), while the aim of RED Art. 31a has been explained as to organize the tracing for RED III target accounting in a centralised way at EU level in the Union Database.

As such, there could be a risk that the same gas is disclosed separately through different legislative tracking systems, namely GOs in national databases and the Proofs of Sustainability under National or Voluntary Schemes, reported by Economic Operators to the UDB. However, REDIII art.31a contains provisions that aim to overcome this risk, as shown in the relevant excerpts of this article here below.

VII.3.2Legal embedding of the interaction UDB-GO framework

REDIII formalises the interaction between GOs and the UDB, with obligations for Member States and restrictions for the market flow of Guarantees of Origin:

REDIII Art. 31a §4 *Where guarantees of origin have been issued for the production of a consignment of renewable gas, Member States shall ensure that those guarantees of origin are transferred to the Union database at the moment when a consignment of renewable gas is registered in the Union database and are cancelled after the consignment of renewable gas is withdrawn from the Union's interconnected gas infrastructure. Such guarantees of origin, once transferred, shall not be tradable outside the Union database.*

It also establishes responsibilities from Member States regarding quality of data flows into the UDB:

REDIII Art. 31a§5 *Member States shall ensure in their national legal framework that the accuracy and completeness of the data entered by economic operators into the database is verified, for instance by using certification bodies in the framework of voluntary or national schemes recognised by the Commission pursuant to Article 30(4), (5) and (6) and which may be complemented by a system of guarantees of origin.*

Such voluntary or national schemes may use third-party data systems as intermediaries to collect the data, provided that such use has been notified to the Commission. (…)

Regarding the organisation of data flows at national level and EU-central level, Member States have the option to exploit their existing or new national database:

REDIII Art. 31a§5 (…) *Each Member State may use an already existing national database aligned to and linked with the Union database via an interface, or establish a national database, which can be used by economic operators as a tool for collecting and declaring data and for entering and transferring those data into the Union database, provided that:*

a) the national database complies with the Union database including in terms of the timeliness of data transmission, the typology of data sets transferred, and the protocols for data quality and data verification;
b) Member States ensure that the data entered into the national database are instantly transferred to the Union database.

Member States may establish national databases in accordance with national law or practice, such as to take into account stricter national requirements, as regards sustainability criteria. Such national databases shall not hinder the overall traceability of sustainable consignments of raw materials or fuels to be entered into the Union database in accordance with this Directive.

The verification of the quality of the data entered into the Union database by means of national databases, the sustainability characteristics of the fuels related to those data, and the final approval of transactions shall be carried out through the Union database alone. The accuracy

and completeness of those data shall be verified in accordance with Commission Implementing Regulation (EU) 2022/996 (*). They may be checked by certification bodies.

Member States shall notify the detailed features of their national database to the Commission. Following that notification, the Commission shall assess whether the national database complies with the requirements laid down in the third subparagraph. If that is not the case, the Commission may require Member States to take appropriate steps to ensure compliance with those requirements.

VII.4 Statistics from data in UDB will be essential for Residual Mix

VII.4.1 There will be statistics

REDIII also ensures that new statistics will become publicly available regarding data recorded in the UDB. This could help as data input for the Residual Mix calculation, if relevant. Currently, it is not yet fully specified which type of statistics will be published from UDB.

REDIII Art. 31a §6 Aggregated data from the Union database shall be made publicly available, with due regard to the protection of commercially sensitive information, and shall be kept up-to-date. The Commission shall publish and make publicly available annual reports about the data contained in the Union database, including the quantities, the geographical origin and feedstock type of fuels.

VII.4.2 Timing of statistics

Whether the data will be available in a timely manner and with the relevant granularity for the Residual Mix calculation, is however an essential question that has not yet been answered given the current stage of UDB development. Also because some elements may depend on the specific implementation that Member States will apply.

According to the timeline for Residual Mix calculation, discussed in 6.3 Data collection and calculation timeline, data from the UDB would annually be needed to feed into the RM calculations by 21 April, which is also the deadline for competent bodies to send data on GOs. This in order to facilitate updated origin disclosure figures by gas suppliers annually from July 1st onwards, and stick close enough to the year of supply for a meaningful disclosure.

VII.4.3 Categories in the statistics

Clarification on the type of statistics that will be published from UDB is needed. For transparency in the Disclosure of the sources of consumed energy, it is recommended to publish the number of PoS cancelled for consumption per Member State, per country of origin, and in categories on whether or not accompanied by GO cancellation. It is recommended to provide subcategories per energy source, at least differentiating between renewable and low-carbon gas, but also further detailed per energy source. Tags that are optionally available on GOs and in PoS on the UDB regarding the Advanced Biofuels character should be part of the categories in the statistics.

This will enable the parties who use the data from the UDB, among others for Residual Mix calculation, to have an overview and start their analysis from accurate data. The same goes for policy development and general monitoring on green claims.

For Member States' Disclosure supervisory authorities, not only aggregated data, but also the details of every consignment of gas that the UDB registers as consumed in their country, can be made available at request. This would indicate whether or not accompanied by a GO in the UDB. Also it would clarify if the UDB displaying facilitates a consumption claim based on the record in the UDB or not. Such availability strengthens the Member States in their responsibilities regarding detecting of double counting when such would occur.

VII.5 Challenges on the interaction between national and EU central tracking responsibilities

Where it comes to responsibilities on tracking the energy source of energy, legislation foresees a shared responsibility between the European Commission and national level. The following paragraphs summarise challenges arising from these circumstances.

VII.5.1 Central tracking tasks at EU level

The European Commission monitors the quantities of biofuels and biomass eligible to be counted towards Targets based on the information provided from Member State authorities and economic operators. For doing so, there is a tracking throughout the supply chain of sustainability characteristics, which includes the Proof of Sustainability (PoS) and Greenhouse Gas (GHG) emissions.

VII.5.2 National responsibilities related to energy origin tracking and claims

On the other hand, national responsibilities encompass a wide range of tasks. Following REDIII, these tasks include:

- ensuring the origin of Renewable Energy Sources (RES) can be guaranteed;
- issuing Guarantees of Origin upon the request of the producer;
- ensuring that each unit of RES is counted only once to prevent double counting;
- calculating the Residual Mix;
- ensuring that used gas GOs correspond to the "network characteristics" of gas consumption;
- managing national support systems;
- require Economic Operators (EO) to show that criteria are met for target accounting;
- ensure the GOs they issue, adhere to the EN16325 GO standard;
- ensure that GOs expire, at maximum 18 months after the production period (but possibly earlier, depending on national system design choices).

MS also have to supervise reliable Disclosure as per the Recast Gas Directive and ensure substantiated green claims as per the draft Green Claims Directive.

Note that Member States can only execute their responsibilities on the condition that the cancellation of GOs takes place under the control of the country where the RES consumption is claimed. This is essential for a harmonised and reliable system for tracking and claiming renewable energy consumption.

VII.6 Conditions for preventing double counting with other reliable tracking systems than GOs

If consumption claims on renewable and low-carbon gases would legitimately be made based on other instruments than GOs, then, in order to prevent double claims of the same renewable & low-carbon Attributes:

1) These other Tracking Instruments should be following the physical flows of gases. This follows from the definition of the Residual Mix in Art. 19.2 13) of RED: "'Residual Energy Mix' means the total annual energy mix for a Member State, excluding the share covered by cancelled Guarantees of Origin". Indeed, only the share covered by cancelled GOs is excluded from the total annual energy mix of a Member State. Therefore, the energy covered by other tracking systems than GOs must be included in the "total annual energy mix" of a Member State; and

2) there should be double counting prevention measures for that "other reliable tracking instrument", in all stages of its existence, being ensuring uniqueness at issuance, transfer, cancellation, usage, including erroneous duplication prevention, and there should be rules that explicitly forbid claims being made outside the legitimate tracking systems; and

3) the Disclosure supervisory authority of the Member State should have insight in the data on these instruments, for which energy production they are issued, where they are used, and whether this is in line with the Disclosure rules for the country of consumption; and

4) if such instrument were to be PoS that are registered in the UDB, then in addition to the gas supplier, the national Disclosure supervisor and both the national and international party who calculate the Residual Mix would also need to know which PoS entitles for the Disclosure towards the respective consumer. Access to these parties to the relevant data inside the UDB can overcome this.

5) data collection mechanisms should be in place at national and central level for the whole calculation area of the Residual Mix.

While the integration of the gaseous value chain in the UDB is ongoing, these essential conditions need to be covered.

Currently, flows of records or certificates issued under voluntary schemes, are not systematically collected at Member State level, but this would be dealt with in the Union Database. Further exhaustive reporting requirements are not yet fully implemented. They are only in the UDB when PoS are used for target accounting purposes, not when used for other types of consumption claims.

This brings the conclusion that in the current legal setting and data collection processes, any proof of sustainability for which no corresponding GO is cancelled and that is not registered in the UDB, would cause double counting, as these renewable gases are also in the Residual Mix. Furthermore, the UDB may give access to the national Disclosure supervisory authorities regarding which renewable gases are registered for consumption in their domain, and whether or not a GO is linked to it.

VII.7 GOs and PoS should be inseparable at consumption

As such, GOs and PoS issued for the same unit of energy should be inseparable at the point of energy consumption where that specific unit of energy is claimed. Indeed,

1) Where both exist for the same unit of energy, their separate trade risks double claims of the same unit of energy,
2) Where no GO is issued, the energy covered in an PoS is already included in the Residual Mix.

ANNEX VIII CRITERIA FOR RENEWABLE HYDROGEN FOR POLICY TARGET ACCOUNTING: DELEGATED ACT ON RFNBO

Delegated Act 2023/1184[53] on Renewable Fuels of Non-Biological Origin (RFNBO) establishes detailed rules for determining when electricity used for the production of renewable liquid and gaseous transport fuels of non-biological origin can be considered fully renewable. Here we first touch upon the general framework and subsequently on some attention points with impact on the Residual Mix and our focus regarding double claim prevention. Further, the guidance from DG ENER from the European Commission is analysed with the same focus.

VIII.1 Two delegated Acts

The Commission has proposed detailed rules to define what constitutes renewable hydrogen in the EU, with the adoption of two Delegated Acts (DA) required under the Renewable Energy Directive. These Acts are part of a broad EU regulatory framework for hydrogen which includes energy infrastructure investments and state aid rules, and legislative targets for renewable hydrogen for the industry and transport sectors. These rules and targets aim to ensure that all renewable fuels of non-biological origin (also known as RFNBOs) are produced from renewable electricity. The two Acts are inter-related and the requirements in both acts are necessary for the fuels to be counted towards Member States' renewable energy target.

For certification of renewable hydrogen, producers can rely on a system of certification by third parties, so-called Voluntary Schemes.

VIII.1.1 RFNBO DA

The Delegated Act RFNBO[54] of 10 February 2023 sets out the rules for defining renewable fuels of non-biological origin (RFNBOs), such as hydrogen produced from renewable electricity. Section VIII.2 touches upon these rules and elaborates on how they may impact the framework for GOs and Disclosure.

VIII.1.2GHG DA[55]

RFNBOs must have a life-cycle greenhouse gas emission saving of at least 70% compared to the fossil fuel comparator. The act provides a methodology for calculating the life-cycle emissions, taking into account the emissions from electricity generation, processing, and transport.

VIII.2 Criteria for renewable hydrogen

The RFNBO DA builds on the concept of “Renewable Electricity” as input for an electrolyser.

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[53] Commission Delegated Regulation (EU) 2023/1184 of 10 February 2023 supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable liquid and gaseous transport fuels of non-biological origin : https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R1184
[54] RFNBO DA: See Commission Delegated Regulation (EU) 2023/1184.
[55] GHG DA: See Commission Delegated Regulation (EU) 2023/1185

The exhaustive phrasing of and mutual interaction between so called “RFNBO-criteria” for eligibility of hydrogen under the RFNBO DA are to be read in the delegated regulation itself. There are multiple scenarios, forming a decision tree: if condition X is met, then criterion Y applies, if not criterion Z is applicable. This provides a structured approach to determining eligibility. GO market analyser Veyt summarizes the criteria as follows.

Direct connection	RES-E grid	Low carbon grid	Imbalanced grid	General grid
	Unbundled GOs	Bundled GOs	Unbundled GOs	Bundled GOs
		Temporal correlation		Temporal correlation
		Geographical correlation		Geographical correlation
Additionality				Additionality

Figure 43 Pathways for complying with RFNBO criteria considered from GO market perspective (Source: Veyt)

With “**bundled GOs**”, a Power Purchase Agreement between electricity producer and electrolyser operator is meant, for which the electricity consumption is backed by the cancellation of GOs from the respective electricity Production Device.

Names given to some of the criteria are Additionality, Geographical and Temporal Correlation. They are defined in the DA.

Additionality: Where this criterion applies, hydrogen producers must ensure that the electricity used for hydrogen production is matched by renewable electricity production. This can be demonstrated either in the same installation or through a renewables power purchase agreement (PPA). The renewable electricity installation has not been operational for more than 36 months before the electrolyser and has not received any form of aid.

Geographical Correlation: Where this criterion applies, it requires hydrogen producers to ensure that the renewable electricity production is located where it can reach the location where the hydrogen is produced.

Temporal Correlation: Requires that renewable electricity and hydrogen are produced in the same time interval

VIII.2.1 Information collection for compliance check

To verify the conditions are met, regarding the electricity from renewable sources with which the hydrogen is produced, there is need for information types that enable to qualify whether following conditions are met:

1. General eligibility for electricity from the grid:
   - Is the electricity injected on the grid in a bidding zone with 90% renewable production on average in preceding calendar year? (yes/no),
     or
   - Is the electricity injected on the grid in a bidding zone with emission intensity <18 gCO_2eq/MJ, and renewable PPA and temporal and geographical correlation criteria are met? (yes/no),

or

- Are the “Downwards redispatching criteria” met during the imbalance settlement period - DA Art.4.3? (yes/no),

or

- Does the electricity comply with the “additionality criteria” and the “temporal and geographic correlation criteria”? (yes/no),

2. Temporal correlation:
    - Monthly correlation till 31/12/2029, hourly correlation from 1/1/2030 onwards: does the production period of the hydrogen coincide with the production/storage release period of the electricity with which the hydrogen is produced – DA Art.6 ? (yes/no),

    OR

    - Is the Clearing price of electricity in day-ahead market in the bidding zone lower than a threshold of:
        1. 20 euro/MWh or
        2. 0,36 * emission allowance price /ton CO_2eq ? (yes/no)
3. Geographical correlation:
    - Bidding zone correlation – DA Art. 7: Is the electricity produced in the same bidding zone or Interconnected zone with equal or higher price as the one where the electrolyser is located ? (yes/no),
4. Additionality
    - Is the Electricity production device less than 3 years older than the RFNBO production device– DA Art.5.a? (Y/N),
    - Is there Absence of support for the pre-conversion electricity – DA Art. 5.b ? (yes/no)
5. Does there exist a Power Purchase Agreement (PPA) between the electricity producer and the RFNBO producer (needing the start date and end date of the contract) ? (yes/no)
6. Certifying party and reference to the certifying statement – (Voluntary Scheme or other) – DA Art.9
7. Is there a “Direct connection” between electricity production and electrolyser – DA Art.3 ? (yes/no).

It is obvious that the current GO system is not collecting all these information items needed to check compliance on the criteria. Yet part of the information can be sourced from electricity GOs, regarding the electricity input for hydrogen production. Doing so, would save time and expenses from the certification bodies operating under national or Voluntary Schemes and as such can lower the overall cost of certification. That is helpful for overcoming barriers for a liquid market.

VIII.2.2 Renewable Hydrogen for policy target accounting may be produced in countries without a GO system

Art 9 of the Delegated Act 2023/1184 states:

Regardless of whether the renewable liquid and gaseous transport fuel of non-biological origin is produced inside or outside the territory of the Union, fuel producers may make use of national schemes or international voluntary schemes recognised by the Commission pursuant to Article 30(4) of Directive (EU) 2018/2001 to demonstrate compliance with the criteria set out in Articles 3 to 7 of this Regulation, in line with Article 8, as relevant.

Where a fuel producer provides evidence or data obtained in accordance with a scheme that has been the subject of a decision in accordance with Article 30(4) of Directive (EU) 2018/2001, to the extent that such decision covers the demonstrating of compliance of the scheme with Article 27(3), fifth and sixth subparagraphs of that Directive, a Member State shall not require the suppliers of renewable liquid and gaseous transport fuels of non-biological origin to provide further evidence of compliance with the criteria set out in this Regulation.

Reflection

This reflects the reality that hydrogen may be imported from countries where no GO system is installed, while still complying with the criteria for policy target accounting. These import flows would however still be accounted for, through the framework that the UDB framework installs for recognition.

VIII.3 Carbon/GHG emissions of RFNBOs

When coming to the stage in the Disclosure process where it must be determined what is the carbon footprint of gases that are supplied to consumers, it is important to know that there are varying pieces of legislation that set out an emissions calculation method. This in itself brings along the challenge that a future emissions calculation method for the Residual Mix may be torn between differing methodologies for emissions calculation.

The abovementioned RFNBO criteria in Sections VIII.2 and 10.3VIII.2.1 become a main market driver, as they entitle to be counted as being below the emission threshold in policy targets.

The GHG DA (2023/1185) sets a minimum limit for the savings of greenhouse gas emissions from recycled carbon fuels. It also outlines the method for calculating the savings of greenhouse gas emissions from renewable liquid and gaseous transport fuels of non-biological origin, as well as from recycled carbon fuels.

Art.3 states:

The greenhouse gas emissions savings from renewable liquid and gaseous transport fuels of non-biological origin and from recycled carbon fuels shall be determined in accordance with the methodology set out in the Annex.

Annex A of this GHG DA (2023/1185):

Electricity qualifying as fully renewable according to Article 27(3) of Directive (EU) 2018/2001, shall be Attributed zero greenhouse gas emission.

When determining the emissions that gas suppliers must mention on the bill related to renewable and low-carbon gases, following annex 1.5 of the Gas Directive, it will likely be consistent to apply the same reasoning and consider RFNBO compliant gases as having zero emissions.

For applying this in an efficient manner, it may be convenient to have on a hydrogen GO a tag that indicates whether or not the hydrogen was produced with such (RFNBO criteria compliant) electricity that is Attributed to have zero greenhouse gas emissions.

VIII.4 Clarifying Q&A by DG ENER on RFNBO

Multiple stakeholders provided their questions to DG ENER, seeking further interpretation of the DA RFNBO. The section presents a collection of responses from DG ENER to those questions, as provided on 26 July 2023[56], refined on 14 March 2024[57].

VIII.4.1 Excerpts

Responding to stakeholders' questions, responses from DG ENER from 14 March 2024, are as follows:

18. ***Could concluding a renewables power purchasing agreement between an RFNBO producer and a retailer supplying physical electricity and associated GOs comply with the requirement set out in Article 4 (2)(a)?***

Reply: No. Fuel producers are required to have concluded directly, or via intermediaries, one or more renewables PPAs with economic operators producing renewable electricity. While electricity suppliers could act as intermediaries (i.e. facilitators of the contracting), the fuel producer would need to conclude renewables PPAs with economic operators producing renewable electricity. The associated GOs are an additional element necessary to ensure that the same unit of energy from renewable sources is taken into account only once.

19. ***What are the minimum requirements for "renewable PPA"?***

Reply: The requirements for renewable PPAs stem from the definition set out in the RED itself and the RFNBO delegated act. In the RED, a renewables PPA is defined as a contract under which a natural or legal person agrees to purchase renewable electricity directly from an electricity producer. The delegated act allows fuel producers to conclude one or more renewable power purchase agreements directly, or via intermediaries. The renewable PPAs need to clearly identify the installations that produce the amount of renewable electricity that is used to produce the renewable hydrogen. Furthermore, the hydrogen producer can only claim the production of RFNBOs based on a renewable PPA if the electricity supplied under the contract has effectively been produced. Intermediaries referred to in the RFNBO delegated act may be involved by various means and for various purposes, including as a contracting party. For example, intermediaries can represent the electricity producers, but it is important that a direct relationship between the electricity producer and the hydrogen producer is maintained. In addition, the requirements on cancelling Guarantees of Origin "GOs" as described under question 20, the requirements set out in Article 5 of the RFNBO delegated act, as well as the requirements set out in Article 19 RED (referred to in recital 15 of the RFNBO DA), have to be met.

20. ***Several provisions in the RFNBO delegated act require concluding renewables PPAs with economic operators producing renewable electricity. What requirements would apply for GOs in this context?***

Reply: The GOs for the PPA need to comply with the general requirements in Article 19 of RED and furthermore carry the same Attributes as the physical installation producing the electricity. This includes e.g. the location of the installation, the age of the installation, and the

[56] https://energy.ec.europa.eu/system/files/2023-07/2023_07_26_Document_Certification_questions.pdf
[57] https://energy.ec.europa.eu/document/download/21fb4725-7b32-4264-9f36-96cd54cff148_en?filename=2024%2003%2014%20Document%20on%20Certification.pdf

time of the production. The associated GOs need to be cancelled before the expiry of the validity period and the volume cancelled shall correspond to that claimed under the PPA. The RES-e producer is not allowed to sell or transfer the associated GOs to any other entity than the operator of the electrolyser under the PPA. To enforce this, the Member State may decide to immediately cancel the associated electricity GOs. The requirements on GOs also apply in cases where the RFNBO DA does not require the conclusion of a renewables PPA.

32. ***Which requirements on electricity GOs would apply when the RFNBO delegated act does not require the conclusion of a renewables PPA*** *(e.g. areas with more than 90% RES in the electricity mix)*

Reply: According to recital 15 of the RFNBO delegated act, Article 19 of RED obliges Member States to ensure that the same unit of energy from renewable sources is taken into account only once. Therefore, if RES GOs have been issued for the electricity used to produce the hydrogen, then these GOs need to be cancelled. The cancellation of the respective GOs can be done e.g. by the competent body designated by the Member States or by the producer of the hydrogen. It is up to the certifier of the installation to ensure that the amount cancelled corresponds to the volume of electricity used.

33. ***What is the role of GOs for the implementation of the RFNBO delegated act?***

Reply: The RFNBO delegated act does not set out rules for the use of GOs and the use of GOs is not required to implement the requirements of the hydrogen delegated acts. The requirements for GOs stem entirely from Article 19 RED and therefore apply only where GOs have been issued or are used. GOs and systems characterised by a comparable degree of robustness may still be used as a tool for demonstrating compliance with the criteria of the RFNBO delegated act. For instance, it would be possible for the fuel producer to demonstrate via cancelling the required number of GOs that at least an equivalent amount of electricity that is claimed as fully renewable has been produced by the installations producing renewable electricity under the renewable PPA. Only electricity produced by the contracted installations themselves is eligible. Accordingly, only GOs that have been issued for the installations covered by the renewables PPAs can be used to demonstrate compliance with the conditions on additionality and temporal and geographic correlation.

VIII.4.2 Interaction with Disclosure

From the above referenced Q&A, it becomes clear that RFNBO criteria interact with the framework for Disclosure of hydrogen from RES. This is seen in the requirement to use GOs in the conjunction with renewable PPAs. It also clarifies that the associated GOs corresponding to the volume claimed under the PPA, should be cancelled before their validity period.

The cancellation of the GOs ensures that each unit of energy from the renewable sources is taken in account only once, preventing double counting. These GOs or units of energy results in removing renewable energy from the generation mix, impacting the Residual Mix calculation.

VIII.5 Risks for double claims

VIII.5.1 PPA based renewable claims without GOs

Stakeholders ask questions on how to prove that electrolysers produce green hydrogen from renewable energy: “Is a GO needed on the electricity side to prove the renewable property or is “only” a certification of temporal compliance sufficient to declare the hydrogen as green?”

The Q&A from DG ENER interprets the legal texts so that, when a GO is issued, this GO shall be used as part of the compliance proof, but that not all renewable production might have received a GO. In that case it might be possible to prove compliance without GOs.

Caution must however be given to ensure the prevention of double claims, and the absence of a GO for the same electricity should be confirmed.

Furthermore, the Residual Mix calculation for electricity would need adjustment:

The definition of Residual Energy Mix in RED Art.2 (13) excludes only GOs from a country’s annual energy mix. As the Residual Mix is to be used for untracked commercial offers, in case other instruments (e.g. PoS, renewable PPA) entitle to claim renewable energy consumption, these should also be excluded from the definition of the Residual Energy Mix, in order to prevent double consumption claims of the same renewable characteristics. As Member States have an obligation to annually publish the Residual Mix, this can only be done if reporting and data collection systems are installed (regarding such alternative instruments) to ensure this exclusion.

Alternatively, to prevent confusion in the market and to prevent subsequent double claims, it should be clarified in explicit legislation that only GOs entitle to claim renewable energy consumption.

Note however that the RFNBO criteria “only” relate to policy target accounting. They by themselves do not put limitations on the origin Disclosure towards consumers, which suppliers must base on GOs, following the upcoming update of the Gas Directive, Annex 1§5.

VIII.5.2 Renewable grid-based claims shall still cancel GOs

Another recurring stakeholder question is what will be the Residual Mix in countries with grids that have if the production mix of one of their bidding zones, or of the whole country is more than 90% renewables? (NO, SE1, SE2)

Stakeholders wonder whether it would be possible to sell the GOs from these renewable energy generation plants to other regions? There is worry that there would be double claiming. DG ENER’s response to Q&A question 32 above however clarifies that such GOs should be cancelled and cannot be exported.

The Residual Mix will still balance out for the exported GOs for the electricity from renewables that is not claimed for RFNBO.

VIII.5.3 Compensate in the electricity Residual Mix for renewable electricity that is counted as RFNBO input

In case the implementation of the RFNBO Criteria would be based on an interpretation that it would be possible to claim the renewable origin of electricity for RFNBOs without GOs, then

still, ensure that the electricity, that is counted as renewable at a specific consumption point for the RFNBO criteria, is excluded from the Residual Mix.

ANNEX IX FORMULA FOR THE RESIDUAL MIX FOR THE ELECTRICITY SECTOR

When the conditions for reliable Disclosure are in place, the formula from the electricity Residual Mix method (see Figure 44) can be applied.

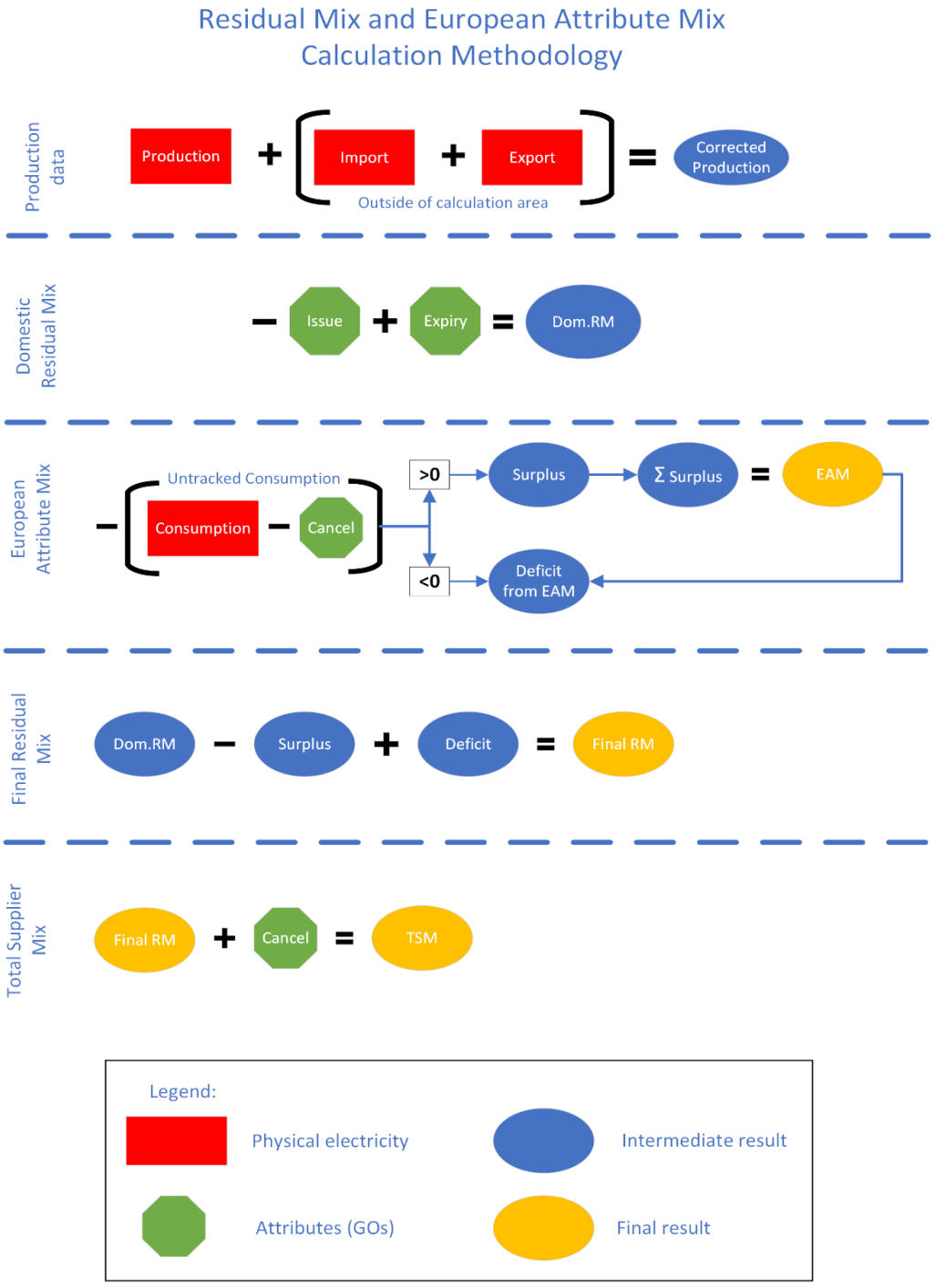

Figure 44: Calculation methodology for the Electricity Residual Mix

The methodology starts with the calculation of domestic Residual Mix for a country. This step involves determining the availability of the attributes and considering the imports and exports

from outside the calculation area. It then determines whether there is surplus or deficit of Attributes, considering environmental indicators, and negative balances.

The next step is to establish the European Attribute Mix or EAM. This step determines which countries have a surplus and establishes the Final Residual Mix in these countries. Following this, EAM is created. Finally, the Residual Mix is established in the deficit countries. The final step of the methodology is to establish Total Supplier mix which is done by adding the Cancelled attributes to the Residual Mix.

This method of calculating Residual Mix has been widely implemented and accepted.

ANNEX X CALCULATION EXAMPLE: TESTING THE RM FORMULA WITH NUMERICAL DATA

With a view to confirm the feasibility of the developed calculation method for the Residual Mix for gas set out in chapter 5, with the data as elaborated in chapter 6, the method is tested using a calculation example with data from a few countries.

As a disclaimer for the numerical outcome, with such limited geographical scope, the current calculation example cannot be considered to lead to a complete result. This is partly due given the interconnected gas markets from which not all data are included and partly due to lack of input data, and partly to incomplete availability of input statistics. It however allows to draw some first learnings, which are elaborated in chapter 7 of the report.

X.1 Selected case

X.1.1 Selected gas: methane

The calculation example is developed for the methane-type of gas. More and more countries are injecting biomethane in the natural gas grids and are issuing Guarantees of Origin for biogas. First transactions of biogas GOs in between EU Member States already have taken place as well.

These developments guarantee the availability of sufficient data to elaborate a calculation example, which reflects could reflect a potential reality in the market. Yet, this calculation example does not pretend depicting the actual natural gas and biomethane flows in Europe; its sole purpose is to test the calculation methodology for the Residual Mix of gases.

The development of hydrogen markets, in contrast, is still in its infancy in Europe and elaborating a case for it would be based too much on hypotheses.

X.1.2 Selected year: 2022

For this calculation example, data for 2022 are taken. At the time of finalising this report, not all data for 2023 are available.

While it is intuitively odd for consumers to receive the 2022 Residual mix only at the end of 2024, the recommendation stands to provide data publicly much earlier on the gas movements and transactions of Tracking Instruments. For the purpose of testing the calculation formula, the selected year however works.

X.1.3 Selected countries: FR, BE, NL, LU, DE, DK

For the calculation example, a calculation area of 6 countries was chosen. This allows to examine how Untracked Gas is distributed form countries with a surplus to countries with a deficit.

Following six countries were selected: France – Belgium – Netherlands – Luxembourg – Germany – Denmark, see Figure 45. The selection of these countries is based on the significance of the gas exchange amongst these countries, the significance of their domestic biomethane production, maturity of gas GO schemes and because they together form a geographical confined area.

Most of the chosen countries had biomethane GOs in place at the year for which there is data available. Countries like Denmark and Germany had higher cross-border flows of biomethane in the year 2022, yet the inflow of biomethane in Germany was not all backed with formal GOs.

By selecting six countries, the calculation area also includes a country that is entirely enclosed by other countries of the calculation area, which would also be the case when applying the calculation methodology for the whole of Europe.

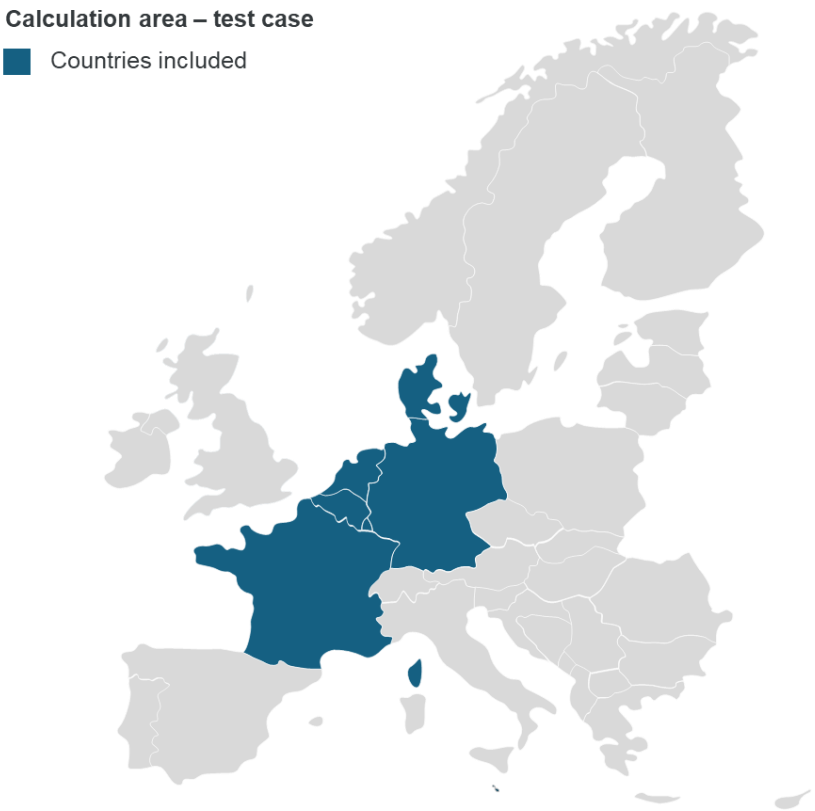

Figure 45: Selected calculation area for testing the calculation methodology for the Residual Mix for gases.

X.1.4 Granularity of energy sources

Three energy sources are considered in this calculation example:

- (Fossil) natural gas
- Biomethane (injected into the natural gas grid)
- Unknown

The diversity of energy sources is lower than for electricity, for which a variety of renewable sources (solar, wind, hydro, biomass, …) and non-renewable sources (coal-based, gas-based, nuclear, …) are considered.

X.2 Data input

X.2.1 Natural gas data

X.2.1.1Natural gas – physical balance

Data on physical quantities of natural gas produced (yield), imported and exported, stored or released from storage and consumed are taken from Eurostat – Complete Energy Balances. These data are chosen because of their consistency over the different countries selected and because the inputs and outputs of gas is in balance (as much natural gas is added to each of the countries as is withdrawn from the countries).

From the Complete Energy Balances of Eurostat, following data fields are selected:

1. Primary production, as a proxy for 'Yield'
2. Imports and Exports
3. Change in stock, as proxy for 'Gas released from storage' (in case of a positive number) or 'Gas stored' (in case of a negative number)
4. Gross available energy, as a proxy for 'Consumption'

The numerical data is presented in Table 14.

Table 14: Summary of annual physical flows (energy represented in MWh) into and out of the selected countries for the calculation example. These numbers were derived from Eurostat – Complete Energy Balances.

MWh	Belgium	Denmark	Germany	France	Luxembourg	Netherlands
Primary production (1)	120,425	14,473,259	42,007,891	206,977	0	149,822,517
Imports (2)	235,835,198	26,765,425	822,237,624	575,545,280	6,117,396	325,054,600
Exports (2)	83,838,743	22,086,249	0	154,171,595	0	148,784,782
Change in stock (3)	-1,331,551	-2,415,429	-87,789,516	-35,140,382	0	-53,572,685
Gross available energy (4)	***150,785,330***	***16,737,006***	***776,455,997***	***386,440,280***	***6,117,396***	***272,519,651***

X.2.1.2Natural gas trade with countries outside the calculation area

The data on Imports and Exports, in the table above, concern the gas exchange of the concerned country with all other countries in the world. For the calculation of the Residual Mix, a distinction needs to be made between the exchange of the concerned countries with the other countries inside and with countries outside the calculation area.

Hereto, data are taken from Eurostat:

- Imports of natural gas by partner country - monthly data
- Exports of natural gas by partner country - monthly data

However, when comparing the import and export statistics, differences could be observed. For instance, the import statistics indicate that Germany imported 254,073,580 MWh of natural gas from Belgium in 2022, while the export statistics indicate that Belgium exported 256,449,750 MWh to Germany. To overcome these data inconsistencies, the average of both was taken.

As a next step, the export-data were subtracted from the import-data to arrive at data on the net-imports of natural gas between each of the countries of the calculation area. The result is

shown in Table 15. Only positive number are added to this table to avoid double counting. Cross-country trades that are zero, such as between France and Denmark, are omitted from the table.

Deducting these values on natural gas import-export within the calculation area from the total natural gas imports and exports results in how much natural gas each of the six selected countries imported or exported from outside the calculation area.

Table 15: Summary of physical cross-border flows of gas between the considered countries in the calculation example, expressed as imports in MWh.

Net-imports (MWh)	**Importing country**						
Exporting country	**Belgium**	**Denmark**	**Germany**	**France**	**Luxembourg**	**Netherlands**	**SUM**
Belgium			255,261,665		6,757,386	68,670,209	**330,689,260**
Denmark						10,355,034	**10,355,034**
France	36,262,180						**36,262,180**
Germany		21,866,621		14,082,407	40,545		**35,989,573**
Luxembourg							**0**
Netherlands			216,904,137	13,397			**216,917,534**
SUM	**36,262,180**	**21,866,621**	**472,165,802**	**14,095,804**	**6,797,931**	**79,025,243**	**630,213,580**

Deducting these values on natural gas import-export within the calculation area from the total natural gas imports and exports results in how much natural gas each of the six selected countries imported or exported from outside the calculation area.

However, additional inconsistencies between the Eurostat data on the Complete Energy Balances and on the Monthly data on imports/exports of natural gas by partner country were found.

For Luxembourg, the gas balance table indicates that this country imported 6,117,396 MWh, whereas the net-import table, derived from monthly gas statistics indicates an import of 6,797,931 MWh. The number of the gas balance was taken.

For Belgium, the gas balance table indicates an import of 235,835,198 MWh from all countries in the world, while the net-imports table indicates an import of 36,262,180 MWh from the other countries in the calculation area. The difference, 199,573,019 MWh, is what Belgium imported from the countries outside the calculation area.

In a similar way, the quantity Belgium exported in 2022 to countries outside the calculation area can be calculated. Yet, the quantity Belgium exported to all countries (83,838,743 MWh) is lower than the quantity Belgium exported to the other countries within the calculation area (330,049,270 MWh). Subtracting the latter from the former results in a negative export (-246,210,527 MWh); in other words, a positive import of 246,210,527 MWh from countries outside the calculation area.

This imported quantity of 246,210,527 MWh comes on top of the 199,573,019 MWh calculated above. Hence, the total natural gas imports from outside the calculation area to Belgium amounts to (246,210,527 + 199,573,019 =) 445,783,546 MWh, while the exports from Belgium

to outside the calculation area is set at zero. Similar corrections were carried out for Germany and the Netherlands, see Table 16.

Table 16: Correcting net-imports and net-exports for discrepancies between Eurostat data on the Complete Energy Balances and Monthly data on imports-exports. Corrections were needed for Belgium, Germany and the Netherlands.

MWh		A: Gas trade with all countries (source: Gas Balances)	B: Gas trade within calculation area (source: Monthly gas Imports/Exports)	C = A – B: Gas trade with countries outside the calculation area	D: correction of column C (negative exports = imports)
Belgium	Import	235,835,198	36,262,180	199,573,019	445,783,546
	Export	83,838,743	330,049,270	-246,210,527	0
Germany	Import	822,237,624	472,165,802	350,071,822	386,020,850
	Export	0	35,949,028	-35,949,028	0
Nether-lands	Import	325,054,600	79,025,243	246,029,358	314,162,109
	Export	148,784,782	216,917,534	-68,132,752	0

For the other three countries, no correction is needed, as their export to other countries inside the calculation area is lower than the overall exports, see Table 17.

Table 17: Deriving gas trade with countries outside the calculation area. No corrections were needed for France, Luxembourg and Denmark.

MWh		A: Gas trade with all countries (source: Gas Balances)	B: Gas trade within calculation area (source: Monthly gas Imports/Exports)	C = A – B: Gas trade with countries outside the calculation area
France	Import	575,545,280	14,095,804	561,449,476
	Export	154,171,595	36,262,180	117,909,415
Luxembourg	Import	6,117,396	6,117,396	0
	Export	0	0	0
Denmark	Import	26,765,425	21,866,621	4,898,804
	Export	22,086,249	10,355,034	11,731,215

X.2.1.3Overview of the data input for natural gas

The combination of all these data leads to following input data on the physical quantities of natural gas in Table 18.

Table 18: Combining all previously presented data into the input numbers for the physical gas quantities for the Residual Mix calculation.

MWh	Belgium	Denmark	Germany	France	Luxembourg	Netherlands
Yield	120,425	14,473,259	42,007,891	206,977	0	149,822,517
Released from storage	0	0	0	0	0	0
Imports from outside area	445,783,546	4,898,804	386,020,850	561,449,476	0	314,162,109
Exports to outside area	0	11,731,215	0	117,909,415	0	0
Quantities stored	1,331,551	2,415,429	87,789,516	35,140,382	0	53,572,685

Consumption	150,785,330	16,737,006	776,455,997	386,440,280	6,117,396	272,519,651

X.2.1.4Natural gas – Tracking Instruments

It is assumed that no Tracking Instruments are issued for fossil natural gas. Yet, the calculation methodology requires that the energy source of the natural gas streams is specified. Following assumptions are made in this calculation example:

- Natural gas, produced within the calculation area, is considered to be 'fossil gas'.
- Natural gas, imported from outside the calculation area, is considered to be 'unknown'.
- No energy source needs to be considered for natural gas that is consumed and for natural gas that is stored.

X.2.2 Grid-injected Biomethane

X.2.2.1Disclaimer on impact of incomplete data sources in the formula for testing purposes

Disclaimer – use of asterisk (*)

For gas from renewable energy sources injected into the grid, no unique and consistent database could be found to provide the necessary data for the calculation of the Residual Mix for gases. Instead, a variety of sources was used to collect the data: data provided by issuers of gas-GOs and by the European Biogas Association, supplemented with data taken from statistical reports on biogas and biomethane. As a result, **a hypothetical picture on trade in biomethane and** biomethane-related **Tracking Instruments** within the selected countries is presented in this calculation example, **which deviates from the actual market conditions in 2022.**

Countries are mentioned with an asterisk (*) behind the country name to indicate this theoretical aspect. As such, Germany* is not fully reflecting the reality of figures from Germany, Denmark* is not fully reflecting Denmark, etc.

Yet, the assumed data **is only used to allow to test the calculation methodology for the Residual Mix for gases,** which is the purpose of this exercise**.**

X.2.2.2Biomethane – balance of the Tracking Instruments – assumptions made

The balance of Tracking Instruments for biomethane bases itself on the following data assumptions, see Table 19.

1) For the data field 'Issued', no consistent data source could be found, and data were collected from different sources:
    a. For Flanders, Brussels and France, data were provided by the issuing bodies.
    b. For Denmark, data from public statistics were taken, however, they concern the year 2023 instead of 2022.[58]
    c. For Germany, Luxembourg and the Netherlands, the production statistics were copied, assuming that injected biomethane would be represented by a Tracking Instrument.
    It is known that this assumption is not a complete and accurate picture of the reality, especially for the calculation year. There are in practice flows of renewable attributes traded bilaterally across borders with or without GOs and

[58] Source:EnerginFet, Certifikater i tal

with or without PPAs, as in the calculation year no pan-European disclosure legislation nor supervision existed.

2) It is assumed that Tracking Instruments are neither issued nor cancelled for storage.
3) The data field 'Expired' is based on data from GO statistics for France and on data provided by the issuing body provided for Flanders. For Denmark, the difference between issued and exported plus cancelled was observed. To overcome this difference – see 7.2 about the risks when inputs do not equal the outputs, the difference is assumed to be expired within that year.
   This of course should not be done when calculating a real residual mix working with real data, as it would risk double counting. Expired GOs should only be in the residual mix if the governmental framework declared them to be expired. Yet here for feasibility check of the formula, it is interesting to see what happens if there are expired GOs included. (It results in the renewable share of the RM.)
4) The 'Export to outside the calculation area' concerns a transfer from Denmark to Sweden, which is in this calculation example outside the calculation area.
5) The data field 'Cancelled' is also based on different sources and assumptions:
   d. Data provided by the issuing bodies were copied for Flanders, Brussels, Denmark and France.
   e. The number of Tracking Instruments cancelled was set equal to the number that had been set for the of Tracking Instruments issued for Wallonia, Luxembourg and the Netherlands. In other words, it was assumed that in the countries no Tracking Instruments expired nor was there an export.
   f. Finally, it was assumed that Germany absorbed and cancelled all remaining Tracking Instruments within the calculations that other countries did not cancel, export or let expire.
   With this assumption, the inputs and outputs of Tracking Instruments is in balance, meaning that over the entire calculation area that the total number cancelled, exported and expired is the same as the total number issued[59]. This is obviously a too wide approximation of the facts, but here only done with a view to showcase the formula, not to make any statements of reality.

Table 19: Compiling statistics on issuance of Tracking Instruments for the Residual Mix calculation.

MWh	Belgium*	Denmark*	Germany*	France*	Luxembourg*	Netherlands*
Issued (1)	(44,731)	7,944,956	(10,580,000)	6,681,900	(53,000)	(2,419,000)
Issued for storage (2)	0	0	0	0	0	0
Imports from outside area	0	0	0	0	0	0
Expired (3)	0	(750,146)	0	90,417	0	0
Exports to outside area (4)	0	2,194,505	0	0	0	0
Cancelled for storage (2)	0	0	0	0	0	0

[59] For natural gas, data from the Complete Energy Balances of Eurostat were taken to have a balance between the inputs and outputs within the calculation area.

Cancelled (5)	(51,060)	970,260	(16,252,255)	4,945,944	(53,000)	(2,419,000)

Note: The numbers between brackets refer to the numbered assumptions above this table. The numerical data in this table should not be interpreted without considering these assumptions

X.2.2.3Biomethane – physical balance – assumptions made

Following data for the physical balance of (injected) biomethane are assumed, see Table 20.

1) For the data field 'Yield', no consistent data source could be found, and data were collected from different sources:
    a. For Belgium, production statistics were provided by the Flemish and Brussels regulator. For Wallonia, the production data is based on press communications on a biomethane injection project[60].
    b. For Denmark, the number of GOs issued for 2023 was copied[61].
    c. For France[62] and Germany[63], biomethane production data were taken from national biogas statistics. For France, the biomethane production exceeds the number of Tracking Instruments issued; this difference is respected in the calculations to mimic a (theoretical) situation in which not all injected biomethane would be represented by Tracking Instruments.
    d. For Luxembourg and the Netherlands, production statistics from the European Biogas Association were taken[64].
2) It is assumed that biomethane is not stored, nor released from storage.
3) No import of biomethane as assumed, due to a lack of public statistics on biomethane imports.
4) The 'Exports to outside the calculation area' is copied from the number of Tracking Instruments exported.
5) The data field 'Consumption' is also copied from the number of Tracking Instruments cancelled, except for Germany for which the number is adjusted to arrive at a zero balance of biomethane within the calculation area (the total quantity consumed and exported is the same as the quantity produced). This is an assumption to make the formula fit and is not based on facts.

Table 20: Collecting physical quantities of biomethane as input to the Residual Mix calculation.

MWh	Belgium	Denmark	Germany	France	Luxembourg	Netherlands
Yield (1)	(44,731)	(7,944,956)	(10,580,000)	6,973,802	(53,000)	(2,419,000)
Released from storage (2)	0	0	0	0	0	0
Imports from outside area (3)	0	0	0	0	0	0
Exports to outside area (4)	0	(2,194,505)	0	0	0	0

[60] Source: https://territoire.charleroi-metropole.be/projets/biomethanisation-et-injection-de-gaz-vert-dans-le-reseau
[61] Source:Energinet, Certifikater i tal
[62] +Source: Statinfo - biométhane
[63] Source: DENA, Analyse Branchenbarometer Biomethan 2023
[64] Source: personnal communication

Quantities stored (2)	0	0	0	0	0	0
Consumption (5)	(51,060)	(970,260)	(17,381,720)	4,945,944	(53,000)	(2,419,000)

Note: The numbers between brackets refer to the numbered assumptions above this table. The data from this table should not be interpreted without considering these assumptions.

X.3 Residual Mix calculation example - detailed methodology

X.3.1 Step 1: Calculating the Preliminary Domestic Residual Mix

As a first step in the calculation of the Residual Mix, the Preliminary Domestic Residual Mix is calculated, see Table 21.

The Preliminary Domestic Mix is the sum of following terms:

A. (Plus) Yield (quantities produced)
B. (Minus) Number of Tracking Instruments issued for production
C. (Plus) Quantities released from storage (not added to the tables below, as it is zero for all countries)
D. (Minus) Number of Tracking Instruments issued for storage (not added to the tables below, as it is zero for all countries)
E. (Plus) Quantities imported from outside the calculation area
F. (Minus) Number of Tracking Instruments imported from outside the calculation area
G. (Plus) Number of Tracking Instruments expired

Table 21: Calculation of the Preliminary Domestic Residual Mix. Columns in grey indicate terms to be added to the Preliminary Domestic Residual Mix, white columns are subtracted from it.

	A. Yield +	B. Issued –	E. Import from outside area +	F. Import of tracking instr. –	G. Expired +	**Preliminary Domestic Residual Mix** =
BELGIUM*						
Fossil gas	120,425					**120,425**
Biomethane	44,731	44,731	0	0	0	**0**
Unknown			445,783,546			**445,783,546**
SUM						***445,903,971***
DENMARK*						
Fossil gas	14,473,259					**14,473,259**
Biomethane	7,944,956	7,944,956	0	0	750,146	**750,146**
Unknown			4,898,804			**4,898,804**
SUM						***20,122,209***
FRANCE*						
Fossil gas	206,977					**206,977**
Biomethane	6,973,802	6,684,900	0	0	90,417	**379,319**
Unknown			561,449,477			**561,449,477**
SUM						***562,035,773***

GERMANY*						
Fossil gas	42,007,891					**42,007,891**
Biomethane	10,580,000	10,580,000	0	0	0	**0**
Unknown			386,020,850			**386,020,850**
SUM						***428,028,741***
LUXEMBOURG*						
Fossil gas	0					**0**
Biomethane	53,000	53,000	0	0	0	**0**
Unknown			0			**0**
SUM						***0***
NETHERLANDS*						
Fossil gas	149,822,517					**149,822,517**
Biomethane	2,419,000	2,419,000	0	0	0	**0**
Unknown			314,162,109			**314,162,109**
SUM						***463,984,626***

X.3.2 Step 2: Calculating the Domestic Residual Mix

As a next step, the attribute mix of the Preliminary Domestic Residual Mix is specified, as elaborated in 5.4. This is the export of gas outside the calculation area minus the export of Tracking Instruments to outside the calculation area.

For three countries, the export of gas to outside the calculation area is recalibrated to zero, as explained in X.2.1.2: Belgium, Germany and the Netherlands, see Table 16, while for Luxembourg it is zero by default as this country is completely surrounded by other countries of the calculation area. For these countries, the Domestic Residual Mix is the same as the Preliminary Domestic Residual Mix.

The two other countries export gas and Tracking Instruments outside the calculation area. For these, the Domestic Residual Mix is represented in Table 22.

Table 22: Calculation of Domestic Residual Mix for Denmark and France. The Preliminary Domestic Residual Mix is compensated for the export of gas and Tracking Instruments outside the calculation area. The other countries have no export outside the calculation zone, and hence the Preliminary Domestic RM equals the Domestic RM.

	Preliminary Domestic Residual Mix	Export of gas outside the area	Export of Tracking Instruments outside the area	Untracked export	**Domestic Residual Mix**
DENMARK*					
Fossil gas	**14,473,259**			8,437,887	**6,035,372**
Biomethane	**750,146**			437,334	**312,812**
Unknown	**4,898,804**			2,855,995	**2,042,809**
SUM	**20,122,209**	13,925,721	2,194,505	11,731,216	**8,390,994**
FRANCE*					
Fossil gas	**206,977**			43,422	**163,555**
Biomethane	**379,319**			79,577	**299,742**

Unknown	**561,449,477**			117,786,417	**443,663,060**
SUM	**562,035,773**	117,909,416	0	117,909,416	**444,126,357**

X.3.3 Step 3: Calculation of Untracked Consumption

The next step in the calculation of the Residual Mix is the calculation of the Untracked Consumption:

A. (Plus) Quantities of gas consumed
B. (Minus) Number of Tracking Instruments cancelled
C. (Plus) Quantities of gas stored
D. (Minus) Number of Tracking Instruments cancelled for storage

In this step, only the total quantities and numbers are considered without making a distinction between the different energy sources.

The results of this step are shown in Table 23.

Table 23: Calculation of the Untracked Consumption for all countries inside the example calculation area. The terms in the grey columns are added to the Untracked Consumption, and those in the white columns subtracted from it.

	A. Consumption	B. Cancelled	C. Quantities stored	D. Cancelled for storage	**Untracked Consumption**
	+	**–**	**+**	**–**	**=**
BELGIUM*	150,836,390	51,060	1,331,551	0	**152,116,881**
DENMARK*	17,707,266	970,260	2,415,429	0	**19,152,435**
FRANCE*	391,386,224	4,945,944	35,140,382	0	**421,580,662**
GERMANY*	793,837,717	16,252,255	87,789,516	0	**865,374,978**
LUXEMBOURG*	6,170,396	53,000		0	**6,117,396**
NETHERLANDS*	274,938,651	2,419,000	53,572,685	0	**326,092,336**

X.3.4 Step 4: Comparing between Domestic Residual Mix and Untracked Consumption

In the next step, the Domestic Residual Mix is compared with the Untracked Consumption. In case the former is larger than the latter, there is a surplus of untracked gas in the country. If not, there is a deficit. The results of this step are shown in Table 24.

Table 24: Step 4 of the RM calculation determines if the countries have a surplus or deficit of attributes in the Domestic RM.

	Domestic Residual Mix	**Untracked Consumption**	**Difference**	
	+	**–**	**=**	
BELGIUM*	445,903,971	152,116,881	**293,787,090**	**SURPLUS**
DENMARK*	8,390,994	19,152,435	**-10,761,442**	**DEFICIT**
FRANCE*	444,126,357	421,580,662	**22,545,695**	**SURPLUS**
GERMANY*	428,028,741	865,374,978	**-437,346,237**	**DEFICIT**
LUXEMBOURG*	0	6,117,396	**-6,117,396**	**DEFICIT**
NETHERLANDS*	463,984,626	326,092,336	**137,892,290**	**SURPLUS**

X.3.5 Step 5: Pooling of the surpluses – redistribution to countries with a deficit

As a next step, the surpluses are pooled into the European Attribute Mix and consequently proportionally distributed to the countries with a deficit, as indicated in Figure 46.

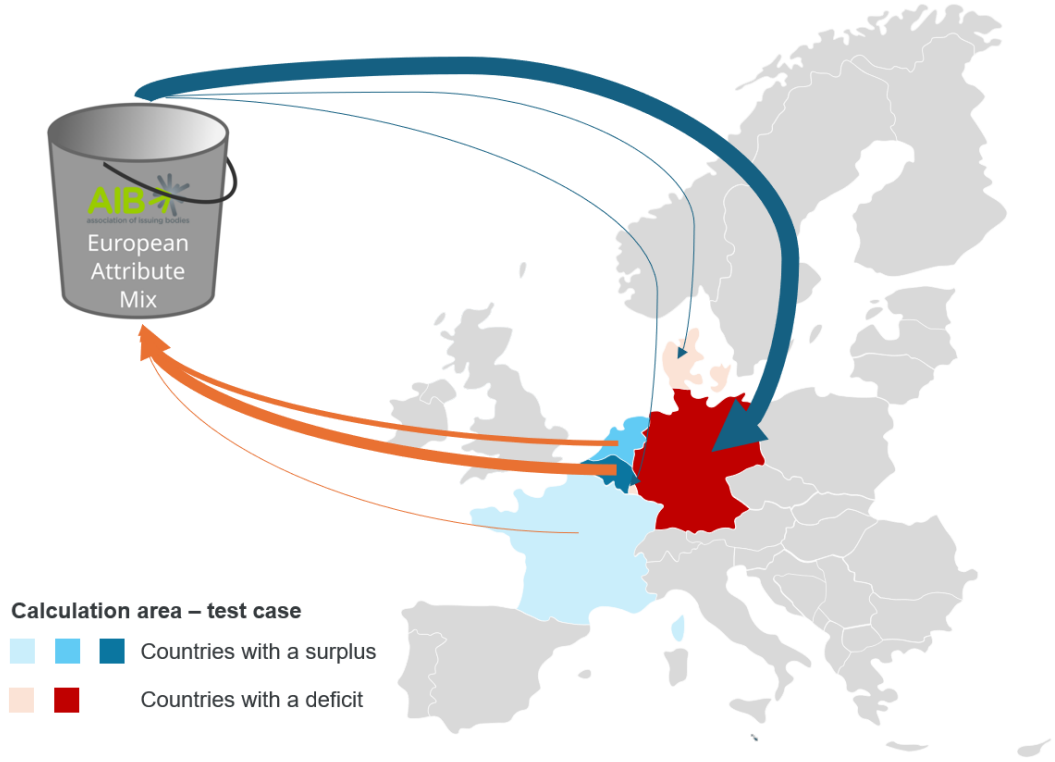

Figure 46: Visualisation of flows of attributes to and from the European Attribute Mix. The thickness of the arrows indicates the volumes.

In each of the concerned countries, the surplus is considered to consist of the same mix as the Domestic Residual Mix. The resulting surpluses and deficits are shown in Table 25.

Table 25: Surpluses are added European Attribute Mix. The EAM is thereafter redistributed over countries with a deficit. Note that these results should be interpreted in light of the assumptions made for this example calculation.

	SURPLUS Added to EAM			**European Attribute Mix**	**DEFICIT** Taken out of EAM		
	BELGIUM*	FRANCE*	NETHER-LANDS*		DENMARK*	GERMANY*	LUXEM-BOURG*
Fossil gas	79,343	8,303	44,525,980	**44,613,626**	1,056,981	42,955,799	600,846
Biomethane	0	15,216	0	**15,216**	360	14,651	205
Unknown	293,707,747	22,522,176	93,366,310	**409,596,233**	9,704,101	394,375,787	5,516,345
SUM	*293,787,090*	*22,545,695*	*137,892,290*	***454,225,075***	*10,761,442*	*437,346,237*	*6,117,396*
Share of EAM	64.7%	5.0%	30.4%	**100%**	2.4%	96.3%	1.3%

In this calculation example and based on the assumptions listed above, the European Attribute Mix consists of 10% fossil gas, predominantly originating from the production in the Netherlands and of 90% unknown energy source, mostly originating from gas that Belgium, and to a lesser extent, the Netherlands have imported.

Biomethane in our calculation example only accounts for 0.003% to the European Attribute Mix and originates from biomethane that is either not represented by any Tracking Instruments or for which the Tracking Instruments are expired, and of which the energy source is not exported to outside the calculation area.

X.3.6 Step 6: Calculating the Residual Mix and the Total Supplier Mix

As a final step, the Residual Mix is calculated for each of the countries in the calculation area, see Table 26.

For the countries with a surplus, the Residual Mix is the Domestic Residual Mix minus the surplus (or that part of the Domestic Residual Mix that stays within the country). For the countries with a deficit, the Residual Mix is the Domestic Residual Mix plus the proportional share of the European Attribute Mix.

Adding the number of cancelled tracking instruments to the Residual Mix results in the Total Supplier Mix.

Table 26: Calculation of (final) Residual Mix and Total Supplier Mix for the six countries in the example calculation according to the detailed methodology.

BELGIUM*	**Domestic Residual Mix**	(–) Surplus	**Residual Mix**	(+) Cancelled	**Total Supplier Mix**
Fossil gas	**120,425**	79,343	**41,082**		**41,082**
Biomethane	**0**	0	**0**	51,060	**51,060**
Unknown	**445,783,546**	293,707,747	**152,075,799**		**152,075,799**
SUM	***445,903,971***	*293,787,090*	***152,116,881***	*51,060*	***152,167,941***
DENMARK*		(+) Deficit			
Fossil gas	**6,035,372**	1,056,981	**7,092,353**		**7,092,353**
Biomethane	**312,812**	360	**313,172**	970,260	**1,283,432**
Unknown	**2,042,809**	9,704,101	**11,746,910**		**11,746,910**
SUM	***8,390,994***	*10,761,442*	***19,152,435***	*970,260*	***20,122,695***
FRANCE*		(–) Surplus			
Fossil gas	**163,555**	8,303	**155,253**		**155,253**
Biomethane	**299,742**	15,216	**284,526**	4,945,944	**5,230,470**
Unknown	**443,663,060**	22,522,176	**421,140,884**		**421,140,884**
SUM	***444,126,357***	*22,545,695*	***421,580,662***	*4,945,944*	***426,526,606***
GERMANY*		(+) Deficit			
Fossil gas	**42,007,891**	42,955,799	**84,963,690**		**84,963,690**
Biomethane	**0**	14,651	**14,651**	16,252,255	**16,266,906**
Unknown	**386,020,850**	394,375,787	**780,396,637**		**780,396,637**
SUM	***428,028,741***	*437,346,237*	***865,374,978***	*16,252,255*	***881,627,233***
LUXEMBOURG*		(+) Deficit			
Fossil gas	**0**	600,846	**600,846**		**600,846**

Biomethane	**0**	205	**205**	53,000	**53,205**
Unknown	**0**	5,516,345	**5,516,345**		**5,516,345**
SUM	***0***	*6,117,396*	***6,117,396***	*53,000*	***6,170,396***
NETHERLANDS*		(–) Surplus			
Fossil gas	**149,822,517**	44,525,980	**105,296,537**		**105,296,537**
Biomethane	**0**	0	**0**	2,419,000	**2,419,000**
Unknown	**314,162,109**	93,366,310	**220,795,799**		**220,795,799**
SUM	***463,984,626***	*137,892,290*	***326,092,336***	*2,419,000*	***328,511,336***

Figure 47 visually presents this resulting Residual Mix and the Total Supplier Mix.

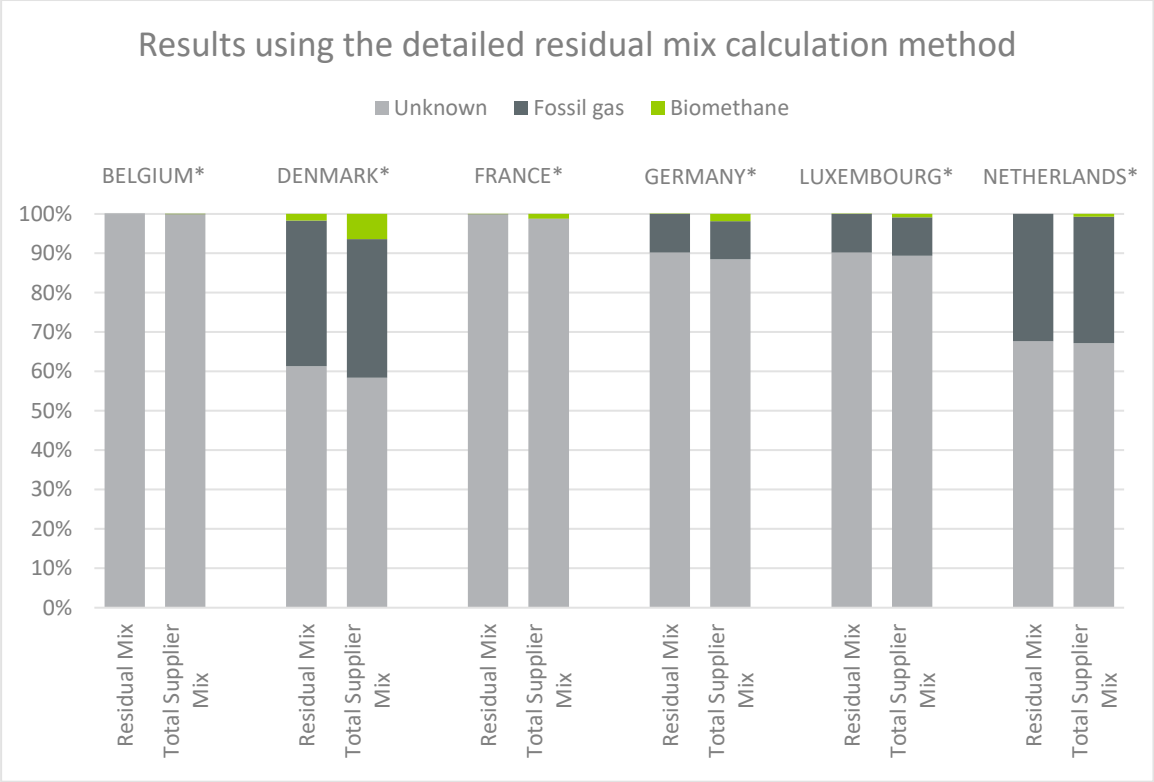

Figure 47: The resulting Residual Mix and Total Supplier Mix calculated according to the detailed method.

X.4 Calculating the Residual Mix and Total Supplier Mix according to the simplified methodology

In the simplified methodology, the complete Untracked Consumption is considered to consist of fossil natural gas only. The Untracked Consumption is calculated in the same way as done in step 3 of the detailed calculation method, see X.3.3:

A. (Plus) Quantities of gas consumed
B. (Minus) Number of Tracking Instruments used
C. (Plus) Quantities of gas stored
D. (Minus) Number of Tracking Instruments used for storage

Adding the used Tracking Instruments to the Residual Mix results in the Total Supplier Mix, see Table 27.

Table 27: Calculation of (final) Residual Mix and Total Supplier Mix for the six countries in the example calculation according to the simplified methodology.

BELGIUM*	**Residual Mix**	(+) Used	**Total Supplier Mix**
Fossil gas	**152,116,881**		**152,116,881**
Biomethane		51,060	**51,060**
Unknown			
SUM	***152,116,881***	*51,060*	***152,167,941***
DENMARK*			
Fossil gas	**19,152,435**		**19,152,435**
Biomethane		970,260	**970,260**
Unknown			
SUM	***19,152,435***	*970,260*	***20,122,695***
FRANCE*			
Fossil gas	**421,580,662**		**421,580,662**
Biomethane		4,945,944	**4,945,944**
Unknown			
SUM	***421,580,662***	*4,945,944*	***426,526,606***
GERMANY*			
Fossil gas	**865,374,978**		**865,374,978**
Biomethane		16,252,255	**16,252,255**
Unknown			
SUM	***865,374,978***	*16,252,255*	***881,627,233***
LUXEMBOURG*			
Fossil gas	**6,117,396**		**6,117,396**
Biomethane		53,000	**53,000**
Unknown			
SUM	***6,117,396***	*53,000*	***6,170,396***
NETHERLANDS*			
Fossil gas	**326,092,336**		**326,092,336**
Biomethane		2,419,000	**2,419,000**
Unknown			
SUM	***326,092,336***	*2,419,000*	***328,511,336***

Figure 48 presents the resulting Residual Mix and the Total Supplier Mix.

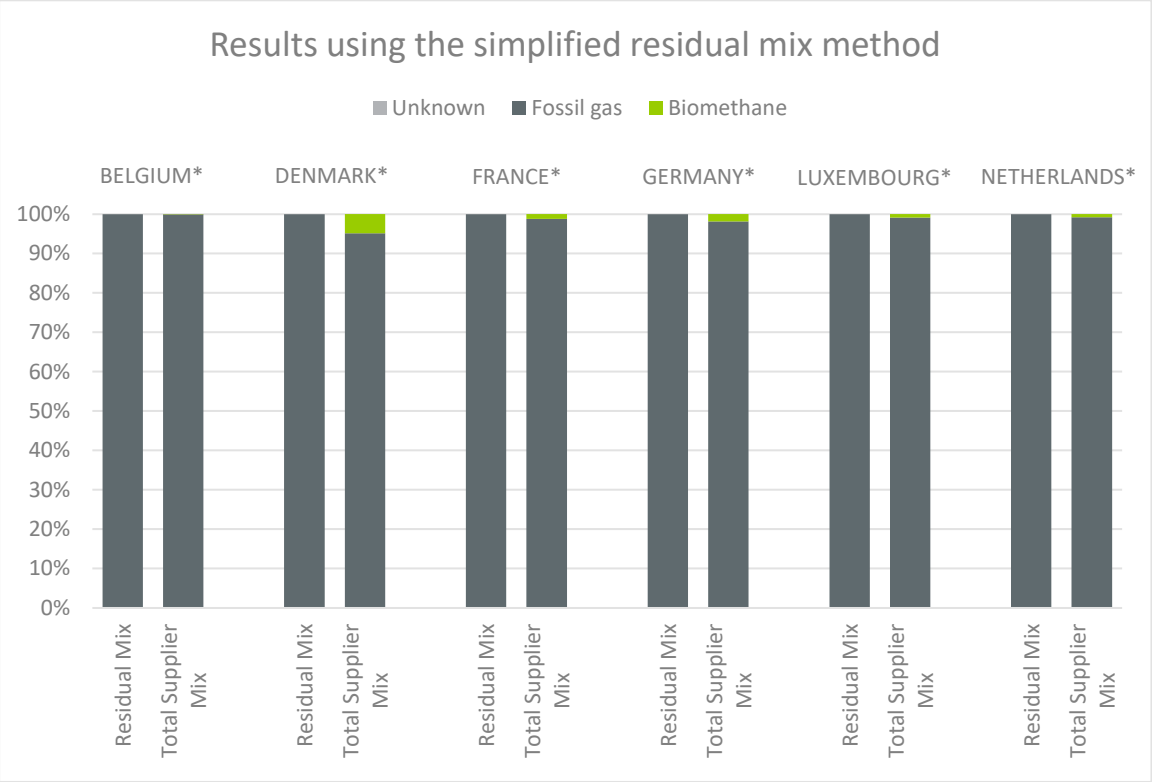

Figure 48: The resulting Residual Mix and Total Supplier Mix calculated according to the simplified method.

X.5 Differences between detailed and simplified methodology due to imports/exports

X.5.1 Final Residual Mix: a lot of 'unknown' and a bit of 'biomethane' vs. 100% 'fossil gas'

Figure 49 compares the Residual Mix, obtained - based on the assumptions taken – with this simplified calculation method, with the one obtained with the detailed calculation method.

While the detailed calculation method is precautious by not allocating a specific energy source to imported gas – 88.9% within the Residual Mixes of the six countries combined is "unknown" –, the simplified calculation method considers this gas as 'fossil gas'.

Moreover, the simplified method considers the small fraction in the Residual Mix considered as biomethane by the detailed method – 0.03% within the Residual Mixes of the six countries combined – to be 'fossil gas' as well.

This difference is most pronounced for Denmark. According to the detailed calculation method, its Residual Mix consists of 37.0% fossil gas, 1.6% biomethane and 61.3% of gas with an unknown energy source. According to the simplified method, the Residual Mix consists of 100% fossil gas. The 1.6% share of biomethane, the detailed calculation method arrives at, consists of that part of the expired Tracking Instruments that is not exported and is added to the Domestic Residual Mix.

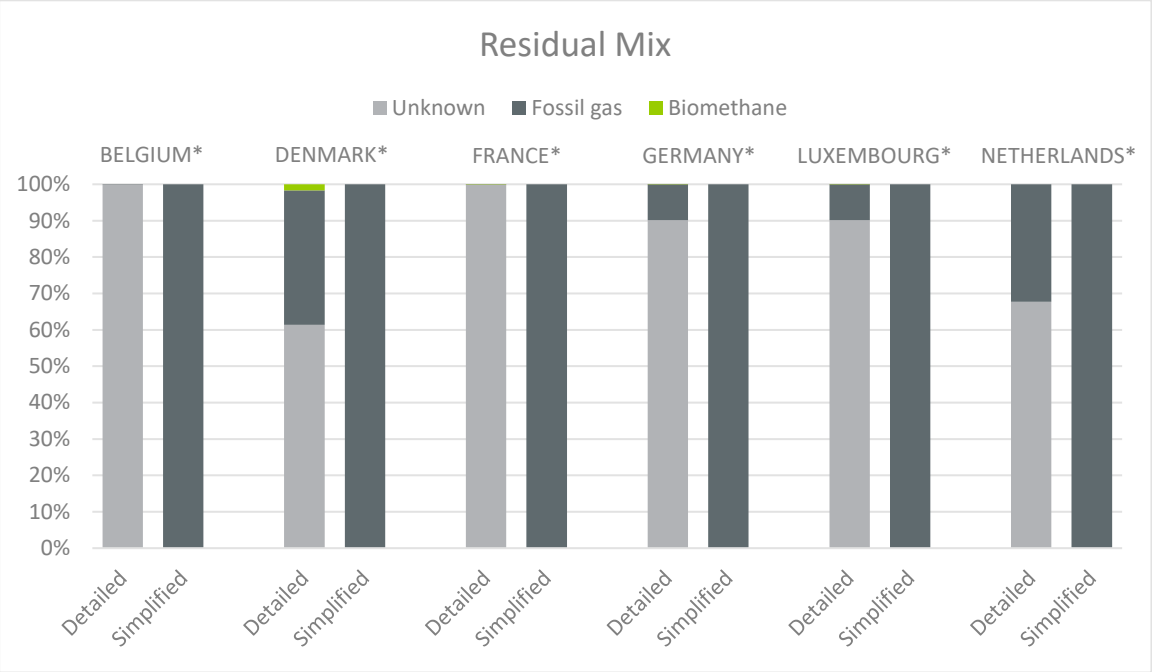

Figure 49: Comparison between the Residual Mix calculated according to the detailed and according to the simplified method.

In the detailed calculation method, only a small part of the biomethane attributes is redistributed by the European Attribute Mix. In this example, countries with a surplus only add 15,216 MWh to the European Attribute Mix (actually, only France does). This represents only 0.16% of the in total 9,437,533 MWh of biomethane that these countries produced.

To compare, the biomethane production in these countries represents 0.64% of the total gas production and imports. So, in this calculation example, only 1 fourth of the biomethane attributes present in the countries with a surplus, is redistributed to countries with a deficit.

Hence, as long as the share of gas for which Tracking Instruments are issued – biomethane in this example – in the total gas mix is small, the redistributive effect of European Attribute Mix is limited.

X.5.2 Total Supplier Mix: 'unknown' versus 'fossil gas' as main difference

Adding the number of cancelled Tracking Instruments to the Residual mix reduces the difference between the detailed and simplified calculation method for the Total Supplier Mix, see Figure 50.

According to the detailed calculation method, the Total Supplier Mixes of all the six countries combined consists of 10.92% fossil gas, 1.39% biomethane and 87.69% gas of an unknown source. According to the simplified calculation method, the combined Total Supplier Mixes consists of 98.64% fossil gas and 1.36% biomethane.

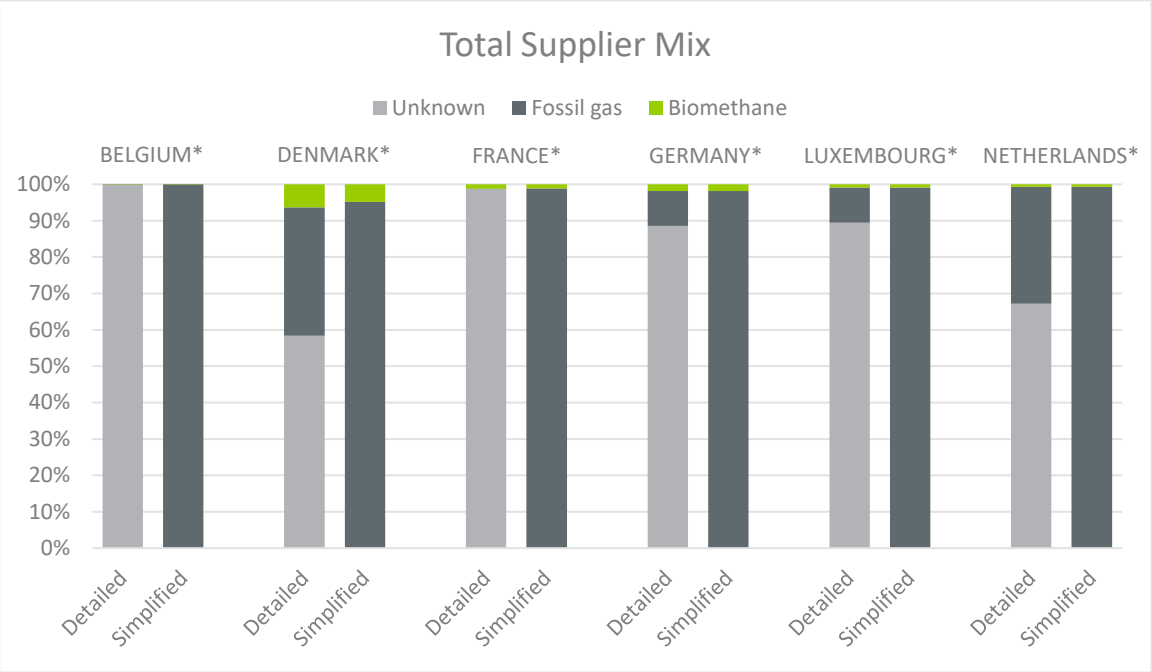

Figure 50: Comparison between the Total Supplier Mix calculated according to the detailed and according to the simplified method.

Here as well, the difference is the most pronounced for Denmark. According to the detailed calculation method, its Total Supplier Mix consists of 35.2% fossil gas, 6.4% biomethane and 58.4% of gas with an unknown energy source. According to the simplified method, the Total Supplier Mix consists of 95.2% fossil gas and 4.8% of biomethane.

X.5.3 Main difference in methods due to im-/exports and expired GOs

These factors explain the difference in results of the calculation methods for the Residual Mix differ:

1. The quantity of fossil gas differs because the detailed calculation method considers the energy source of imports as ‘unknown’, while the simplified calculation method considers these imports as ‘fossil gas’. This is the biggest difference between both methods.
2. The quantity of biomethane differs because the detailed calculation method adds expired Tracking Instruments to the Residual Mix; the simplified calculation method does not. Yet, only a fraction of the Tracking Instruments will expire in view of the significant market interest in renewable gases.
3. In addition, the detailed calculation method redistributes part of the attributes of biomethane from countries with a surplus to countries with a deficit; the simplified calculation method does not. In practice it is likely that not much renewable/low-carbon attributes end up in the domestic residual mix and hence in the surplus. This is because the legal framework for renewable and low-carbon gases stimulates explicit tracking. Therefore, only a marginal quantity of renewable attributes is redistributed.

Considering the energy source of all imports from countries outside the calculation area as ‘fossil gas’ instead as ‘unknown’ eliminates the first factor. If another energy source needs to be considered, it should be backed by mutually recognised tracking schemes that avoids double counting and double claiming of the exported attributes in the exporting countries.

The second factor can be eliminated if the simplified calculation method would add expired Tracking instruments to the Residual Mix as well.

Concerning the third factor, the redistributive capacity of the European Attribute Mix deems to be very limited. This remains valid as long as the share of energy sources of gas, for which Tracking Instruments are issued, remains small in the total gas mix.

ANNEX XI GLOSSARY AND REFERENCES

XI.1 List of Referenced EU Legislation

Abbreviation	Reference name	Weblink
IEM	Internal Energy Market (2019/944)	http://data.europa.eu/eli/dir/2019/944/oj
Recast Gas Directive	PE_104_2023_REV_1, 13 June 2024	https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CONSIL:PE_104_2023_REV_1
REDII	Renewable Energy Directive (2018/2001)	http://data.europa.eu/eli/dir/2018/2001/oj
REDIII	Recast Renewable Energy Directive (2023/2413)	http://data.europa.eu/eli/dir/2023/2413/oj
RFNBO DA	Delegated Act 2023/1184	http://data.europa.eu/eli/reg_del/2023/1184/oj
GHG DA	Delegated Regulation 2023/1185	http://data.europa.eu/eli/reg_del/2023/1184/oj
CSRD	Corporate Sustainability Reporting Directive (2022/2646)	http://data.europa.eu/eli/dir/2022/2464/oj
ESRS	European Sustainability Reporting Standards	http://data.europa.eu/eli/reg_del/2023/2772/oj
Green Claims	Green Claims Directive COM (2023) 166	https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2023%3A166%3AFIN

XI.2 Glossary

Term	Meaning
Account (source: Draft CEN EN 16325; May 2024)	Record on a registration database relating to a particular Account Holder in which GOs are held.
Attribute (source: Draft CEN EN 16325; May 2024)	Data field specifying the characteristics of an energy unit produced by a Production Device in terms of the input(s) used and/or the details (standing date) of the Production Device and Production Process.

Cogeneration (source: Draft CEN EN 16325; May 2024)	energy conversion from the same source into two or more utilised forms of energy within one common controlled process. Note 1 to entry: combined heat and power is a specific implementation of cogeneration used for the simultaneous production of heat and electricity.
Cancel (source: Draft CEN EN 16325; May 2024)	Mark, at the request of the holder of the account on which it is held, a GO as having been used for the purpose of Disclosure of consumed energy, and to prevent it from subsequently being: - Transferred to another Account, or - Marked again in this way.
Cancellation Statement (source: Draft CEN EN 16325; May 2024)	Electronic, non-transferrable receipt which provides evidence of the cancellation of one or more GOs for the purpose of Disclosure of the Attributes of those GOs for the beneficiary or beneficiaries of the cancellation.
Competent Body (source: Draft CEN EN 16325; May 2024)	Body duly authorised under the laws and regulations of any state (and, as the case may be region) to exercise or discharge any legislative, governmental, regulatory, administrative, or supervisory function associated with the administration of Domain GO scheme.
Conversion Issuance (or GO Conversion Issuance) (source: Draft CEN EN 16325; May 2024)	issuance of a GO for output resulted from Energy Carrier Conversion, and for which GOs representing the attributes of the input to that production device (3.47) have been cancelled
Disclosure (source: Draft CEN EN 16325; May 2024)	Provision of information to a final customer on the share or quantity of the energy supplied to them as having specific Attributes.
Disclosure Statement (source: Draft CEN EN 16325; May 2024)	Information provided as a result of Disclosure
Domain (source: Draft CEN EN 16325; May 2024)	Geographic area containing Production Devices with respect to which an Issuing Body is responsible for Issuing GOs for the relevant Energy Carrier.
Economic Operator (source: 2014/24/EU[65])	Any natural or legal person or public entity or group of such persons and/or entities, including any temporary associations of undertakings, which offers the execution of works and/or a works, the supply of products or the provision of services on the market
Energy Carrier (source: Draft CEN EN 16325; May 2024)	substance carrying the energy content of an *Energy Type (where Energy Type is defined as: substance that can be used to produce mechanical work or heat or to operate*

[65] http://data.europa.eu/eli/dir/2014/24/oj

	chemical or physical processes and the means by which it is conveyed, being electrical energy, gas or heating and cooling
Energy Carrier Conversion (source: Draft CEN EN 16325; May 2024)	production of an energy carrier in a production device from one or more inputs including at least one other energy carrier
(source: EECS® Rules release 8 v1.8)	The transfer of energy carried by one type of energy carrier to another type of energy carrier.
Energy Storage or Storage (source: Draft CEN EN 16325; May 2024)	Device or system that is used to store energy, where the Energy Carrier injected into that device or system is the same as the Energy Carrier that flows out of it.
European Attribute Mix (source: RE-DISS II[66])	The EAM is a calculatory pool of surplus available Attributes in Residual Mixes and is needed for reliable coordination of Residual Mix calculation in Europe. EAM results from surpluses of available Attributes compared to Untracked Consumption in surplus countries. The EAM is used to cover deficits of available Attributes compared to Untracked Consumption in deficit countries.
European Energy Certificate System or EECS® (source: EECS® Rules Release 8 v1.6)	The integrated European framework for the issuing, registration, transfer, Cancellation, and other processing of Certificates arising as a consequence of the implementation of the provision of the EECS® Rules. https://www.aib-net.org/eecs
Expiry (source: CEN EN 16325; May 2024)	Cessation of a GO being eligible for transfer or cancellation, as a consequence of the passage of a given period of time since the production of the associated energy.
Facilitating Standards for Guarantees of Origin or FaSTGO (source: Association of Issuing Bodies)	FaSTGO is a project that provided expert advice to the European Commission DG ENER. Terms or reference N° ENER/C1/2019-517: “Technical support for RES policy development & implementation. Establishing technical requirements and facilitating the standardisation process for Guarantees of Origin on basis of Dir (EU) 2018/2001” https://www.aib-net.org/news-events/aib-projects-and-consultations/fastgo
GO issuing request (source: Draft CEN EN 16325; May 2024)	Request by the authorised representative of Production Device to an Issuing Body for the Issue of GOs in respect of that Production Device and a specific period of time.
Guarantees of Origin or GO (source: Draft CEN EN 16325; May 2024)	Electronic document relating to the Attributes for a specific amount of energy issued by an Issuing Body under a Domain GO scheme with the purpose of Disclosure.

[66] https://www.aib-net.org/sites/default/files/assets/facts/residual-mix/RE-DISSII_RM_EAM_Calculation-Methodology.pdf

Issue (source: Draft CEN EN 16325; May 2024)	Process of creating (as a GO) an account, i.e. a record in a Registration Database
Issuing Body (source: Draft CEN EN 16325; May 2024)	Competent body or competent body's 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 cancellations of GOs
Low-carbon Gas (source: Recast Gas Directive)	the part of gaseous fuels in recycled carbon fuels as defined in Article 2, point (35), of Directive (EU) 2018/2001, low-carbon hydrogen and synthetic gaseous fuels the energy content of which is derived from low-carbon hydrogen, that meet the greenhouse gas emission reduction threshold of 70 % compared to the fossil fuel comparator for renewable fuels of non-biological origin set out in the methodology adopted pursuant to Article 29a(3) of Directive (EU) 2018/2001
Production Device (source: Draft CEN EN 16325; May 2024)	Separately measured device or group of devices that yields one or more outputs from one or more inputs, with one specific technology type.
Proof of Sustainability (source: RED III)	a means of evidence showing the compliance of an quantity of biofuels, bioliquids and biomass fuels with the sustainability and greenhouse gas emissions saving criteria. These criteria are laid down in REDIII Art. 29. REDIII also introduced Art. 29a, which adds sustainability criteria for RFNBOs and recycled carbon fuels. The verification of compliance with these criteria is delegated to Voluntary Schemes in REDIII Art. 30.
Public Support (source: Draft CEN EN 16325; May 2024)	any instrument, scheme or mechanism applied by a State, or a group of States, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased, including but not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and sliding or fixed premium payments
Registration Database (source: Draft CEN EN 16325; May 2024)	Database operated by an issuing body or its agent, comprising: - accounts and the GOs in those accounts. - standing data of production devices and information provided to the issuing body or a third party on its

	behalf in connection with the registration of those production devices; and - standing data of GOs which have been transferred out of that registration database.
Renewable Fuel of non-biological Origin or RFNBO (source: 2023/2413 EU[67])	Liquid and gaseous fuels the energy content of which is derived from renewable sources other than biomass
Renewable Gas (source: Recast Gas Directive)	Biogas defined in art 2, point (28) of Directive 2018/2001, including biogas that has been upgraded to biomethane, and renewable fuels of non-biological origins ('RFNBOs') as defined in art 2, point (36) of that Directive
Residual Mix or Residual Energy Mix (source: 2018/2001 EU[68])	The total annual energy mix for a Member State, excluding the share covered by cancelled Guarantees of Origin Practical implementation for electricity: https://www.aib-net.org/facts/european-residual-mix
Tracking Instruments	For the ease of the text flow, this text uses the term Tracking Instruments to refer collectively to GOs and other Reliable Tracking Systems (RTS). The latter would only apply where protection measures for the reliability are in place. Section 4.4 instrument for renewable gas consumption claims elaborates on the instruments acknowledged for tracking.
Withdraw (source: Draft CEN EN 16325; May 2024)	Correction by an issuing body of an error with regard to a GO held in its registry by removal of that Go from an account, or through amendment of its status in a way that it is no longer transferable and can no longer be cancelled.

XI.3 Bibliography

This report in REGADISS builds on work done in other projects and groups. References are made throughout the document, yet the main preceding work is the following:

REDISS

EECS®: https://www.aib-net.org/eecs

- EECS® Rules: https://www.aib-net.org/eecs/eecsr-rules
- Subsidiary Documents: https://www.aib-net.org/eecs/subsidiary-documents
- Fact Sheets: https://www.aib-net.org/eecs/fact-sheets
- Best Practice Recommendations: https://www.aib-net.org/eecs/best-practice-recommendations

FASTGO: https://www.aib-net.org/news-events/aib-projects-and-consultations/fastgo

- List of project deliverables: https://www.aib-net.org/news-events/aib-projects-and-consultations/fastgo/project-deliverables

[67] http://data.europa.eu/eli/dir/2023/2413/oj
[68] http://data.europa.eu/eli/dir/2018/2001/oj

REGATRACE: https://www.regatrace.eu/

- Work packages: https://www.regatrace.eu/work-packages/

CEN EN16325 drafting process

CEER Advice on trustworthy green offers: https://www.ceer.eu/documents/104400/-/-/832ddef0-87de-c539-38f8-ec4d6ce63269

"Increased Ambitions Study":

> Technical support for RES policy development and implementation: delivering on an increased ambition through energy system integration" from Trinomics , E3-Modelling, Artelys, and Ludwig-Bölkow-Systemtechnik GmbH (LBST)
>
> https://data.europa.eu/doi/10.2833/86135 - referencing here mainly Annex B "Improve Energy System Integration" Section 3.

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