Scoping study setting technical requirements and options for a Union Database for tracing liquid and gaseous transport fuels

Navigant, A Guidehouse Company
July - 2020

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A Guidehouse Company

EUROPEAN COMMISSION

Directorate-General for Energy
Directorate C - Renewables, Research and Innovation, Energy Efficiency
Unit C.1. - Renewables and CCS policy

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2020

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Manuscript completed in July 2020

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Luxembourg: Publications Office of the European Union, 2020

PDF	ISBN: 978-92-76-21417-5	doi: 10.2833/91335	MJ-01-20-530-EN-N

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[1] On October 11, 2019, Guidehouse LLP completed its previously announced acquisition of Navigant Consulting Inc. In the months ahead, we will be working to integrate the Guidehouse and Navigant businesses. In furtherance of that effort, we recently renamed Navigant Consulting Inc. as Guidehouse Inc.

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Scoping study setting technical requirements and options for a Union Database for tracing liquid and gaseous transport fuels

Final report

Prepared for:

European Commission - DG ENER

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Reference No.: 204325
16 July 2020

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1. INTRODUCTION

This final report is the response to your request for service 'Scoping study setting technical requirements and options for a Union Track and Trace Database to fulfil the requirement set in Article 28 of the Recast of the Renewable Energy Directive' (ENER/C1/2019-520) in the context of the Framework Service Contract ENER/C1/2018-513 prepared by Navigant, a Guidehouse company.

1.1 Background to the project

On 24 December 2018, the recast of the Renewable Energy Directive (Directive (EU) 2018/2001) known as the REDII entered into force. Directive 2009/28/EC (REDI) will be repealed on 1 July 2021. This recast introduces several changes compared to the previous Directive, such as:

- A new target for renewable energy of 32% for the year 2030;
- A target of 14% of renewable energy consumption in the transport sector in 2030; and
- The inclusion of two new categories of fuels that can be counted towards the targets: renewable fuels of non-biological origin (e-fuels from RES electricity) and recycled carbon fuels (low carbon fuels from non-renewable sources).

Article 28 of the REDII includes provisions that require the European Commission and Member States to strengthen cooperation between national systems and between national systems and voluntary schemes and verifiers (including, where appropriate, the exchange of data), with the aim of minimising the risk of single consignments of fuels being claimed more than once in the Union. The article furthermore requires that the Commission sets up a Union database to enable the tracing of liquid and gaseous transport fuels that are:

- Eligible for being counted towards the target (specifically the numerator referred to in point (b) of Article 27(1) – the renewable transport target);
- Suitable for measuring compliance with renewable energy obligations; and
- Eligible for financial support for the consumption of biofuels, bioliquids and biomass fuels.

The Union database is intended to complement the existing traceability requirements for biofuels. The so-called mass balance traceability requirements are currently verified at the economic operator level, usually in the context of independent auditing under the Commission-recognised voluntary and national schemes[1]. In addition, the database is intended to facilitate cross-border trading of biomethane used in either the transport sector or in heating/cooling or electricity generation.

Member States will require economic operators to enter into the database information *inter alia* the sustainability characteristics of fuels placed on the market, including their life-cycle greenhouse gas emissions. A Member State *may* set up a national database that is linked to the Union database ensuring that information entered is instantly transferred between the databases.

The application of the database aims to ensure that reporting of the production and use of renewable transport fuels and biomethane is consistent across the European Union (EU) and does not generate a risk of multiple counting of fuels in the EU or global markets.

[1] List of Commission-recognised schemes is published here: https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes

The purpose of this project is to support the Commission in setting options and identifying technical requirements for the Union database to fulfil the requirement set out in Article 28 of the REDII. The development of the database itself does not form part of this project.

It is not expected that the revision of the REDII by June 2021, as foreseen by the Green Deal Communication of 11 December 2019, will change the scope of Article 28 in relation to the Union database.

1.2 Overview of project

The project is structured around four distinct Tasks:

- Task 1 - Review of existing database systems;
- Task 2 - Assessment of technical options and technical specifications:
    - Task 2.1 - Technical options matrix (referred to as 'Scope and Design of the Union database' in this report);
    - Task 2.2 - Assessment of the technical specifications (referred to as 'Set up and Operation of the Union database' in this report);
- Task 3 - Consultation of stakeholders and validation of the identified technical requirements;
- Task 4 - Recommendation on the technical requirements to establish the Union database.

The review of the existing database systems (Task 1) and the matrix of different technical options (Task 2.1) constituted the Interim Report, submitted to the Commission on 4 March 2020. This report includes the outputs for the remaining tasks.

The consultation of stakeholders (Task 3) primarily took place through an online webinar held on 7 May 2020. The webinar was attended by over 70 stakeholders with representation from the Member States, voluntary schemes and industry associations. In addition, a presentation was given to the Committee on the Sustainability of Biofuels and Bioliquids meeting held on 14 May 2020.

2. SCOPE AND DESIGN OF THE UNION DATABASE

There are numerous business requirements and design decisions that can meet the requirements of the Union database. This scoping study is structured according to the **scope and design of the database** (covered in this chapter) and the **set-up and operation of the database** (covered in chapter 3)[2].

The **scope and design** define the overall framework of the database. While the basis for some of these options is guided by legislative requirements (e.g. REDII, GDPR), more flexibility can potentially be applied for other options. The choices made when implementing each option will have an impact on the operation (or design) of the database, the impact of which will vary between the options. Some options will have a more fundamental impact than others. The supply chain scope (section 2.1.1), in particular, will have a very significant impact.

We have identified a set of scope and design options based on the relevant legislative requirements and the review of the databases undertaken in Task 1, as well as our own insights. These options are described as follows:

- **Scope of the Union Database:** needed to define how the database will work;
- **System architecture:** needed to facilitate the process; and
- **Database management:** needed to manage the database system.

2.1 Scope of the Union Database

2.1.1 Application of the database

Article 28(2) requires that "Member States shall require economic operators to enter into the database information on the transactions made and the sustainability characteristics of those fuels […]" In our view, therefore, a mandatory pre-condition for sustainable fuels to be eligible for consumption in the EU should be that they have been registered in the database. This implies that the data associated with these fuel supply chains will need to be registered by relevant parties in the database (see section 2.1.2 on supply chain scope). Materials that are not intended for the EU fuels market (either raw material or finished fuels) would not need to be registered. For example, wheat that is intended for the food or feed market would not need to be registered in the Union database. Nonetheless, an agricultural producer *may* choose to register their material on a voluntary basis to provide the optionality to trade material into the biofuels market. A pre-requisite to register material in the database is that the producer is certified to an existing voluntary or national scheme.

Although Article 28(2) states that Member States shall require material to be entered into the database, this will in practice be enacted by the voluntary schemes as they have an existing relationship with economic operators along the full supply chain. Member States can place a requirement on obligated fuel suppliers to only supply fuel that has been registered in the Union database, and consequently obligated fuel suppliers will play a key role in providing a driver for material to be registered in the database as they would only purchase fuels that have been registered in the Union database.

[2] Note that we have modified the terms used in the Terms of Reference, which refers to 'Methodological options' and 'Technical parameters'.

2.1.2 Supply chain scope

The choice of which point to start registering material (data) in the database has a fundamental impact on the design of the Union database, and in particular the technical specifications of the database (see chapter 3).

Figure 1 describes a generic fuel supply chain, starting from the point of origin to the fuel supplier. Three potential options are set out for the **starting point** of registering data in the database (in each case the database is expected to extend downstream to the fuel supplier responsible for reporting to the Member State):

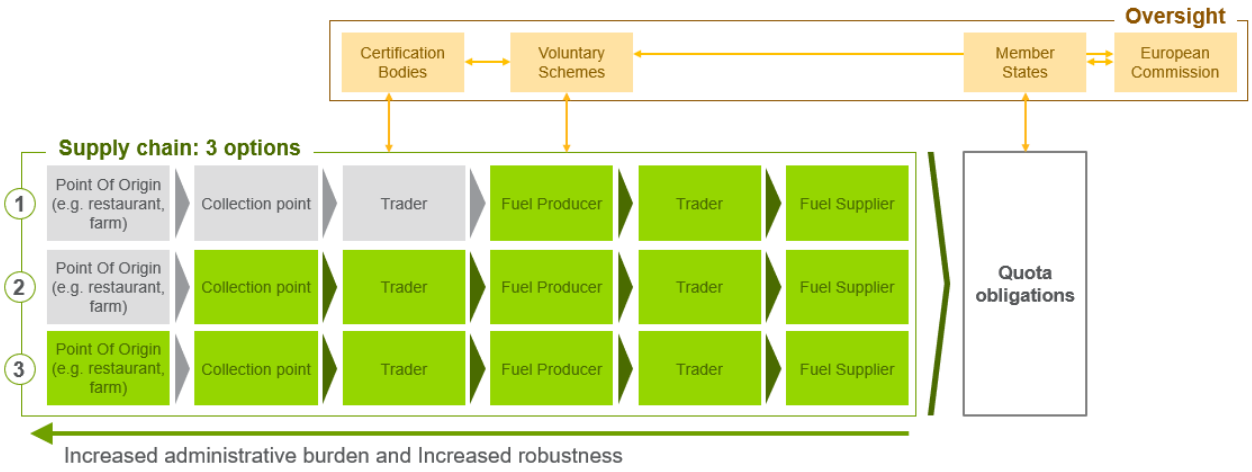
1. **Fuel producer:** This scope is most in-line with Article 28(2) of the REDII which requires "[…] economic operators to enter into that database information on the transactions made […], starting from their point of production to the fuel supplier that places the fuel on the market". Example databases: existing Member State databases (e.g. elNa, Nabisy).

2. **Collection point:** The scope is extended upstream to cover the entity that collects the feedstock from points of origin, typically referred to as a 'collection point' for wastes and residues or a 'first gathering point' for agricultural or forestry biomass. Example database: Trace Your Claim.

3. **Point of origin:** The scope also covers the entities producing the feedstock (e.g. restaurant or farm). Example databases: Bioledger, RSPO PalmTrace (independent smallholders via RSPO Credits).

It should be emphasised that the voluntary scheme certification process will always cover the full supply chain. The decision on database scope solely relates to the point in the supply chain that data is first registered.

Figure 1. Generic fuel supply chain, illustrating the three options for supply chain scope



The main advantage of a database which covers the upstream supply chain is that the risk of fraud is likely to be greatly reduced, in particular if the starting point is the point of origin. This is because it is more difficult to register multiple volumes of the same physical feedstock or to introduce 'false' volumes of fuels into the database, in comparison with a database that starts at biofuel production[3]. This serves to support the aim of Article 28(1), in minimising the risk of single consignments being claimed more than once in the Union. Inclusion of the full supply chain also provides greater transparency and traceability as additional data is available for inspection. This would greatly support Member States and voluntary schemes in performing their monitoring responsibilities, as well the certification bodies in conducting audits of economic operators.

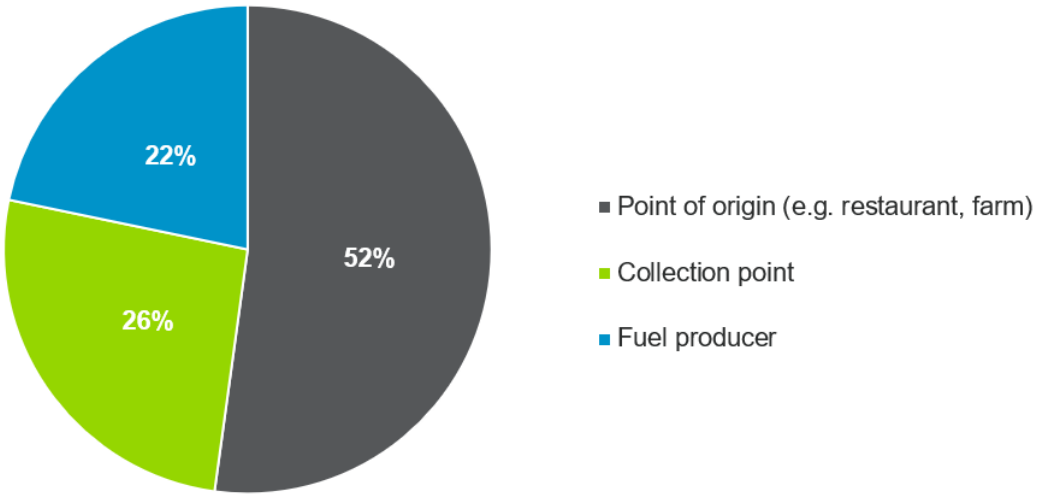
[3] In particular to prevent large-scale fraud, such as a fuel producer registering volumes in excess of plant capacity.

Ideally, the database scope would start at the point of origin, in particular for high risk feedstocks such as used cooking oil. However, in our view, the implementation of this approach must be contingent on the availability of low-cost technology solutions at a global level that can be used to automate the process[4] to ensure that the administrative burden is minimised[5]. An additional benefit of using such technology is that it digitises the collection process, replacing the paper-based system that is currently in use. This would improve the overall robustness of the audit process for collection points and furthermore greatly reduce the administrative burden.

A disadvantage of a broader scope is that the technical development would be more complicated, as additional processes and data flows would need to be considered and tested. Furthermore, the number of database users would increase significantly. A database starting at the fuel producer would likely involve up to ten thousand users, whereas a database covering the upstream supply chain would increase the number of users to tens of thousands.[6] The phase-in of the database would also become more challenging, as the majority of these users would not be familiar with a (bio)fuels database, in comparison to the downstream supply chain who are already actively using the Member States databases (in particular Nabisy). This may necessitate a longer phase-in period to ensure that users are trained and registered in the database prior to its launch. Pilots of all representative fuel supply chains would also have to be undertaken, which would be more extensive if the database scope covers the upstream supply chain. All of these aspects would increase the database cost, both development and ongoing operation. (For further discussion on the phase-in refer to section 3.1.)

Stakeholders attending the webinar held on 7 May were asked to vote on the supply chain scope. The outcome was clear cut with 78% of the respondents supporting a database that includes the upstream supply chain, with the point of origin receiving the highest share (52%) of the votes (Figure 2).

Figure 2. Stakeholder voting result on Supply chain scope (Sample size: 46 participants)



This view is also consistent with the 'Database for Biofuels Stakeholder Group', an industry-led initiative that aims to support the adoption of a single database by the European biofuels supply chain as an interim solution ahead of the Union database. The group is currently assessing both the Bioledger and Trace Your Claim databases.

[4] This solution is being actively promoted by Bioledger. Technology solutions include mobile apps or hand-held devices. Trace Your Claim have also indicated that they could implement a similar approach if this set-up is desired.

[5] Not all stakeholders support the view that the administrative burden will be reduced by using mobile devices. Another concern raised was which entity will be responsible for training the (many) economic operators on using the devices.

[6] Nabisy, the most widely used biofuels database in Europe, has around 7,000 active users. (In total, around 9,950 users are registered: 5,000 traders, >2,000 producers, 2,000 CHP plants, 600 Member States, >500 network grid operators.) In comparison, the TRACES database, which has a broader scope, has around 42,000 active users.

A summary of the advantages and disadvantages is presented in Table 1 below.

Table 1. Comparison of the advantages/disadvantages of the supply chain scope options

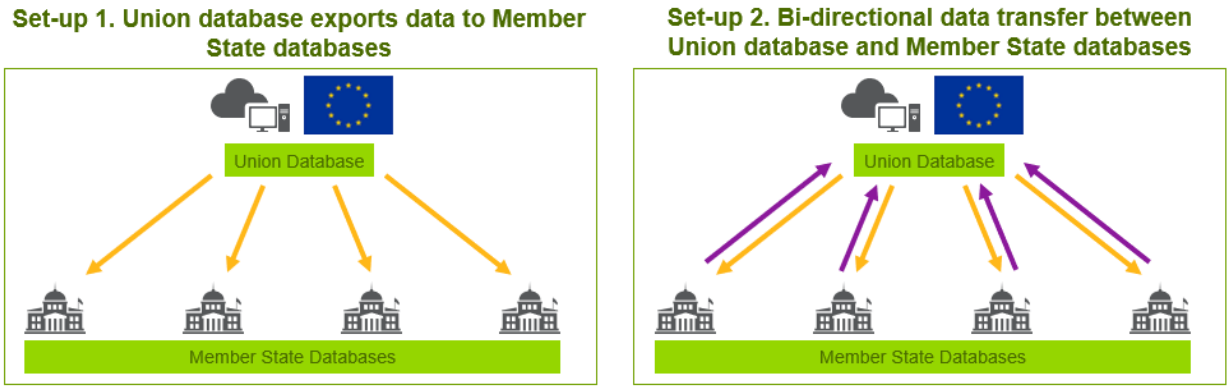
Point of origin/ Collection point to Fuel supplier	Fuel producer to Fuel supplier
Advantages • More robust solution against fraud • Greater supply chain transparency and traceability (facilitates Member State and voluntary scheme monitoring responsibilities) • Widespread support from industry	**Advantages** • Consistent with the scope of the existing Member State databases (e.g. elNa, Nabisy) • Less complicated database development and phase-in process • Lower cost (development and ongoing)
Disadvantages • More complicated database development and phase-in process • Significantly more users to manage (increasing database administration) • Higher cost (development and ongoing)	**Disadvantages** • Less robust solution against fraud • Limited supply chain transparency and traceability • Less widely supported by industry

We recommend that the overall aim should be to establish a database that includes the upstream supply chain. As discussed, this would ideally be the point of origin if technical solutions can be implemented globally.

2.1.3 Interaction of Union database with Member State databases

A number of different set-ups can be envisaged for the interaction between the Union database and Member State databases (where they exist). As with the supply chain scope, the choice of which option to implement has a fundamental impact on the subsequent design of the database. The two main options we have identified are presented in Figure 3 below.

Figure 3. Interaction of Union database with Member State databases



Article 28(2) of the REDII states that a "Member State may set up a national database that is linked to the Union database ensuring that information entered is instantly transferred between the databases". This would imply a bi-directional flow of information between the Union database and Member State database (set-up 2).

Our recommendation is instead that the Union database serves as the primary database to register all sustainable fuels that are intended to be consumed in the European Union (set-up 1). Volumes of fuel are then checked out of the Union database to the respective Member State (or third country) account of the Union database by the fuel supplier that places the fuel on the market. Following this, the fuel supplier cannot use the same volume of fuel in any further transaction. The BLE has previously proposed that competent authorities of the Member State place a usage note on consignments that are placed on the market to ensure that they cannot be traded anymore. In our view, this approach is not necessary with the set-up we propose.[7]

Once allocated to the Member State account of the Union database, the volumes of fuel and associated sustainability data can be exported out of the Union database by the Member State. Member States could choose whether to automatically accept volumes of fuel that have been registered in the Union database before export to their system, or otherwise perform a validation check prior to export.

In our view, this is the most robust solution as it ensures that there is no double counting of the same fuel volume in multiple Member States. This risk is not mitigated in a set-up where Member States' databases can transfer volumes from a national database to the Union database as it would be very challenging, and also time consuming, for Member States to validate. This set-up is also the most straightforward solution to implement technically. These aspects are further compounded if the supply chain scope of the Union database covers the upstream supply chain, given that all of the existing Member State databases start at the fuel producer (or fuel supplier). It would be very challenging to ensure that double counting was avoided in a bi-directional set-up.

2.1.4 Sectoral scope

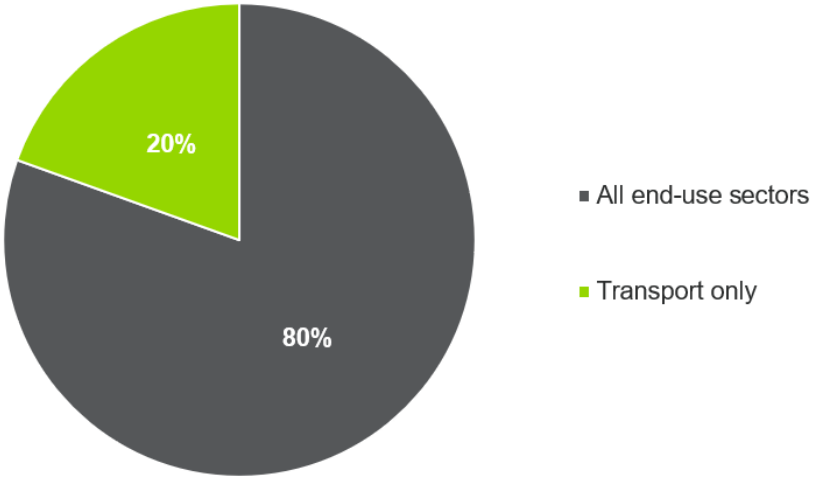
Article 28(2) of the REDII makes clear that the intended sectoral scope of the Union database is the transport sector. However, in our view, it would be appropriate to broaden the scope for biomethane[8], given that it is very difficult to know at the point of injection whether the gas will be used in the transport sector, or in another sector (i.e. heating, cooling or power). Restricting the scope to transport may therefore serve as a barrier to the registration of biomethane in the database.

Stakeholders endorsed this recommendation at the stakeholder webinar (see Figure 4 below).

[7] BLE, The EU database: thoughts and exchange on requirements to the functionality of a common database from the perspective of regulatory institutions. REFUREC workshop, 9-11 April 2019.

[8] Biomethane is upgraded biogas that can be used in the transport sector. The gas is typically fed into a natural gas grid but can be used directly off-grid.

Figure 4. Stakeholder voting result on biomethane scope (sample size: 41 participants)



On a related note, Article 29(1) gives Member States the option to set a 2 MW threshold for installations producing gaseous fuels to comply with the REDII sustainability criteria. We would recommend that the Union database does not set a minimum threshold given that Member States are likely to deviate from the 2 MW thresholds, to ensure that biomethane can be readily traded across the EU without restriction. Without a minimum threshold, it would be up to the individual installation to choose to register their biomethane in the database.

The European Biogas Association (EBA) was consulted on this aspect as part of this project. The EBA's preference is not to set a threshold, or if a threshold is set then they suggest a lower threshold of 300 kW. The EBA assert that setting a minimal thermal input would further extend the challenges of creating an internal European market for biomethane, and as a consequence that the acceptance and usage of the database would probably be limited.[9]

An open question, linked to the fuel scope, is whether bioliquids[10] should be registered in the database given their (potential) substitutability with biofuels. For example, a virgin vegetable oil or waste oil could be used as a ***transport* biofuel** (either in its pure form or following processing), or equally used to generate ***heating, cooling or power* as a bioliquid**. It may not always be known at the point of supply, and therefore registration in the database, what the end use of the material will be. This issue is more likely to be relevant for a database which includes the upstream supply chain.

Both the elNa and Nabisy national databases cover bioliquids in their scope. We recommend that bioliquids are also covered in the Union database, despite the lack of a legal basis for this. This could be via a Member State opt-in. The inclusion of bioliquids would help to support the functioning of the bioliquids market and minimise the risk of the same material being counted twice for different end uses. From a practical perspective, including bioliquids would not result in additional database development effort. It could be readily implemented through an 'out-booking' option, whereby the relevant volumes of material are exported out of the database to the Member State in question by companies seeking to market the material as a bioliquid. Alternatively, the same material volumes could be used for the production of biofuels and marketed as such.

This aspect was not discussed at the stakeholder workshop.

[9] The EBA indicated that there are multiple small-scale projects under development around Europe with a thermal input below 1 MW thermal input for biomethane intended as a transport fuel. In some cases, the capacity is as low as 300 kW. Personal communication with Susanna Pflüger (Secretary General – EBA).

[10] Article 2(32) defines bioliquids as liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass.

2.1.5 Fuel scope

Article 28(2) of the REDII clarifies that the Union database should "enable the tracing of liquid and gaseous transport fuels that are eligible for being counted towards the numerator referred to in point (b) of Article 27(1), or that are taken into account for the purposes referred to in points (a), (b), and (c) of the first subparagraph of Article 29(1)".

Article 27(1) point (b) states that "for the purposes of the first subparagraph of Article 25(1), the energy content of all types of energy from renewable sources supplied to all transport sectors, including renewable electricity supplied to the road and rail transport sectors, shall be taken into account", and furthermore that "Member States may also take into account recycled carbon fuels". Article 25(1) makes explicit reference to both renewable fuels of non-biological origin and recycled carbon fuels.

Points (a), (b) and (c) of the first subparagraph of Article 29(1) refer to:

a) Contributing towards the Union target set in Article 3(1) and the renewable energy shares of Member States;

b) Measuring compliance with renewable energy obligations, including the obligation laid down in Article 25; and

c) Eligibility for financial support for the consumption of biofuels, bioliquids and biomass fuels.

On this basis, from a legal perspective, the Union database should cover:

- Biofuels;
- Biomethane;
- Renewable fuels of non-biological origin; and
- Recycled carbon fuels.

We also propose that bioliquids are included, and that the scope for biomethane is not restricted to transport end uses, both as discussed in section 2.1.4 above. Renewable electricity supplied to the road and rail transport sectors should not be included as it is not a liquid or gaseous fuel.

2.1.6 Raw material scope

It follows that the raw material scope should cover all potential raw materials relevant to the proposed fuels and sector scope (see 2.1.4 and 2.1.5). The list of potential raw material names to include in the database will not be exhaustive and will need to be kept up to date over time.

The types of raw material relevant to each fuel category are detailed below[11]. Note that the actual raw material will need to be entered into the database (e.g. 'rapeseed' and not 'agricultural biomass', 'used cooking oil' and not 'waste' etc).

- **Biofuels and biomethane:** Agricultural biomass, forestry biomass, agricultural, aquaculture, fisheries and forestry residues, residues, wastes, biodegradable fraction of waste (including industrial and municipal waste of biological origin);

[11] The raw materials for 'Renewable fuels of non-biological origin' and 'Recycled carbon fuels' can be further defined as part of their implementation under the REDII, in the context of the forthcoming Delegated Acts.

- **Renewable fuels of non-biological origin:** Renewable electricity; and

- **Recycled carbon fuels:** Liquid or solid waste streams of non-renewable origin, waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations.

We recommend that the list is aligned with the voluntary schemes market data reporting template, where relevant[12].

2.1.7 Chain of custody system

The chain of custody system should be aligned with the REDII sustainability framework and should allow economic operators to implement a mass balance system, as set out in Articles 30(1) and (2) of the REDII. The practical operation of the mass balance system is discussed further in section 3.2.6.

2.1.8 Transaction tracing method

The Union database will need to track sustainable volumes of material registered and traded through the supply chain, along with all associated sustainability information. There are different ways of tracking sustainable volumes through the database, including:

1. **Certificates:** such as a proof of sustainability (PoS), that are traded 'intact' (i.e. without any changes to either content or volume) between parties in the supply chain along with the registered volume of material associated with the PoS. Example databases: eINa, Nabisy and TRACES.

2. **Transactions:** registered volumes along with associated sustainability data are traded between parties. Example databases: Bioledger, RSPO PalmTrace and Trace Your Claim.

3. **Tradeable credits:** registered sustainable volumes that are converted into a tradeable unit and traded between parties. Example databases: REV, ROS and Vertogas.

We recommend a **transaction-based system**, given that that the supply chain scope of the database starts at the point of origin of the raw material. Sustainability data will therefore have to be added and amended as the material moves downstream in the supply chain (e.g. the material will be converted from a raw material to a biofuel and additional sustainability data such as GHG related data will need to keep being added to each consignment). Consequently, in this system the PoS certificate that is registered along the supply chain and transferred between parties will not be unique and cannot be transferred intact (i.e. the PoS may relate to either a raw material or fuel). A certificate-based system is more appropriate if the starting point of the database is the fuel producer as in that case the material is the final biofuel. Therefore, the material and the accompanying PoS does not change further downstream and can be transferred intact.

In our view, a credit-based system is not appropriate for the Union database as it does not provide the necessary transparency of the sustainability data and furthermore is not in line with the mass balance system. A credit-based system is only in line with the REDII requirements from the point that fuels have been registered for sale in a single EU market, and have been accepted as meeting the REDII requirements by that EU market.

Full traceability along the supply chain for authorised parties needs to be built into the design of the database to support the monitoring or auditing activities performed by Member States or voluntary schemes. For economic operators, only the data relating to transactions between the respective

[12] See 'Data Reporting Template'. Available at: https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en?redir=1

parties should be available. Importantly, no information on the transactions that have been registered by upstream parties should be included to protect the confidentiality of trading parties (e.g. a fuel producer should not have access to information on the points of origin that supply a collection point that they have sourced raw material from).

2.2 System architecture – overarching principles

2.2.1 User management

The database can allow either one or multiple people on one account. When an account allows user management for multiple users, user rights can restrict edit and/or view rights for specific roles.

Our recommendation would be to allow multiple users per account with differentiated access rights between users (see section 3.4.5 for further details).

2.2.2 Data privacy measures

Data privacy refers to the right of a citizen to have control over how their personal data is used. Measures aimed at protecting data privacy further extend to the protection of companies' professional secrecy via Article 339 TFEU[13]. As a baseline standard, the database must comply with GDPR and thus the physical location of the servers hosting the data must be in a GDPR-compliant country.

A robust privacy policy in the Union database's terms of service must be drafted which considers the different actors in the supply chain who will need access to specific data, such as Member States or auditors, and properly communicates the ways in which Union database administrators will use the data and with whom they will share it. From the technical side, developers must take the 'Privacy by design' principle into account and design the database in such a way that embeds privacy into every stage of its development. Specific data privacy measures and recommendations are elaborated in section 3.4.1.

2.2.3 Data security measures

Data security measures protect data from unauthorised access, use, change, disclosure, corruption and destruction. The Union database will need to deploy measures which will ensure the compliance of the database with European Commission's IT security and information security polices and standards, as those detailed in the Commission Decision 2017/46[14]. These specify that effective IT security shall ensure appropriate levels of authenticity, availability, confidentiality, integrity, non-repudiation, protection of personal data and professional secrecy (see Box 1). The database will also need to comply with the Commission Decision 2015/443[15], which states that "Commission services owning, managing or operating communication and information systems shall only allow other Union institutions, agencies, bodies, or other organisations to have access to those systems provided that those Union institutions, agencies, bodies, or other organisations can provide reasonable assurance that their IT systems are protected at a level equivalent to the Commission's Information Systems Security Policy."

[13] Consolidated Versions of the Treaty on the European Union and the Treaty of the Functioning of the European Union, (2016/C 202/01). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A12016E339

[14] Commission Decision (EU, Euratom) 2017/46 of 10 January 2017 on the security of communication and information systems in the European Commission. Available at: https://op.europa.eu/en/publication-detail/-/publication/f9fd8acf-d7c9-11e6-ad7c-01aa75ed71a1/language-en

[15] Commission Decision (EU, Euratom) 2015/443 of 13 March 2015 on Security in the Commission. Available at https://op.europa.eu/en/publication-detail/-/publication/1ec52f4a-cc70-11e4-ab4d-01aa75ed71a1/language-en

Box 1. Data security measures

EU Decision 2017/46 stipulates that effective IT security shall ensure appropriate levels of:

- **Authenticity**: the guarantee that information is genuine and from bona fide sources
- **Availability**: the property of being accessible and usable upon request by an authorised entity
- **Confidentiality**: the property that information is not disclosed to unauthorised individuals, entities or processes
- **Integrity**: the property of safeguarding the accuracy and completeness of assets and information
- **Non-repudiation**: the ability to prove an action or event has taken place, so that this event or action cannot subsequently be denied
- **Protection of personal data**: the provision of appropriate safeguards in regard to personal data in full compliance with Regulation (EC) No 45/2001
- **Professional secrecy**: the protection of information of the kind covered by the obligation of professional secrecy, in particular information about undertakings, their business relations or their cost components as laid down in Article 339 of the TFEU

We emphasise that accordance with the European Commission Digital Strategy[16], regardless of the specific measures deployed, the database in its entirety should be approached with the principle of 'Security by design' in mind. This approach entails building security into every part of the IT management process such that the software perpetually and consistently controls the security of the system. Such an approach requires creating a limited amount of strictly defined user pathways such that developers may establish secure boundaries of use. In other words, if a user uses the database in the exact way that developers mean for them to do so, then the process should be secure. Specific data security measures, their trade-offs, and final recommendations in areas such as authentication and data transfer are elaborated in section 3.4.3.

2.2.4 Interfaces for external data exchange

Member State databases and other applications[17] could interface with the Union database to exchange data. Developing such interfaces enables cross validation and opens data for further analysis. However, it requires interfaces to be designed in the system architecture. Furthermore, standards need to be defined for other applications to communicate with the database.

As discussed in section 2.1.3, we propose a set-up whereby fuel volumes are exported from the Union database to Member State systems. Our recommendation is to provide flexible options for data transfer. This is further discussed in section 3.3.6.

2.3 Database ownership and management

2.3.1 Ownership

Ownership refers to who will legally own and host the database. This could be either the European Commission, or potentially an external party.

In our view, the most credible option would be for the European Commission to own and host the database. Member State databases would of course continue to own their national databases, where existing. (Data access and governance of the database is discussed further in section 3.4.2.)

[16] Communication to the Commission, European Commission Digital Strategy, A digitally transformed, user-focused and data-driven Commission. C(2018) 7118 final. Available at: https://ec.europa.eu/info/sites/info/files/file_import/digitally-transformed_user-focused_data-driven_commission_en.pdf

[17] For example, applications such as the VTA Biofuels application that is linked to Nabisy to provide additional reporting functionality and mass balance reconciliation.

2.3.2 Development and maintenance

The database can be developed and maintained internally, or it can be outsourced to an external party.

Our recommendation would be for the development process to be led by the European Commission, including further scoping of the database and the phase-in. The actual development could either be managed by the European Commission's internal IT team, or an external developer (subject to competitive tender). Ongoing maintenance could by managed by an external actor, contracted by the European Commission. We recommend that consideration is made to relevant ISO certification (see section 3.4.3 for further details).

2.3.3 Development platform

From a practical perspective, a selection on the front- and back-end development platforms would need to be made.

The front-end development platform concerns the user interface (browser or application) of the database. The front end of the database can be built using low-code development platforms such as Mendix, open source platforms such as Liferay, conventional development platforms such as JavaScript or more 'novel' blockchain technologies such as Hyperledger Fabric.

The back-end development platform concerns the server side of an application and everything that communicates between the database and the browser. The back end of the database can be built using platforms like Oracle, SQL Server or PostgreSQL (Postgres).

In our view, it is not appropriate to be prescriptive on the choice of technology platform. Instead it would be more appropriate to ensure that the selection meets a set of defined criteria, for example:

- **Cost:** This relates to both the development and ongoing operation of the database.
- **Ease of use:** The database front end needs to be accessible for the users of the database.
- **Privacy and Security:** The database needs to ensure that the data privacy and security can be assured (as outlined in sections 2.2.2 and 2.2.3).
- **Technical viability (and scalability):** The database needs to meet all the specific technical requirements, and importantly must be scalable.

A further consideration is that the Commission's internal IT team may prefer to align the platform selection with those technologies that are already commonly used within the Commission to be able to better control the overall development process.

2.4 Scope and design summary

A summary of our recommendations for the technical options is provided in Table 2 below.

Table 2. Scope and design of the Union database

Option	Recommendation
Scope of the Union database	
Application of the database	A mandatory pre-condition for sustainable fuels to be eligible for consumption in the EU is that they have been registered in the Union database.
Supply chain scope	Feedstock to fuel supplier (ideally starting at the point of origin contingent on the availability of low-cost technology solutions at a global level that can be used to automate the process).
Interaction of Union database with Member State databases	All fuel volumes are registered in the Union database and exported to a Member State account in the database once the fuels are placed on the market for consumption. The fuel volumes can then be exported out of the Union database to the Member State databases (where existing).
Sectoral scope	All liquid and gaseous fuels: Transport. Bioliquids and Biomethane: Transport, heating, cooling and electricity.
Fuel scope	Biofuels, bioliquids, biomethane, renewable fuels of non-biological origin and recycled carbon fuels.
Raw material scope	All potential raw material relevant to the proposed fuels.
Chain of custody system	Mass balance system (aligned with REDII Articles 30(1) and (2)).
Transaction tracing method	Unique transactions (volumes along with associated sustainability information, such as a PoS, and GHG emission data) which enables full traceability along the supply chain.
System architecture – overarching principles	
User management	Multiple users per account with differentiated access rights between users.
Data privacy measures	Protection of personal data (GDPR compliant) and Professional secrecy (commercial confidentiality) need to be assured and 'Privacy by design' principles must be observed.
Data security measures	Compliant with European Commission Information Systems Security Policy and with 'Security by design' principles.
Interfaces for data exchange	Flexible options for data transfer between Union database and Member State databases (where existing).
Database ownership and management	
Ownership	European Commission for the Union database, and Member States for national databases (where existing).
Development and maintenance	Development led by the European Commission (internal or external developer). Maintenance by an external actor contracted by the European Commission.
Development platform: front-end, back-end	Key considerations to include: • Cost (development and ongoing); • Ease of use; • Security; and • Technical viability (and scalability).

3. SET-UP AND OPERATION OF THE UNION DATABASE

This chapter sets out how the Union database will work in practice, following on from the recommended scope and design options described in the previous chapter. This chapter is split into four categories:

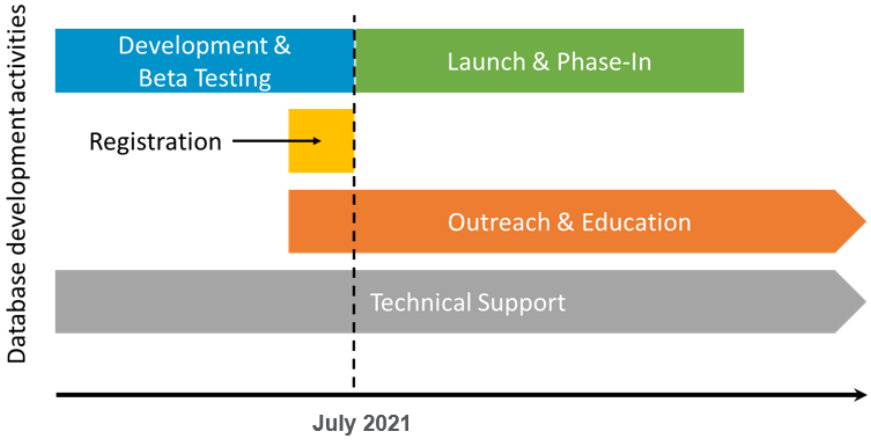
- **Database set-up:** Database development and implementation;
- **Processes:** Practical operation of the database;
- **Data:** Data specification, format and method, export to other systems; and
- **System architecture – detailed specification:** Data access and governance, security, privacy.

3.1 Database set-up

3.1.1 Database development process

The development and roll-out of the Union database is a technically challenging IT project that will require careful planning to deliver successfully and on-time. There are five activities that will be critical to the development and launch of the database as indicated in Figure 5.

Figure 5. Database development process



Development and beta testing

A key first step is for the European Commission to decide whether to develop the Union database internally, or to use an external contractor. Whichever route is chosen, there will need to be a process of more detailed database scoping, planning and development. The recommendations in this report will serve as a firm basis to build on.

Effective communication between key players is essential during the database development and phase-in. We recommend creating a technical working group to support this process. The group's role will be to advise on specific technical aspects and serve as a sounding board to the development team throughout the phase-in process. Such a body could include representation from the European Commission, Member States (potentially supported by REFUREC[18]), voluntary schemes, certification bodies and key industry associations across the supply chain.

[18] Renewable Fuels Regulators Club. See: http://www.refurec.org/

Having a variety of stakeholder groups represented helps to ensure that all perspectives are considered, potential issues are identified at an early stage and facilitates knowledge transfer. The technical working group should input throughout the development process and be retained following launch (e.g. for 12 months) to provide a sounding board to the database administrator to address ongoing issues and questions.

We recommend that a range of stakeholders from all stages in the global supply chain are involved in testing 'beta' versions of the database through 'real-life' pilots. The aim of testing a beta version (i.e. a non-live practice version) is to test the technical functioning of the database – does it work, is everything that Member States, voluntary schemes and economic operators need included, and is it user-friendly? It is reasonable to expect that a beta version could be available within 3 to 4 months of development. Involvement in testing the database was widely supported by the stakeholders that attended the webinar. The testing phase should be iterative and consultative to ensure that the database works for as many stakeholders as feasibly possible when launched. The database developer should be responsible for the execution of this beta testing phase, guided by the Commission and with support from the technical working group on which stakeholders and supply chains to include and which recommendations from the testing phase should be prioritised.

The aim of the beta testing phase is to test that the database works from a technical and user-friendliness perspective. Therefore, the beta database should be tested by a range of companies of different scales throughout the supply chain (also to test the transfer of transactions from one company to the next), and a range of feedstocks, fuel types (both liquid and gaseous) and countries (EU and non-EU). Several Member States and third countries should also be involved in testing the export of data, both in the situation where data is exported to an existing database and for situations where no country database exists.

Once the beta testing groups are chosen, the cycle of user testing and further development should begin. We recommend that the initial group of stakeholders will test the database and provide feedback to developers for at least one mass balance period (i.e. covering 3 months). For the initial beta test, it could be possible to conduct this in a shorter period of time, using old or test data. For example, companies could add test data for one week or one month to test the initial functionality of the database.

Following this, we suggest that a second test is run using an updated beta version which has incorporated any feedback provided by the first test run. The second test should use 'real-life' data (subject to confidentiality already being agreed and access to the beta database being appropriately restricted) and run for one mass balance period (i.e. covering 3 months) with an additional month to assess the data. The test should ideally involve the same organisations as the first test run to ensure continuity between the test runs, with involvement from additional organisations. Industry associations should work closely with the companies involved to ensure that insights are applicable to the wider industry.

Registration

The aim of the registration phase is to enable the registration process for the users of the database to start. This will help to ensure that all necessary users can have an account with their relevant details uploaded from the date of launch.

Member States and voluntary schemes will need to communicate to their respective scheme participants the need to register in the Union database, with explicitly stated deadlines and requirements. The terms and conditions of the voluntary schemes will need to be updated to mandate the use of the Union database. The voluntary/national schemes and certification bodies will also be responsible for coordinating with the database administrator to ensure that users registering in the Union database have valid and active certifications. It could be explored as part of the phase-in whether the data from the voluntary schemes lists of certified economic operators could be uploaded directly into the Union database, rather than all potential users (or the voluntary schemes/certification

bodies) having to enter all their details, as this would greatly reduce the administrative burden of the process (see section 3.2.1).

The registration and validation process for all users should start as soon as possible and be completed well in advance of Union database launch. This stage will require the database to be developed to such an extent that there can be a good working platform/website to register details and we therefore anticipate that registration should start towards the end of the development phase.

Outreach and education

The database administrator will have an important role to play in stakeholder outreach and education. The system will be new for everyone and although representatives from all stakeholder groups should be involved in the testing phase, many stakeholders will not have the opportunity to use the database until it is launched. There will need to be a programme of online webinars or workshops, and the development of online learning modules, guidance documentation and frequently asked questions. It could also be explored whether a test version of the database could be made available for users to familiarise themselves with its operation prior to launch. Any lessons learned from the launch and operation of the TRACES/TRACES-NT database should be taken on-board.

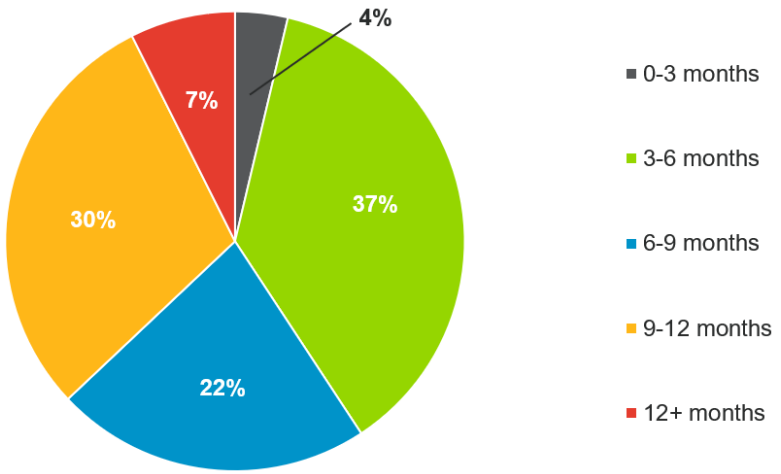
Stakeholder outreach and education will need to start at the same time (if not slightly before) the registration process starts and should continue after launch, especially focusing on keeping guidance and frequently asked questions up to date.

Launch and phase-in

The official launch date of the Union database should be signalled well in advance to the market to enable them to prepare. Following launch, economic operators can start to register material in the database. It is particularly important that a phase-in period is established to ensure that economic operators throughout the supply chain can start to register material and build up stocks within the database. **At the end of the phase-in period the database would "go live", at which point it will become mandatory to use for compliance purposes across the EU**.

During the webinar we gathered stakeholder feedback on the optimal time frame for phasing in the database (see Figure 6). Almost 90% of participants believed that a time frame of between 3 and 12 months was appropriate, with the highest percentage (37%) favouring a time frame of 3 to 6 months (this would cover two complete mass balance periods). In our view, a phase-in period of up to 12 months provides enough time for all parties concerned to transition to the new system, including stakeholders from those Member States which have existing national databases, such as Austria, Belgium/Luxembourg and Germany.

Figure 6. Stakeholder voting result on phase-in period (sample size: 27 participants)



Technical support

A technical support team will be required to respond to questions and technical issues from users during the beta testing of the database and following launch. This team will need to have the competence to cover content as well as technical (IT) related questions. The team will also need sufficient capacity to deal with the (expected) large volume of queries that will arise following launch.

3.1.2 Cost and financing of the set-up and ongoing operation of the database

3.1.2.1 Costs

The main cost drivers of the database will be development, hosting and ongoing operation and maintenance. Such data was provided for a selection of the databases reviewed in the Interim report submitted on 4 March 2020.

The development of **Nabisy** was undertaken by the BLE and reportedly took around six months involving five full-time equivalents (FTE). Ongoing developments and maintenance are managed with 0.75 FTE.[19] The **REV** database was developed by an unspecified external supplier, with very close involvement from NEa. Three versions of the registry have been developed to date, each costing ~€800,000 (including VAT), therefore totaling ~€2,400,000. A lower cost of ~€1,500,000 is estimated if the full functionality of the registry was developed in one version[20]. Annual costs amount to ~€150,000 for support and hosting and the involvement of one FTE at NEa.

The development of the **Vertogas** database took one year with a team of between six and eight developers at a cost of €500,000. The current operation, maintenance and hosting costs are €50,000[21]. No specific cost data was provided for the **RSPO PalmTrace** database, except that development of the database would take about a year with the current development team[22]. According to **Bioledger**, the estimated cost of developing a minimum viable product (MVP) solution with full supply chain scope is €500,000. This includes staff costs and ancillaries, such as hardware and hosting[23].

The cost information is summarised in Table 3 and could serve as a reference point for the Union database, while also recognising that these databases have different scopes. This would suggest that the Union database will cost a minimum of €500,000 to develop. The costs associated with the TRACES database (which were not available to the project team) should also be considered, as this database is an example of an operational Union database.

Table 3. Selected database development costs and resources

Database	Model	Develop. Cost [€]	Develop. Team [FTE]	Develop. Time [years]	Ongoing [€/year]	Support [FTE]
Bioledger	External	500,000	-	-	-	-
Nabisy	In-house	-	5	0.5	-	0.75
REV	External	2,400,000 (incl. VAT)	-	-	150,000	1

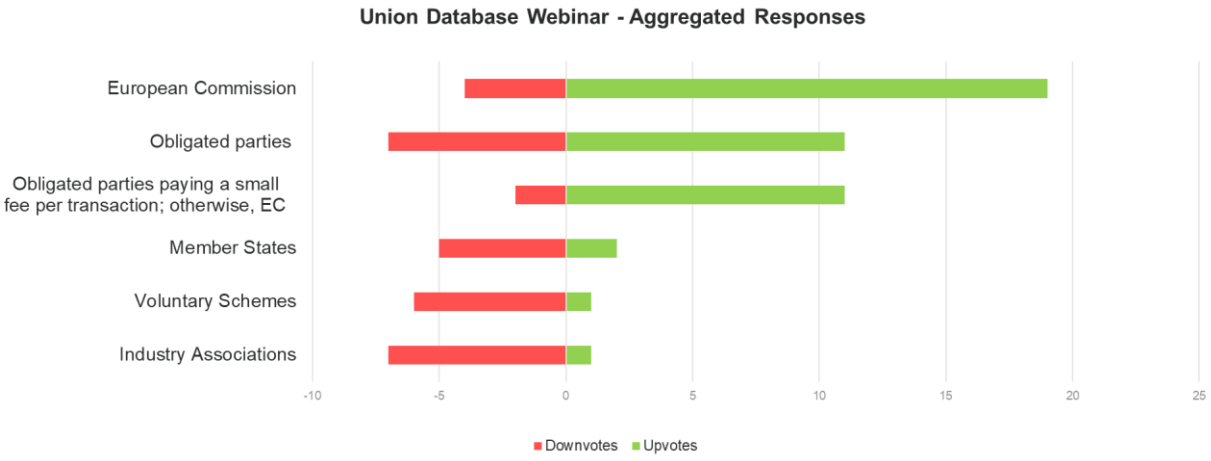
[19] Personal communication with Karl-Heinz Schnau (Deputy Head of Sustainable Biomass Division - BLE).
[20] Personal communication with Jaap Bousema (REV coordinator).
[21] Personal communication with Roelf Tiktak (CEO - Vertogas B.V.).
[22] Personal communication with Ronald van Marissing (Development Operations Manager - RSPO PalmTrace).
[23] Personal communication with Patrick Lynch (Bioledger Ltd - CEO).

Database	Model	Develop. Cost [€]	Develop. Team [FTE]	Develop. Time [years]	Ongoing [€/year]	Support [FTE]
RSPO PalmTrace	External	-	-	1 (estimated)	-	-
Vertogas	External	500,000	6-8	1	50,000	-

3.1.2.2 Financing

Our starting premise is that since the European Commission will own the Union database, it will also be responsible for funding the set-up of the database. From there, we see various ways in which the ongoing operation of the database could be financed. The most practical option would be that the European Commission also finances the ongoing operation. This approach is consistent with the national databases (elNa, Nabisy, REV, ROS) and TRACES, and was the most popular option indicated by stakeholders at the webinar (see Figure 7.).

Figure 7. Stakeholder (up/down) voting on financing the ongoing operation of the database



Since the use of the database for Member State compliance purposes will be imposed on the obligated parties, many stakeholders indicated that it should be the responsibility of the body setting the obligation to fund the ongoing operation (namely the European Commission and the Member States). However, stakeholders also indicated a willingness to support financing models in which costs were shared by the Commission and obligated parties, including Member States as well as economic operators, provided the fees were not significant. A common view expressed by industry stakeholders was that shared funding should also equate to shared decision making with respect to the governance of the database and its ongoing operation. This could be addressed by setting up the proposed technical working group, which should logically include representation from relevant industry associations, as well as representatives from representative economic operators.

Ongoing database costs could be recovered through several means, such as through a one-time registration fee, annual fee or a transaction-based fee.

RSPO PalmTrace applies a volume-based administration fee ranging from $0.63 to $1.40/tonne for physical shipments of CSPK and CSPO respectively[24]. This supports the ongoing development of the RSPO programme, part of which is for Rainforest Alliance to manage the database system. Currently RSPO PalmTrace is linked to an accounting platform. First buyers from the mills are invoiced once

[24] A separate fee structure is set for credit-based transactions. See: https://rspo.org/palmtrace#fees

'shipping announcements' are confirmed. Information then flows to the accounting system and invoices are generated, typically on a weekly basis.[25]

Vertogas applies an annual fee that is differentiated according to the user type. This fee is invoiced to all system users once a year in February, or otherwise in the calendar month after registration for new customers[26]. Producers are charged €900 and Traders €4,000 (end users and grid operators are not charged). Traders furthermore pay an additional charge when creating, trading or redeeming certificates of 0.496, 0.09 and 0.083 €/MWh respectively. These transaction costs are invoiced and collected monthly.

Trace Your Claim intends to apply a similar financing model, although it is still under development. The proposed fee structure is a one-time registration fee of €150 and an annual flat fee of €350 for all users, except for traders who would be charged between €1,000 and €2,000 depending on their turnover.[27] In addition, a transaction-based fee of 5 to 15 Euro cents per tonne would be charged, depending on volumes registered. Under consideration is whether to pay collection points a premium of 5 Euro cents per tonne to reflect the experience from the Trace Your Claim pilots that collection points can be a potential bottleneck to the database's implementation.

Results from a recent multi-stakeholder survey conducted as part of the **Bioledger** ISEAL pilot project, indicated an average willingness to pay from those who responded to the survey of €1.35 per metric tonne of biofuel, prorated across the supply chain for the database described in the Bioledger pilot. This would translate to a willingness to pay of up to 45 Euro cents per tonne per transaction in a simple supply chain or less than 10 Euro cents per tonne for a longer supply chain.

3.2 Processes

3.2.1 Validation process for registering new users

The main user types for the Union database are:

- Member States (covering regulators, ministries, tax offices);
- Third countries;
- Voluntary and national schemes;
- Certification bodies;
- National system auditors and verifiers; and
- Economic operators.

We recommend a differentiated approach to registering and validating these user types. This approach reflects the 'status' of the user type, the number of users that will need to be registered per user type, the practicality of validating these requests and importantly the voluntary scheme certification process.

New users of the Union database will first need to create an account before they can login to the database. To do this they will need to register their credentials and an email address. After this they will receive an automatic email with a unique link, which directs them to the database webpage so

[25] Personal communication with Paula van Hartog (Sector Lead Palm Oil - Rainforest Alliance).

[26] Part of the registration at Vertogas is to provide bank and VAT details, which may be subject to validation by Vertogas.

[27] Personal communication with Sascha Wüstenhöfer (System Manager - ISCC).

they can configure a secure password. For security, we recommend that the link is time limited for 24 hours, as in the case of TRACES.

Initial registration for each user type should always be undertaken by a 'lead user', a representative who has sufficient seniority and legal capacity within the organisation (e.g. company director, head of department). Appropriate evidence should be provided to accompany the registration, to prove the applicant is genuine[28]. This could include, for example, a pdf copy of the chamber of commerce including the date of incorporation, legal status of the company, VAT number and individual proofs of identity for at least one company director. The evidence should include the company domain name and the names of representatives who have signing powers.[29] The lead user will then receive a self-registration email, which can be activated by clicking on the validation link sent. A manual comparison between the name registered and the domain on the pdf should also be undertaken.

We recommend that a separate user account is set up for each legal entity/mass balance site, consistent with the certification scope applied by the applicable voluntary or national scheme. In the situation where an organisation consists of several legal entities, or operates multiple mass balance sites, then we recommend that these accounts are linked in the Union database for greater transparency and furthermore to help organisations to align the information in the database with their existing internal reporting systems.

Following successful registration, additional representatives of the respective organisation can register in the database. These requests are validated by the lead user. The lead user will have full access rights on the account (i.e. read only, read/write, read/write/administration). Access rights for other users are specific to the user, as determined by the lead user (or delegated administrator). Following validation, the general screens are dynamically adjusted to the specific user type.

We propose that the **database administrator** validates the (lead user) requests registered by **Member States[30], third countries[31] and voluntary schemes**. The validation of additional users could be facilitated using whitelisted domain names of the relevant organisations that will need to access the Union database, or by providing details of approved email addresses and telephone numbers for two-step verification[32]. The validation of **auditors and/ or verifiers** approved for use in a national system could be undertaken by the relevant **Member State** body, and similarly the **voluntary schemes** can validate the registration requests for approved **certification bodies**.

We propose that the **voluntary schemes and certification bodies** are jointly responsible for validating the registration requests of **economic operators**, which will be by far the largest user type by number. Only those economic operators that hold a valid certificate will be able to register in the Union database.

The economic operator will need to register (as a minimum) the following information:

- Company details (name, address, contact number);
- Contacts details of lead user;
- Voluntary scheme;

[28] For example, see: https://www.gov.uk/guidance/renewable-transport-fuels-obligation

[29] See also sections 8.4 and 8.11.4 of the 'Harmonisation and strengthening of sustainability certification for biofuels, bioliquids and biomass fuels under REDII' draft final report, which outlines approaches for the registration of new scheme participants. It is suggested that similar approaches are adopted by Member States in national schemes for consistency.

[30] It should be noted that the user group 'Member States' is potentially broad in scope and will in fact encompass several bodies. For example, regulators, ministries and tax offices.

[31] It is feasible that some third countries will also need to be registered in the Union database as not all fuels registered in the database will ultimately be consumed within the European Union.

[32] Such a 'whitelist' allows specific IP addresses to access the network.

- Certification body; and
- Certificate number.

A two-step approach is proposed, which is broadly similar to the approach implemented by RSPO PalmTrace. Firstly, the relevant **certification body** will receive a notification of the registration request and validate the details registered by the economic operator. The **certification body** is also responsible for registering additional details relevant to the economic operator, including the certificate validity (from/ to), scope of certification (e.g. activity, feedstock or fuel) and operational data (e.g. plant capacity volume, process conversion factor). The certificate and audit report are uploaded to the user's account by the certification body. The **voluntary scheme** is then responsible for validating all the information registered before the account is activated. Only those economic operators that hold a valid certificate can be registered.

It should be noted that all voluntary schemes are required to keep an up to date list of certificate holders and their status, which should be made publicly available[33]. This data source will serve as the primary means of validating users. Additionally, it could be explored as part of the phase-in whether the data from these lists can be uploaded directly into the Union database as this would greatly reduce the administrative burden of the process. A necessary first step would be to transpose the voluntary schemes data into the Union database format.

It is possible that some economic operators will be certified to more than one voluntary scheme. In this case, we recommend that one common account is set up for the economic operator (with potential sub-accounts for each voluntary scheme) in the database to ensure greater transparency and furthermore to facilitate the audit process (so that auditors will be more readily able to check the complete mass balance for an economic operator).

An adapted version of the above approach could be used by **economic operators** that are participants of a **national scheme**.

A summary of the validation approach by user type is indicated in Table 4 below.

Table 4. Validation of users in the Union database

User type	Validation undertaken by
Member State	Database administrator
Third country	Database administrator
Voluntary scheme	Database administrator
Certification body	Voluntary scheme (as relevant)
National system auditor/ verifier	Member State (as relevant)
Economic operator	Voluntary scheme and Certification body (as relevant)

After the users have finished the registration process and their application has been validated, the general login screen is dynamically adjusted to the screen(s) of the relevant user type (e.g. Member State, Voluntary scheme, Economic operator – Collection point, Trader, Fuel producer, Fuel supplier etc.). This means that the permitted actions and data in the database are available depending on the user type.

The registration and validation process for all users should start as soon as possible and be completed well in advance of Union database launch. This process should be incorporated into the database phase-in (see section 3.1.1).

[33] See, for example: https://www.iscc-system.org/certificates/all-certificates/

3.2.2 Registering raw material and fuel volumes

The database needs to enable the registration of both raw material and fuel volumes (following on from the supply chain scope proposed in section 2.1.1), as well as volumes of any intermediate materials.

Raw material volumes will need to be registered by a first gathering point or collection point (or by farms/plantations if they are individually certified). As discussed in section 2.1.2, this process could be facilitated by the use of technical solutions, such as mobile apps or hand-held devices. A first step will be for the first gathering point or collection point to individually register all suppliers of raw material (points of origin) in their account. For example, a used cooking oil collector would register all the restaurants that they collect from, whereas a first gathering point would register farms that they source from.

Supplier information would also need to be registered, such as company address, and the raw material supplied (in some cases more than one raw material might be applicable). Once the raw material is registered in the database it is available for trade with downstream parties (e.g. traders or fuel producers).

In the case of a palm oil mill, or sugarcane mill, then the volumes of any secondary materials can also be registered in the database. For example, POME and empty fruit bunches in the case of a palm oil mill and bagasse in the case of a sugarcane mill.

Fuel volumes can only be registered by a fuel producer and must be based on available raw material volumes held in stock. As a first step, the fuel producer will need to buy raw material volumes that have been registered by a first gathering point or collection point in the Union database. Only those raw material suppliers that are associated with the fuel producer in the Union database will be eligible to supply material, for subsequent conversion into fuel.

The fuel producer can choose at what point to convert a volume of the raw material held in stock to finished fuel in their database account. A pre-condition is that the raw material has actually been physically converted to fuel. Following this action, the volumes of the raw material and fuel stocks associated with the fuel producer are automatically adjusted in the database. The database should also record the volumes of other materials that are produced (co-products, residues or wastes) to enable the producer to use these materials for further conversion, or otherwise to trade them on.

The raw material conversion factors should be specific to the production process of the economic operator. We recommend that the factors are registered by the certification body as part of the voluntary/national scheme certification process. For new scheme participants, or in the absence of this data, then a conservative 'default value' could be used[34] (see section 3.2.6). This limits the possibility of false volumes being generated by the fuel producer in the database.

We furthermore recommend that capacity data for raw material suppliers and fuel producers are registered as part of the certification process. This could be based, for example, on the previous year's volume or on the volume specified in an environmental permit. Should an economic operator exceed the specified volume on their account then an automatic warning could be sent to the certification body. Through this measure the potential to undertake large scale fraud is greatly reduced.

3.2.3 Registering transactions

The Union database will need to implement a process for registering transactions between a 'seller' and 'buyer' along the supply chain. Our proposed approach is detailed below and is broadly similar to

[34] Such default values could be determined by the JRC, and aligned with the GHG emission calculations undertaken in the context of the default values in Annex V and VI of the REDII.

the process applied in several of the databases reviewed in Task 1 and presented in the interim report (namely Bioledger, RSPO PalmTrace and Trace Your Claim).

As a first step, the **seller** will *register* a transaction (i.e. trade) with a buyer. A pre-condition is that the accounts of the seller and buyer are linked within the database (i.e. a seller would not be able to automatically view all possible buyers registered in the database, and vice versa). The trade must represent a physical trade of material (either feedstock or fuel) and correspond to a specified volume along with the related sustainability information. The data corresponding to the transaction is locked in the seller's account until further action by the buyer to ensure that it cannot be double counted.

The **buyer** can choose to *accept* or *reject* receipt of the transaction from the supplier in their account to finalise the transaction in the database. Until this time the transaction has a *provisional* status. We propose that a period of up to one week is allowed for the buyer to accept or reject the transaction to avoid transactions being stuck in the database for extended periods, with a reminder sent to the buyer after 48 hours. If no action is taken by the buyer within this period, then we suggest that the transaction is automatically *cancelled* and would need to be resubmitted. The process could be facilitated by providing the option for the seller to automatically replicate the transaction details to reduce the administrative burden.

If the buyer *accepts* the transaction, then the associated volume is transferred from the seller's account to the buyer's account. After being *accepted*, the transaction details cannot be modified. Should the buyer *reject* the transaction, then the associated volume is reallocated back to the seller's account. The buyer should be required to specify the reason for the rejection using a pre-defined drop-down selection. The database should also provide the option for the buyer to include a comment to explain why the transaction was *rejected*.

The complete transaction history should be recorded in both the seller's and buyer's respective accounts for all transactions registered.

3.2.4 Accounting for unintentional mistakes

There will invariably be occasions when data has been registered incorrectly by the seller in the database. For example, this could relate to:

- Selecting the incorrect company or delivery address for the buyer;
- Registering incorrect feedstock/fuel volumes or using an incorrect delivery date; or
- Allocating incorrect sustainability information for the registered volume.

The Union database should provide options for correcting such mistakes, on the basis that this process is managed in a robust and transparent way.

We propose that the seller is able to *modify a* transaction. This action could arise in one of two ways. It could be initiated by the seller if a mistake was identified at any time within the one-week period, provided that the transaction has not yet been accepted by the buyer. Alternatively, the seller may choose to *modify* a transaction if it has been *rejected* by a buyer. In this case, the modified transaction should be associated with the original one.

We further recommend that the seller is able to *withdraw* a transaction at any time within the one-week period, provided that it is has not yet been accepted by the buyer. The respective volume is then reallocated back to the seller's account. The seller should be required to specify the reason for the *withdrawal* using a pre-defined drop-down selection. Additional details could be provided in a comment field, if relevant.

In the event that a transaction has been approved by the buyer in error, then we propose that this is corrected by *reversing* the transaction in the database. Such a *reversal* would need the agreement of the respective buyer and seller. The modified transaction should be also be associated with the original one.

We propose that an alert is sent to the certification body if any transactions have been *modified* or *withdrawn*. The complete transaction history should also be recorded in both the seller's and buyer's respective accounts for all transactions that are either modified or withdrawn. These transactions should be subject to specific monitoring by auditors.[35]

3.2.5 Accounting for irregularities identified by auditors

Situations may also arise when irregularities in the registered data are identified. This could be by an auditor, certification body or voluntary scheme in the context of the voluntary schemes' certification process or by a Member State in the context of national system participation or compliance checks. Such irregularities would need to be investigated as part of the audit process, and may be judged to be unintentional mistakes, in which case the process set out in section 3.2.4 would need to be followed. However, in some cases deliberate fraud may be identified. Examples could include registering data that is not consistent with the physical transaction, such as registering false feedstock or fuel volumes and/ or sustainability data.

The voluntary schemes are already required to publish lists of certificate holders and keep the certificate status up to date. The Union database will serve to strengthen this existing requirement.

An issue would arise if the fraud results in invalid data being passed down the fuel supply chain, or in an extreme case potentially even placed on the market.

In the event that fraud is suspected or identified, then the economic operator's account should be immediately suspended, and subject to further investigation by the auditor and (where relevant) Member State. During this time the economic operator should be unable to undertake any further actions in the database. Any open transactions should also be blocked. A similar process should be followed if an economic operator's certificate status is suspended or withdrawn as a consequence of issues relating to aspects outside of the scope of the Union database. Failure to satisfactorily resolve the issue should result in the economic operator's account being permanently closed. An important consideration is at what point an economic operator's account is suspended, and who has the final authority to suspend or close an account. Given the potential impact of blocking the concerned transactions in the system, a decision to do so must not be taken lightly and must be based on solid evidence.

Once an account is suspended, it may be difficult to penalise downstream parties who purchased certified feedstock/fuel in good faith, but equally the integrity of the whole system fails if fuels are allowed to be placed on the market when they are known to be from fraudulent sources. We see a number of options for how this could be handled in the database:

1. Block/freeze/invalidate all related downstream trades;

2. "Red flag" all downstream trades (but allow them to continue to be traded, so it enables identification of those consignments) – these trades should be marked as non-REDII compliant unless/until evidence can be provided to the contrary; or

3. Allow downstream trades to continue unaffected and unidentified.

[35] A certification body we consulted suggested that the certification body would be responsible for authorising any corrections made to a transaction entry, within a set time period (for example two months after creating the transaction). In our view, the approach we outline is sufficiently robust and transparent, and reduces administrative burden.

We recommend that the process for dealing with these instances is subject to further discussion with the Member States and voluntary schemes as part of the phase-in process. We recommend that downstream trades should be either frozen or at least "red flagged" so that they can be identifiable in the database (option 2). We do not recommend option 3.

NEa was consulted on this point. They argue that if a fuel volume has already been claimed/counted by a Member State, then it may be too difficult to correct all transactions retroactively in the database. However, for volumes of biofuels not yet placed on the market, which can still be claimed/counted, then those volumes should be prevented from being claimed/counted towards a target, to protect the integrity of the system. In the alleged biodiesel fraud case in the Netherlands, NEa could not refuse batches of potentially fraudulent biofuel being booked in their system, because Member States are obliged to accept PoS that have been issued by a certified economic operator. This situation could be different for a central Union database with the authority to revoke a PoS. NEa could only forbid double counting verifiers to issue additional statements to biofuel from the concerned plant. Options 1 and 2 above are supported by NEa. Option 3 is not advised.[36]

3.2.6 Operation of the mass balance system

The Union database will need to facilitate economic operators to follow the rules of the mass balance chain of custody system, in line with the rules in Article 30(1) and a forthcoming Implementing Act being prepared by the Commission.

One of the key principles is that "the sum of all consignments withdrawn from the mixture [is] to be described as having the same sustainability characteristics, in the same quantities, as the sum of all consignments added to the mixture…" (Article 30(1)(d)). This core principle is well facilitated by a database. The database should only allow material to flow once down a supply chain and should only allow material that has been received into an economic operator's account to be transferred to downstream parties. The database should also facilitate instant transfer of data from one party in the chain to the next (subject to the relevant approval), which should remove issues related to the timing of more paper-based or manual administration.

Whilst the REDII only requires the balance to be achieved "over an appropriate period of time", it is a working assumption that the database should only allow material with associated sustainability characteristics that is on an economic operator's account to be allocated to the next party down the chain (i.e. that it should not be possible to "go short" in the database). This is currently the case in the Nabisy database. In other words, the Union database should be a closed system with a fixed volume flow – a credit account with no overdraft. In theory the database could allow an 'overdraft' facility, or economic operators could control their mass balance records outside the database and only update the data in the database less frequently (see discussion in final paragraph of this section), but these options would undermine some of the key advantages that the development of the database brings, to provide a system that helps to control the overall volume flow.

The database will need to facilitate key elements of the mass balance system, as well as any additional requirements that arise from the forthcoming Implementing Act on voluntary schemes:

- **Site level mass balance:** The mass balance needs to operate at a site level (or smaller level of granularity). When registering to use the database, economic operators should define "sites" that they operate under the REDII.

- **Timeframe:** The REDII allows the mass balance to be continuous or balanced over an "appropriate period of time". In practice, we recommend that the database does not allow deficits, so the mass balance within the database will effectively be continuous.
  Note that outside the database, economic operators may be operating 3-monthly mass balance periods, as required by many voluntary schemes. The Commission requires that in order to carry material over to the next mass balance period, there must be an equivalent

[36] Personal communication with Jaap Bousema (REV coordinator).

volume of physical stock. This is something that would need to be audited onsite, outside the database. As is currently the case in the Nabisy database, the Union database should allow users the option to retire data (proofs) for which you do not have material in stock every 3 months in accordance with the principles of mass balance to balance your account.[37]

- **Aggregation, splitting and transfer of consignments:** The database will need to allow economic operators to *aggregate, split and transfer* consignments (administratively) at each stage in the supply chain. Sustainability data (see section 3.3.1) should be maintained as material is transferred down the supply chain. The "set of sustainability characteristics" must always stay together.

  For a specific economic operator, on a single site, the database should allow for incoming consignments to be *aggregated* if all sustainability characteristics are identical. Sustainability characteristics includes all mandatory "sustainability data" points listed in Table 5 in section 3.3.1. The aggregation could either be done automatically, or economic operators could choose to allow consignments to be kept separate.

  For outgoing consignments, economic operators should have the flexibility to *split* consignments into smaller consignments as they choose (within the rules of the REDII and the forthcoming Implementing Act from the Commission), or simply *transfer* consignments intact.

  Consignments with otherwise identical sustainability characteristics, but different GHG values can be combined administratively. However, they cannot be combined for the purpose of averaging GHG values to meet the GHG threshold and become REDII compliant (i.e. consignments that would otherwise not meet the GHG saving threshold cannot be administratively combined with consignments that would meet the threshold). If consignments with different GHG values are combined there are two options: 1. Assign the most conservative GHG value to the combined consignment; or 2. Calculate weighted average GHG value for the combined consignment. (This aspect is subject to further discussion in the context of the update to the voluntary schemes assessment framework under the REDII. The agreed approach should be implemented in the Union database for consistency.)

- **Changes to the mass/volume at processing plants:** The database will need to enable economic operators to take into account an appropriate conversion factor when material is processed (e.g. to convert a volume of vegetable oil that enters an operator's account into a volume of FAME biodiesel that is sold). The conversion factor should be applied to incoming material to give the volume of outgoing material that can be sold. (Note that a site producing more than one type of output may require multiple conversion factors.) Ideally, economic operators should enter a conversion factor based on actual data from their plant and this factor should be updated as often as is required. This is unlikely to be required to be entered on a consignment to consignment basis, but may need to be updated more than annually, for example, depending on the different feedstocks processed. The conversion factor should be audited as part of the voluntary scheme audit process. The database could include conservative 'default' conversion factors, depending on the process, that could be used in the absence of user-specific factors that would at least enable the database to operate. This approach is currently implemented in both the RSPO PalmTrace and Trace Your Claim databases. There should be a plausibility check of the user-entered conversion factors in the database, at least to check that the factor is not greater than 1 (i.e. it is not possible for more material to leave the account than entered the account). The JRC could advise on more

[37] BLE Evaluation and Progress Report 2018, Section 8. Available at: https://www.ble.de/SharedDocs/Downloads/EN/Climate-Energy/EvaluationAndProgressReports2018.pdf;jsessionid=80271AB9EDC43F802AB269580FDDA9B7.2_cid335?__blob=publicationFile&v=2

BLE Nabisy Frequently Asked Questions, question 19. Available at: https://www.ble.de/SharedDocs/Downloads/EN/Climate-Energy/Information-Nabisy/Frequently_Asked_Questions.pdf;jsessionid=827DEDB3280B84958D792C46607ED8B3.1_cid325?__blob=publicationFile&v=2

specific conversion factors for plausibility checks and/or on the appropriate value for and 'default' factors.

- **Inventory reconciliation:** The database needs to allow users to make small quantity adjustments to reconcile physical volumes in stock with the data in the database. For example, the database needs to have the ability to take *physical* losses into account at any point in the supply chain, due to drying, spills or natural losses when material is transferred from one container to another. Similarly, the database would need to provide the option for any administrative differences to be taken into account when a buyer in the database "receives" an input into their account. For example, resulting from differences in the volumes registered by a seller and the volumes received by a buyer (noting that transport steps are not likely to be included per se in the database). These differences are typically small (and may be simply due to rounding errors), but nevertheless small quantity adjustments should be possible.

The mass balance of an economic operator will subject to independent audit to cross-check the volumes registered in the database with the volumes stated in contracts, invoices and in transport documents (undertaken as part of the respective voluntary/national scheme). It is assumed that this audit will take place outside the database, but the auditor could already see database entries for the economic operator before doing an onsite audit to validate the database entries with the physical reality. Note that the European Commission's Assessment Protocol for voluntary schemes which is currently undergoing revision is likely to include more specific guidance on aspects relevant for audits of mass balance systems.

The extent to which the database could ultimately replace an economic operator's mass balance records will depend on the willingness of economic operators to integrate the Union database into their company systems, on the user-friendliness of the database and on the technology choices of the database that allow for more "live" transfer of consignments. A key open question is how frequently economic operators would be able or even required to update the database? If an app-based or barcode scanning type system is implemented, the database could be updated on a more-or-less live basis to include individual physical transactions (e.g. each truck load). At the other extreme, companies could keep their mass balance records updated outside the database and only be required to update the database on a monthly or even 3-monthly basis (in line with most voluntary scheme mass balance requirements). The reality is likely to be somewhere in between. Economic operators will need to visit the database interface frequently to accept/reject consignments to ensure that data "flows" unhindered through the database. However, the frequency required will depend on the scale and type of the economic operator's operations and their stage in the supply chain. We recommend that the database is built with the ultimate aim that economic operators can update it on a more-or-less "live" basis. However, the reality of this will depend on the availability of technology. As a starting point, economic operators could be required to update the information in the database as a minimum monthly, covering aggregated transactions.

3.2.7 Interaction with voluntary and national schemes' certification process

We see the Union database playing an entirely complementary role with the existing voluntary and national schemes' certification process.

A major benefit of the database will be to streamline and improve the robustness of the audit process. Certification bodies will be able to access an economic operator's complete mass balance data prior to the audit, furthermore the data will be available in a consistent digital format, facilitating review. There will also be less opportunity for fraudulent operators to 'hide' transactions, since all transactions will need to be registered in the database in order to be eligible for REDII targets. The database could also be designed to pro-actively issue 'alerts' to auditors if irregular transactions have taken place (as discussed in sections 3.2.4 and 3.2.5). This helps to ensure that any potential issues are picked up in a timely manner. We strongly recommend that the certification bodies are involved in the further

scoping of the Union database to take on board any specific views they may have on database design features that will facilitate and enhance the audit process.[38]

In time, the Union database has the capacity to become the central hub for the REDII sustainability system. As a minimum, the database should cover:

- Validation process for registering new scheme users (as discussed in section 3.2.1);
- Publication of lists of economic operators and their certificate status by the voluntary and national schemes (to provide greater market transparency, and also to help identify instances of 'scheme hopping'); and
- Publication of lists of certification bodies and the public authorities recognising and monitoring them by voluntary schemes (as mandated under Article 30(7) of the REDII).

3.3 Data

3.3.1 Data specification and units

Specific data relating to the economic operator will need to be entered into the database on registration to the database, as described in section 3.2.1. This includes the company details (name, address, contact number), voluntary/national scheme certification along with the certificate number. In addition, capacity data for raw material suppliers and fuel producers could also be registered in the database as part of the certification process (see section 3.2.2).

The Union database will need to store and transfer data relating to transactions made (see section 3.2.3) that can be used to demonstrate compliance with the REDII sustainability criteria to Member States, which is the focus of this section.

There was a discussion in the webinar about whether all information that is currently requested by all Member States should be included in the Union database. The database could facilitate this. However, we recommend that the development of the database is taken as an opportunity to harmonise and streamline the standard data requested from economic operators, and that the data mandated to be in the database is kept to the core information required to demonstrate compliance. This aims to minimise administrative burden and helps the database to operate as smoothly and quickly as possible, avoiding that transactions take a prohibitively large amount of time to process. The introduction of the database is designed to provide Member States with further assurance on biofuels, and the ability of Member States to interrogate the database should reduce the requirement from Member States to request additional information from economic operators or voluntary schemes, which should reduce the need for Member States to ask for data to be reported that is specific to that country. Nevertheless, there could be information that specific Member States need, for example, if their support system requires a certain piece of information. This could be facilitated by the database but should be kept to a minimum to avoid unnecessary administrative burden.

Terminology used in the database should always be standardised, data entered should follow standard definitions and should be selected from drop-down menus (e.g. for feedstock or country lists) or entered in a predefined format (e.g. for dates) and with specified units. Data should be entered once and flow down the supply chain or link back to the original economic operator who entered the data, to avoid duplication of entries or errors. Where possible, plausibility checks should be built into the database to prevent users from entering incorrect data (see also section 3.3.4). Where possible, data should be automatically generated rather than inputted by users to avoid errors

[38] It should be emphasised that economic operators will still be subject to an on-site audit, where required, and a thorough review of documentation/evidence to support the transactions made in the Union database. For example, this could involve cross-checks against an economic operator's book keeping system and validating the volumes of material registered in the database with contracts and transport documents.

or inconsistencies. For example, the database could automatically populate whether a feedstock reported is listed in Annex IX part A or B, whether it is a food and feed crop, low/high ILUC-risk feedstock etc. The database could also flag consignments entering one site as being in the same product group for the purposes of the mass balance.

Table 5 sets out the core data that we recommend is inputted by economic operators for all material in the Union database, as well as relevant notes and specifications on the types of data. The data is split into two categories:

- **Sustainability data** is needed to demonstrate compliance with the REDII and will need to flow all the way through the supply chain in the database. “Sets of sustainability data” need to remain together and be allocated appropriately to outgoing consignments (following the REDII rules and any forthcoming rules from Commission Implementing Act). At each step in the supply chain, more data may be added to a set of sustainability data (e.g. additional data points for the GHG intensity calculation).

- **Transaction data** relates to the transfer of a specific consignment between a buyer and seller at each step in the supply chain.

Data related to Member State compliance (e.g. quota year) could be automatically generated when the fuel is checked out of the database.
During the webinar, stakeholders discussed whether a proof of sustainability (PoS) should be generated by an economic operator and entered into the Union database, or whether the database should generate the PoS. A majority of the participants in the webinar said that ideally the Union database would generate the PoS and this would eventually replace the PoS from voluntary schemes. Having two parallel PoS type systems (the database and voluntary schemes) or a hybrid approach could create confusion and double workload.

However, it was also expressed that getting to a point where economic operators and Member States trust the database PoS so it can entirely replace voluntary scheme PoSs would take time and an effort would also be needed to harmonise scheme PoSs. Some voluntary schemes also go beyond the REDII and as such their PoS documents (or equivalent) contain additional information not likely to be required in the database. This harmonisation process should not delay the implementation of the database, so in a first phase it may make more sense to enter existing PoS documents into the database. Another option could be to make the first step to replace voluntary scheme PoSs with a database generated PoS for Member State compliance. Further upstream economic operators could continue to use voluntary scheme PoSs.

It will be important to develop the database in a way that facilitates data or sustainability characteristics to be added or amended in future as the legislation develops. The database should also be built in such a way that allows the granularity of data to be maintained. For example, a certification body noted as part of this project that when Nabisy was launched, it was only able to include a maximum of two countries of origin per PoS. This resulted in a loss of transparency in the database as there were many occasions where a biofuel contained material with more countries of origin than that. Now within Nabisy, it is possible to issue a separate PoS for each country of origin. In our view, and especially as it is recommended that the start from the point of origin, the database should be able to maintain all countries of origin.

Table 5. Core data to be included in the Union database

Sustainability data	Data entry method*	Data format	Notes
Voluntary scheme	Drop-down list – specific to economic operator	Defined code (e.g. ISCC, RSPO)	Name of European Commission-recognised voluntary scheme
National scheme	Drop-down list – could be specific to economic operator	Defined code (e.g. ISCC-DE, REDcert-DE)	Name of European Commission - recognised national scheme or Member State-recognised national scheme
Proof of sustainability number	Specified by economic operator (using the voluntary scheme specific template) or automatically generated by the database	Free text (if specified by economic operator) or standardised format if generated by database	See earlier discussion in this section
Raw material type	Drop-down list	Defined code/ name (tbc)	Option to align with voluntary schemes data reporting template[39] Whether raw material is in Annex IX (Part A, Part B)[40], a 'food and feed crop', low/high ILUC-risk feedstock etc could be automatically generated by the database
Country of raw material origin	Drop-down list	Defined code/ name (e.g. BE)	Align with ISO 3166 (Alpha-2) country codes
Scope of raw material certification	Auto-populated (based on data entered by certification body)	Defined code/ name (tbc)	E.g. whether feedstock is certified to sustainability criteria, most relevant for wastes and residues Entered (at least) annually by certification body/auditor
Waste or Animal By-product permit number	Specified by economic operator	Document upload	On a voluntary basis
Fuel type	Drop-down list – specific to economic	Defined code/ name (tbc)	Option to align with voluntary schemes

[39] Data reporting template. Available at: https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en?redir=1

[40] The list of Annex IX raw materials will need to be updated over time should additional materials be added.

Sustainability data	Data entry method*	Data format	Notes
	operator (biofuel producer)		data reporting template[39]
Country of fuel production	Drop-down list – specific to economic operator (biofuel producer)	Defined code/ name (e.g. NL)	Align with ISO 3166 (Alpha-2) country codes
Date production plant went into operation	Auto-populated (for biofuel producer, based on data entered by certification body)	DD/MM/YYYY	Relevant to judge which GHG threshold biofuel needs to comply with. Entered once by certification body/auditor Technically not required to be reported for an individual consignment if the biofuel has a GHG saving >65%, but necessary if saving is lower. Several Member States ask for this information to check GHG compliance
GHG emission data	Specified by user	Numeric (1 decimal place) for disaggregated intensity	State 'default value' or, if enabling an actual value calculation, then state the disaggregated GHG intensity per supply chain step in the following units following the guidance set out in the voluntary schemes' note[41]: • Raw materials and intermediate products in gCO_2/dry tonne • Finished fuel in gCO_2/MJ fuel Note that it is <u>not</u> envisaged at this point that the database would be a GHG calculator

[41] Note on the conducting and verifying actual calculations of GHG emission savings, Version 2.0, 2017. Available at: https://ec.europa.eu/energy/sites/ener/files/documents/note_on_ghg_final_update_v2_0.pdf

Sustainability data	Data entry method*	Data format	Notes
Whether the material received incentive/subsidy support with respect to Member State target accounting	Drop-down list (with options on the sector support was granted to, or otherwise "not applicable") and Drop-down list (with list of all EU countries and "third country")	Defined code/ name, with option to include free text with specific details (e.g. type of support measure such as "feed-in tariff")	Most important for biomethane. Information needs to include **sector support was granted to** (electricity, heating, cooling, transport) and **country that granted support** Important for Member State target accounting. Therefore, required for third countries who implement the REDII. For other third countries, only the country where the biomethane was generated can be reported

Transaction data	Data entry method*	Data format	Notes
Supplier company name and address	Auto-populated (based on data entered at registration)	Standardised	
Buyer company name and address	Drop-down list – unique to economic operator	Standardised	
Date of (physical) loading	Specified by economic operator	DD/MM/YYYY	Date of dispatch of physical material
Place of (physical) loading or biomethane entry point	Drop-down list – customised by economic operator	Standardised	Place of dispatch of physical material
Delivery date	Specified by user	DD/MM/YYYY	Date of delivery of physical material
Place of (physical) delivery or biomethane exit point	Drop-down list – customised by economic operator	Standardised	Place of receipt of physical material
Company-specific transaction number	Specified by economic operator	Free text comment section	Optional for economic operators to complete. Seen as useful by some economic operators to allow them to reconcile transactions in their internal company system with the database.

Transaction data	Data entry method*	Data format	Notes
Volume	Specified by economic operator (based on available volume in stock)	Numeric (3 decimal places)	Minimum volume threshold (e.g. 1 litre, or 0.001 m^3) Option to align with voluntary schemes data reporting template[39] See section below on proposed units

* Where possible we recommend that measures are implemented to help economic operators to select the right data, to save time and minimise errors in inputting data. This could include restricting drop-down lists to only the items that are relevant to the economic operator (e.g. voluntary scheme certified to), or putting frequently reported terms at the top of drop-down lists for economic operators or allowing economic operators to customise their drop-down lists for frequently used selections (e.g. for place of loading). Throughout the table we have made suggestions for where data could be auto-populated or drop-down lists could be made specific to the economic operator. This could be based on data entered at registration by the economic operator (e.g. supplier company name and address) or based on data entered by the certification body and updated at least annually after audit (e.g. voluntary scheme, fuel type). See also section 3.3.3.

We propose that the database allows some flexibility in the units that volumes of raw material and fuel can be registered in, recognising that there is unlikely to be a one-size-fits all approach across the market. A pre-condition, however, is that an agreed set of standard unit conversion factors are used in the database. Where necessary, the units in the template for voluntary scheme annual reporting to the Commission should be adapted to be in line with the final choice in the database, thereby enabling the database to directly support the voluntary schemes in their annual data reporting process.

Raw materials are typically available in either solid (e.g. wheat grain, sugar cane) or liquid form (e.g. used cooking oil, animal fat)[42]. We propose that the options available are either 'tonnes' (as applied in the voluntary schemes data reporting template) or 'litres'. A consideration could also be to include US-specific units, such as gallons, to facilitate use of the database in other key geographies (as Bioledger proposes to do).

For **liquids fuels**, we propose 'cubic metres at 15°C' (as applied in the elNa, Nabisy databases and a commonly used unit for fuel sales), 'litres at 15°C' (as in the REV and ROS databases) or 'tonnes' (as applied in the voluntary schemes data reporting template and proposed in the Trace Your Claim database).

The registered fuel volume would then be converted using a standard conversion factor from the selected unit to MJ. The energy contents of fuels (in MJ/kg and MJ/l) included in Annex of the REDII could serve as a basis. As the list is not exhaustive it would need to be further updated, and potentially the units set to 1 decimal place for greater accuracy. Fuel densities would also need to be specified (Nabisy uses values that have been provided by the German Ministry of Finance). A complication is that fuel density may change depending on 'real world' conditions which would result in potential discrepancies between what is physically shipped (i.e. in a tanker) and what is reported in the database. An alternative option is to allow the economic operator to specify the density, subject to validation by the certification body. The JRC would be well-placed to support this process.

For **gaseous fuels**, we propose 'MWh' (which is the unit for guarantees of origin specified in Article 19(2) of the REDII and applied in the REV and Vertogas databases – note that Nabisy uses kWh) or

[42] Potentially also gaseous form in the case of recycled carbon fuels (e.g. waste fossil gas from a steel mill).

'tonnes' (as applied in the voluntary schemes data reporting template and the elNA database – the ROS database applies kilograms or litres).

In addition to this core data, the database could include **Contract data**, relating to the commercial contract between a buyer and seller at each step in the supply chain, and **Evidence** that supports any of the other types of data. These types of information could be included in the database if there is demand from users and if access and confidentiality can be resolved appropriately.

During the webinar, we sought stakeholder views on the inclusion of the following data in the database:

- **Contract data:** contract number, incoterms, production specification, sustainability specification, legal terms and conditions.

- **Evidence:** delivery note, voluntary scheme certificate, waste or animal by-product trade certificate, waste or animal by-product permit, environmental permit.

There was relatively low support from webinar participants to include these data in the database, and certainly little support to mandate the inclusion of such information. Participants saw more value in enabling evidence to be included in the database than contract data. The items that had most support from stakeholders to allow for inclusion in the database were the voluntary scheme certificate, the waste or animal by-product permit, the production or sustainability specifications and, to a slightly lesser extent, delivery notes. Stakeholders generally did not support the inclusion of incoterms or legal terms and conditions in the database. One stakeholder also indicated that the inclusion of contract data would, in their opinion, unnecessarily increase the level of confidential data held in the system.

It is important to note that both contract data and supporting evidence tend to relate to a specific economic operator and do not need to "flow" down the supply chain or be entered by multiple parties. For example, a voluntary scheme certificate that relates to the certification of an economic operator could be entered once into the database by the certification body following the annual audit of an economic operator. The economic operator can then choose to share the certificate with downstream parties, thereby avoiding the need to enter the certificate multiple times into the database.

3.3.2 Identifiers

A common coding structure (identifiers) will need to be implemented in the database, both from the perspective of registering data (e.g. users, raw materials or fuels), and for transactions between buyers and sellers (e.g. database generated PoS numbers). The system of identifiers should be developed by the database developer and informed by what the database needs to operate in practice.

The identifiers will need to cover several of the core data from Table 5, as well as certain other aspects. These include *defined identifiers* that are fixed and applicable for multiple users in the database and *unique identifiers* that are system-generated following a specific action made by a user and always relate to that action. Wherever possible identifiers should use commonly accepted codes, given the global application of the Union database.

Defined identifiers will need to be assigned for example for countries, each user type (i.e. Member State, national/voluntary scheme, economic operator etc.), as well as for raw materials and fuels:

- **Countries:** The ISO 3166 international standard is widely applied, including in existing Member State databases, such as Nabisy. We recommend using the 'alpha-2' coding (e.g. AT, BE etc). The country code could be used in a number of different contexts within the

Union database, such as the country of origin of raw material, country of fuel production, place of dispatch and for user identifiers.

- **User types:** The identifier structure applied for Member States should include a reference to both the country and the relevant department/ministry/competent authority (e.g. DE-01 could imply Germany – BLE). The coding used for economic operators should identify the country of location and differentiate between economic operator types (e.g. collection point vs. fuel producer). Separate codes should be used for each legal entity.

- **Raw materials and Fuels:** One approach could be to apply the EU Combined Nomenclature (CN) system coding[43], as in the Nabisy database. An advantage of the CN system is that is consistent with EU trade statistics, provides a high degree of granularity and is already familiar to many economic operators. However, the codes are very long and (in our view unnecessarily) complex. An alternative could be to apply a more simplified coding structure, as in the Trace Your Claim database (e.g. UCO, Animal fats category I). We recommend that the choice of which nomenclature system to apply should be defined during the database development.

Nabisy uses a combination of the fuel type and the pathway to identify a biofuel type. For cultivated biomass, the Nabisy code applies the CN code and includes a specification of the feedstock. In the case of wastes and residues, the waste codes are included (see Table 6 and Table 7).

Table 6. CN fuel codes

CN code	Fuel type
1507 / 1511 / 1512 / 1514 / 1518	Vegetable oil
2207	Bioethanol
15060000	UCO
15161090	Hydrotreated oil from animal fats & oils
15162095	Hydrotreated vegetable oil
27111900	Biomethane
29051190	Biomethanol
38260010	Biodiesel / Fischer-Tropsch diesel

[43] Taxation and Customs Union. The Combined Nomenclature. Available at: https://ec.europa.eu/taxation_customs/business/calculation-customs-duties/what-is-common-customs-tariff/combined-nomenclature_en

Table 7. Nabisy biofuel code structure

Biofuel type	Production pathway	Defined Identifier
Bioethanol		2207
Bioethanol	Bioethanol made from sugar beet	2207-1
Bioethanol	Bioethanol made from wheat (process fuel not specified)	2207-2
Bioethanol	Bioethanol made from wheat (lignite as process fuel in CHP plant)	2207-3
Bioethanol	Bioethanol made from corn	2207-4
Biomethane		27111900
Biomethane	Biomethane made from waste from baked goods and confectionary production (waste flour)	27111900-020601-01

Examples of *unique identifiers* include transaction numbers, PoS numbers (if system generated[44]) and CSV/XML import numbers. The transaction number should relate to the transaction type (accepted, modified, withdrawn etc) and also the respective buyer/seller (in coded form for confidentiality). The identifier used for the PoS numbers could include details, such as the country of origin/production, raw material/fuel, voluntary scheme and a unique proof number. The coding used for amended transactions (e.g. modified transactions) or PoSs that have been aggregated or split should be based on the structure of the original number.

An important point is that the database should be set up in a way to ensure that transactions/PoSs can be traced back through the supply chain for authorised parties.

3.3.3 Data entry methods

The process of data entry should be flexible to accommodate the needs of the various database users. It should aim for a low level of administrative burden for users and it should be secure.

Manual data entry should be available for users that may only have limited interaction with the database and should be set as the default data entry option. **Mass data entry via file upload** should also be available for users that need to register multiple data, such as details of suppliers/ names and addresses or sustainability and transaction data (which may be particularly relevant if the scope of the database starts at fuel producers). Possible file formats could be CSV (as permitted in the eINa, Nabisy, ROS and Trace Your Claim databases), or XML (as permitted in the REV[45] and TRACES databases). The relevant data could be extracted from company ERP systems. CSV files have the advantage of minimal file overhead and being exact representations of data in (MS Excel) table form and greatest familiarity, whereas XML files are larger, hierarchical and enable relationships to be drawn between data. The latter of these qualities could make the transfer of data easier, but it is likely to be less familiar to many users which may hinder its adoption. It is technically feasible to allow both options, however for the purposes of simplicity we recommend standardisation such that only one type of file format is permitted.

[44] Currently certified economic operators can generate a POS number, which can be inputted into the database. Ultimately if the database becomes the POS generator then the transaction and system generated POS number could be integrated.
[45] See: https://www.emissionsauthority.nl/topics/registry---energy-for-transport/rev-login-page

Manual data entry should be based on pre-defined drop-down selections, where possible, to ensure data standardisation and minimise the risk of user error. The available options should also be dynamically generated:

- Based on the user selection (e.g. wastes or residues would require the input of GHG emission data from the process of collection);
- Specific to the certification scope (e.g. a fuel producer should not be able to register feedstock volumes, and similarly a collection point should not be able to register biofuel volumes);
- Specific to the user's account (e.g. the voluntary scheme(s) that the user is certified to, the lists of buyers/sellers available to register transactions).

Users should also be given the option to customise their drop-down selections for frequently used selections. The database could also automatically action this based on usage.

Automatic data population should also be implemented to streamline the data entry process. For example, the voluntary scheme certificate number is automatically loaded on selection, or the company address details of a buyer are automatically loaded when the buyer's name is selected. The user should also be given the option to 'save' commonly used data fields to facilitate use. Some data will be entered by the economic operator upon registration and other data could be entered by the certification body after audit. Both of these data sources should be used to make drop-down menus user-specific (e.g. restrict the list of voluntary schemes to those that are relevant) and/or to auto-populate fields. Free text input should be prevented as much as possible and ideally restricted to the one-time entry of specific company details, or comment fields.

If the mass data upload option is permitted, then user guidelines and standard templates should be made available to facilitate this process and to help to ensure data integrity.

3.3.4 Data validation

Importantly, the database should also deploy automated data validation checks to ensure that the data has been entered in the correct **format**, is **complete,** is **plausible**, and to check for any potential **erroneous** data. Any data that fails to meet the required specification or is identified as being outside of the expected boundaries, should be flagged to economic operators so they have the chance to check the data or complete missing data before saving. If the economic operator saves the data anyway, this flag could remain in the system, so it is brought to the specific attention of auditors. A combination is also possible. For example, the database could prevent economic operators saving consignments with missing data or for impossible fuel-feedstock combinations. For other validation checks, such as for very large consignments, the database could allow the economic operator to save the consignment (after flagging) and that could be flagged for the attention of auditors. The reasons for any flagging of consignments should be provided to the user (and where relevant to auditors) for transparency.

Data validation checks could include, for example:

- Ensuring that all relevant sustainability and transaction data has been entered;
- Checking that the actual value GHG data entered is within typical boundaries for the specific pathway;
- Checking that the fuel-feedstock combination is valid, and in some cases that the feedstock-country of origin combination is plausible;

- Setting a limit on the transaction volume (for example, Nabisy sets a limit of 185,000,000 MJ, equivalent to 5,000 tons of vegetable oil[46]);

- Checking that the date of issue and delivery of the transaction are within the validity period of the voluntary scheme certificate (for both seller and buyer);

- Checking that the volumes registered or traded within a period (month, year) are within specific thresholds (e.g. as specified on an environmental or waste permit); and

- Checking that the feedstock to fuel conversion factors are <1, and potentially are within more specific expected ranges defined for each conversion process.

3.3.5 Member States data specification

As proposed in section 2.1.3, our recommended set-up is that the Union database is the central database for registering all sustainable fuels that are intended to be consumed in the European Union. Volumes of fuel are then checked out of the Union database to the respective Member State (or third country) account of the Union database by the fuel supplier that places the fuel on the market.

It will likely be challenging for the Union database to meet all of the information currently requested by all Member States, and also to report information in all Member State specified formats (this would involve significant effort in transposing data into the required format and potentially the duplication of data fields in the Union database). We instead recommend that the development of the Union database is taken as an opportunity to harmonise and streamline Member State data specification (see section 3.3.1).

The key benefit of the database will be that all Member States will be able to export data in a consistent format and have confidence that the volumes registered are secure (risk of double counting or fraud has been minimised, plausibility checks have been applied), the terminology applied is consistent and follows agreed definitions (e.g. for feedstocks, fuels etc) and that all information is included to demonstrate compliance the REDII sustainability and GHG criteria.

The Union Database also provides Member States with a transparent basis on which to implement their policy decision(s) on which fuels to (double) count towards their targets, in particular by providing the following key data:

- Raw material specification (Annex IX (Part A, Part B), a 'food and feed crop', low/high ILUC-risk feedstock);

- GHG data in consistent units;

- Date production plant went into operation; and

- Whether the material received incentive/subsidy and the type of support (particularly relevant for biomethane).

It could also be explored whether fuel data could be converted from energy units (common database unit) to either volume or GHG, at the time a fuel supplier places fuel on the market to reflect the units that are applied in the particular Member State.

[46] This restriction was set due to issues with users in continental Europe inadvertently overstating the quantity in m^3 due to confusion over the comma and decimal point separator.

3.3.6 Exporting fuel data from the Union database

The Union database should enable fuel suppliers to 'check out' volumes of fuel to a Member State account of the database at the point at which fuel suppliers would currently report sustainability data to Member States. At this point, Member States will take responsibility for whether and how to count those fuel volumes towards their national targets. For example, Member States could choose to automatically accept all volumes that have been registered in the Union database, or otherwise implement a process of periodically checking (a sample of) the transactions made before accepting them. The BLE has also indicated that the Union database should allow the relevant Member State authorities to attach a 'note' to the evidences of sustainability of biofuel shipments subject to an application process for inclusion in the blending or GHG emission saving obligation[47].

Options to transfer fuel data out of the Union database into the Member State's account could include data transfer via a secure link (e.g. API), or otherwise CSV or XML data export[48]. Member States could choose which option to implement, depending on the compliance system used. For example, an API link would enable data transfer from the Union database directly to those Member States that operate databases for end-of-line compliance purposes (e.g. Ireland, The Netherlands). A CSV/XML data export would perhaps be more appropriate for (the majority of) Member States that do not have an operational database. The file export would then serve as the primary means of reporting to the European Commission for these Member States.

It is likely that not all fuels registered in the Union database will ultimately be consumed within the European Union, in the same way that not all fuels registered in Nabisy are consumed in Germany[49]. These fuels may instead be placed on the market in third countries (e.g. EFTA countries, USA or UK, noting that some of these countries may also implement the REDII sustainability criteria and would therefore find value in the full data specification), or otherwise used to serve other purposes (including potentially to facilitate compliance under CORSIA[50]). It is recommended that such transfers are implemented by allowing third countries to set up an account, which would be similar to a Member State account but with less functionality (i.e. no monitoring rights).

Once a fuel volume has been transferred out of the fuel supplier's account then it is no longer possible to trade that same quantity of fuel within the database (i.e. it is retired in the database). This ensures that double claiming is prevented.

3.3.7 Exporting/retiring data for material not used for biofuels

As indicated in section 2.1.1, it is feasible that agricultural producers *may* choose to register their material in the Union database on a voluntary basis to provide the optionality to trade material into the biofuels market. If the material is instead sold on to an alternative market (e.g. food or feed) then there should be a mechanism to allow the producer to either export the data out of the Union database to another database (if such a database exists), or otherwise retire the material from the Union database to prevent the build-up of data in the Union database.

This issue is especially relevant if the scope of the Union database starts at the point of origin or first gathering point.

[47] BLE, EU database: thoughts and exchange on requirements to the functionality of a common database from the perspective of regulatory institutions, REFUREC workshop, April 2019.

[48] Data transfer between the Nabisy and elNa databases is achieved through data exchange using CSV file export.

[49] Federal Office for Food and Agriculture, Evaluation and Progress Report 2018, Biomass Energy Sustainability Ordinance Biofuel Sustainability Ordinance, section 8. Available at: https://www.ble.de/SharedDocs/Downloads/EN/Climate-Energy/EvaluationAndProgressReports2018.pdf;jsessionid=80271AB9EDC43F802AB269580FDDA9B7.2_cid335?__blob=publicationFile&v=2

[50] Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). See: https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx

3.3.8 Reporting requirements and analytics

Under the REDII, Member States are required to monitor the use of fuels towards their renewable energy and renewable transport targets, and also to check the accuracy of the information that is registered in the Union database by economic operators (for example under Article 28(4)). Sometimes one government department is involved and in other cases different departments and agencies have different roles and interests – for example there may be a ministry that sets the policy direction and is responsible for target achievement, an agency that acts as the regulator and a tax authority who is often responsible for reconciling fuel volumes. Both are likely to ensure tax is levied on all fuels (fossil and biofuel) placed on the market. The different departments will have different needs and may require different access rights to the database.

The Union database therefore has to fulfil several requirements to support **Member States**, including:

- Providing access to all relevant Member State authorities (i.e. via a Member State account);
- Enabling relevant authorities to track all fuel placed on the market for target fulfilment;
- Providing downloadable account statements at any time.

The **voluntary schemes** also have a responsibility for monitoring the economic operations that are certified to their scheme. **Certification bodies/auditors** will also need to check an economic operators' data as part of the audit process.

The Union database could greatly facilitate this process by providing user friendly reporting tools/analytics. These should be set up in a flexible way to allow customisation of data requests, within set boundary conditions. Data access rights are covered further in section 3.4.1 and 3.4.2.

Reporting functionality should also be provided for the **economic operators** that will be using the database. For example, on historical transactions made and the volumes of stock held in account.

The Bioledger database proposes to provide advanced reporting/analytics functionality for Member State regulators and auditors to drill down into the global mass balance (so called 'God's Eye View'). A selection of 'mock-up' reports are provided in Appendix A.

3.4 System architecture – detailed specification

3.4.1 Data privacy

Data privacy is important, and the Commission will need to set out data privacy policy that all users will need to agree to. As a minimum, this should consider following the 'Privacy by design' principle.

'Normal' data privacy includes incorporating data privacy in the general terms and conditions of the database that users will need to agree to upon registration. The 'Privacy by design' principle, which stresses the embedding of privacy into all aspects of technical design, necessitates that the privacy policy should be clearly visible in the terms of service and written in language that is understandable by the general public. User-centricity is key to privacy by design so that users may easily navigate the vital information related to the collection and use of their data.

This policy should first and foremost provide the user with information about the data which is being collected:

- What data is being collected;
- Who is collecting that data and who has access to it;

- When, why and how that data is being collected; and
- How that data is processed and how long that data is stored.

Following this, the policy should explicitly list the user's rights with regards to their data and where those rights come from, whether from GDPR or other relevant legislation, as Nabisy's privacy policy[51] does. Building on this, the policy should include clear instructions on how the user may verify, modify or delete their own information, as TRACES does in their policy[52].

The next step in the privacy policy in the terms of service should be to transparently specify the actors involved in the handling of user data: first, the responsible service provider who collects, stores, and uses the data; second, the relevant supervisory authority on data protection to whom users may direct complaints if they believe that the service provider has infringed on their rights specified earlier in the policy. The policy should provide the contact information for both parties. Lastly, all third parties to which the service provider may provide information according to existing regulations, for instance, the Ministry of Finance in Nabisy's case, should be listed in detail, along with specifics regarding what data may be shared and with whom.

On a more technical aspect, a database which uses a web interface will need to use cookies. In this case the privacy policy should explicitly indicate to the user that cookies are used. We propose that the policy also explains what cookies are as well as how to deactivate cookie storage. In addition to this, Trace Your Claim provides a warning of any malfunctions which may be encountered in the interface should cookies be deactivated with the instructions provided[53], an approach which we also recommend. Another best practice found in Nabisy's privacy policy is the indication of what specific technology or software is used in data collection and a confirmation that they meet the requirements of data protection. Finally, the privacy policy in the terms of service should clearly explain how the user's data is protected, whether through the technical aspects of encryption, firewalls or through access policies.

'Advanced' data privacy takes on a more technical approach and may include differentiated viewing rights between companies which blocks all but certain other companies from accessing sensitive data. These and other restricted sharing capabilities further the 'Privacy by design' principles, which by definition also call for policies enforcing the minimisation of data collection and retention; only data that is necessary for database function should be collected, and these data should be kept only as long as is necessary. This minimisation has the added benefit of lowering the database's security risk profile, as the less data is stored, the less damaging a potential data breach would be. It should be noted that some data are more necessary to retain than others, which should be reflected in the amount of time given data are retained. For example, we differentiate between personal data, such as username and password, and other data which cannot be related to an individual. On an aggregate level it will be more useful to retain the latter of these data for longer than personal data is kept, as this is the data that the Member States will need to monitor.

Additional advanced data privacy technical features include explicit opt-in for all processes which will collect user data in any form, whether personal or otherwise. GDPR already provides explicit and robust practices[54] for such opt-in processes and we suggest that the database apply this to all appropriate areas of database usage. Safeguards for the protection of user data such as end-to-end encryption (meaning that data are encrypted such that only the unique recipient may decrypt them, and not anyone in between) are also vital for data privacy, and these security measures are further covered in section 3.4.3. More relevant to data privacy is the enabling of policies to ensure full life cycle protection of user data, which necessitates that data is fully secure during its inception and wholly destroyed at the end of its lifecycle. This feeds back into the idea of defining a clear timeframe during which it is appropriate to retain certain data and ensuring that the data is properly deleted once

[51] Privacy Policy for Nabisy. Available at: https://www.ble.de/SharedDocs/Downloads/EN/Climate-Energy/Information-Nabisy/Nabisy_Privacy-policy.pdf?__blob=publicationFile&v=2

[52] TRACES Privacy statement. Available at: https://webgate.ec.europa.eu/tracesnt/privacy-statement

[53] Trace Your Claim Privacy policy. Available at: https://www.trace-your-claim.com/legal/privacy-policy/

[54] GDPR Consent Requirements. Available at: https://gdpr.eu/gdpr-consent-requirements/

that time limit has expired. In this respect, TRACES stores data for up to 10 years.

Box 2. Data privacy Terms and Conditions best practices

- Be **user-centric:** this entails being clearly visible and accessible in Terms & Conditions and written in simple language.
- **Data:** define **what** data are collected, **who** collects and accesses data, **when** data are collected, **why** they are collected, **how** they are collected and processed and for **how long** they are stored.
- Explicitly define **user's rights** and show where they come from.
- Provide **user instructions** on how to verify, modify, or delete own information.
- Define **responsible service provider** and provide contact info.
- Provide user with the contact information of their relevant **supervisory authority** on data protection.
- If **cookies** are used, explain what they are, indicate that they are used, provide instructions on how to deactivate them and provide a warning of any possible malfunctions which may result from deactivation of cookies.
- Explain how data is **protected.**
- Explicitly list **third parties** which may receive information according to existing regulations and what data would be shared with those parties.

3.4.2 Data access and governance

The Union database will store very valuable commercially sensitive supply chain data, such as counterparty information of buyers and sellers and the volumes traded. This data needs to be protected and kept private to ensure that no commercial advantage is given to other economic operators. A fundamental consideration is therefore to decide which stakeholders can access the data stored in the Union database, and on what basis. Data access should be based on a defined need, and not solely out of interest. It is imperative that this is comprehensively addressed in the set-up of the database to give economic operators the confidence to use the database as intended.

The **European Commission** (e.g. DG ENER or OLAF[55]), being the ultimate owner of the data held in the Union database, should be able to access the data as required. This should be strictly limited to support monitoring of the economic operators/supply chains if evidence has been provided on possible wrongdoing or fraudulent activity. The relevant economic operators should always be informed in advance if commercial data will be accessed, and formally approve any request. The European Commission should, of course, have free access to data if it is to be used for statistical purposes provided that it is in an aggregated and anonymised format.

Article 28(4) of the REDII states that "**Member States** shall have access to Union database", and furthermore requires "they shall take measures to ensure that economic operators enter accurate information into the […] database". Article 30(3) furthermore requires that "Member States shall take measures to ensure that economic operators submit reliable information regarding the compliance with the […] sustainability and GHG emissions saving criteria laid down in Article 29(2) to (7) and (10), and that economic operators make available to the relevant Member State, upon request, the data that were used to develop the information". It is therefore clear that Member States will need to be granted access to data held in the database.

A concern expressed by a participant at the webinar was that if too many Member State representatives have access to the supply chain data, and if the access is "open", then there is a risk of data leaks. It was therefore proposed that access rights should be time limited and on an agreed basis, to be discussed in advance with the owner(s) of the data. In our view, this approach is both fair and transparent. Should an economic operator refuse to provide details to a Member State following a valid request then this could potentially result in the suspension of the operator.

[55] European Anti-Fraud Office (OLAF). See: https://ec.europa.eu/anti-fraud/home_en

The **voluntary schemes** should be granted access to the data on a limited basis, strictly to assist in the monitoring of the performance of certification bodies as part of their internal monitoring process. Only data relating to economic operations that are certified to the scheme should be available for access. Again, the relevant parties should be notified in advance of any data access request, and formally approve any request within the database. In addition, the database could support schemes in preparing the annual market data report. This would help to ensure that the data reported by the schemes is on a consistent basis and of a high quality.

The Union database could serve as a very useful resource to support **certification bodies/auditors** in performing audits of economic operators. The access would be granted to assist auditors in preparing for audits and also during the audit process, rather than in the day-to-day monitoring of economic operators (and clearly only be available for clients). An exception is if an alert is triggered by an irregular transaction (as discussion in section 3.3.7). Data confidentiality is already addressed through non-disclosure agreements that are signed between the certification body and the economic operator, and so less of a concern compared to Member States. Nonetheless, we again propose that economic operators officially grant access to the data via a data request.

Economic operators should have full access to their data as required. This includes, for example supplier/buyer information, stock information, transaction history and PoS data.

Finally, in the interest of transparency and the principle of 'Open data'[56], we propose that aggregated data on raw materials and fuels registered in the Union Database is available to the **general public**. The data could be published on a regular basis (at least annually) by the European Commission.

Table 8 below summarises our proposed recommendation on data access.

Table 8. Data access by stakeholder group

Stakeholder group	Data type	Access basis
European Commission	Aggregated data on feedstocks and fuels	On demand
	Supply chain data to support monitoring	On request – access granted by economic operator
Member States	Fuel data that has been placed on the market by fuel suppliers	On demand
	Supply chain data to support monitoring	On request – access granted by economic operator
Voluntary schemes	Aggregated data on feedstocks and fuels to support annual data reporting process	On demand
	Supply chain data to support internal monitoring	On request – access granted by economic operator
Certification bodies/ Auditors	Data relevant to the audit of an economic operator	On request – access granted by economic operator
Economic operators	Access to own data (e.g. supplier/buyer information, stock information, transaction history, PoS summary)	On demand
General public	Aggregated data on feedstocks and fuels placed on the market	Published by European Commission

[56] EU Open Data Portal. See: https://data.europa.eu/euodp/en/home

With respect to governance, we recommend that the European Commission serves as the primary oversight body of the Union database, irrespective of which entity is operating the Union database. This could be established through a governance board, with potential representation from external stakeholders that are also independent of the Member States and industry.

A view expressed at the webinar was that there should also be a role for other stakeholders (e.g. Member States, voluntary schemes, industry) to provide technical expertise to support the on-going operation of the database, in particular if a shared funding model is applied for the ongoing operation of the database. This could be implemented through the proposed technical working group, which we suggest continues in some capacity beyond the database development (see section 3.1.1).

3.4.3 System security measures

The database can implement 'advanced' or 'normal' security measures to protect the database. Normal security includes the authentication of newly registered users by the database owners, single-factor authentication and firewalls. We recommend going further and taking additional measures with user **education, access and registration** and **technical database features.**

Users are the first line of defence in protecting a system against unauthorised access. For this reason, we recommend that all new registrants of the Union database are provided with comprehensive cybersecurity documentation informing them of various general measures to protect unauthorised access into the system, such as creating strong passwords and learning how to verify digital email signatures and web URLs to protect against phishing attacks, as NEa does. One possible extra option is to require all new users to follow a mandatory training before they can use the application, as elNa does.

Regarding access and registration, we recommend observing the 'Security by design' principle of **establishing secure defaults**: a user's access to resources and permissions must limited by default unless explicitly granted by an administrator. This entails several measures, starting with strong security rules for how user registrations are handled. The 'know-you-customer' policy, through which the responsible entity comprehensively verifies the identity of each new registrant, falls squarely in this category. Registrants signing up for the first time should need to specify their user role and company details, and as in elNa, the registration process should be supervised by Union database administrators. Login credentials should only be provided if the registration data is accepted. Establishing secure defaults also deals with password requirements, namely deciding how often they must be updated and how complex they should be. We recommend that passwords have strict requirements such as a minimum character length, use of uppercase and lowercase letters, use of numbers, use of symbols, etc, and should be mandated to change at least once every 90 days.

Security measures regarding access to the database should follow the 'Security by design' **principle of minimising attack surface area**, by which users are restricted from accessing any features or areas other than those which they need to complete their tasks. As such, within the database, we recommend that a given user may only be able to see detailed information about transactions in which they were directly involved. They should not be able to access areas of the database incompatible with their user type or level of permissions. Access to a user's account should be limited only to the user and to auditors.

Some external parties will inevitably need access to the database. We recommend that the Union database terms of service include specific designations about which entities other than users are allowed access to the database, taking care to ensure that access is given only to those entities which require it. For instance, we expect that competent authorities of Member States, certification bodies and auditors are likely candidates for requiring access to the Union database. The European Commission should have access to the whole database.

Technical security measures begin with encryption. Given the web interface required, we recommend the use of https encryption, and SSL encryption[57] for data hosted on the servers. For transfers of data between the Union database and any Member State databases, we recommend secure data transfer through a VPN tunnel. This consists of two endpoints (the Union database and the Member State database), each with their own firewall which has been configured to directly speak to each other through a private encrypted channel. It is usually the safest option for data transfer and is easiest for one-way transfer of data. Even higher security could be achieved with the use of data encryption at rest, meaning that data is only decrypted when it is read. However, this option puts lots of latency in read and write operations, so it's a trade-off of security and speed.

In the scope of technical security measures, we recommend following the 'Security by design' principle of **failing securely**, by which we mean that a failure should not give the user additional privileges, nor it should not show the user sensitive information. For instance, if a username and password combination attempt is incorrect, the error message should not specify which of the two is incorrect. Lack of activity should flag the possibility that a user has left their session open unattended, and for this reason we also recommend implementing an automatic session timeout if there has been no activity for 30 minutes, as in the ROS database.

Backups and redundancy are essential components in data security. We recommend that the database is configured to regularly back up its data to at least one other back-up server which should be stored in a different physical location than the production server. This protects the data against physical damage to the site of the server.

From a procedural angle, we also recommend that the responsible body behind the database undertakes security audits on its platform. Specifically, we recommend that the responsible body behind both development and maintenance of the database adheres to the ISO 27000 series of cybersecurity standards. Of these, it is possible to achieve an audited certification with the ISO 27001[58] standard, which would allow the developers and maintainers of the database to communicate the database's degree of security standards to stakeholders in an internationally accepted vocabulary. Continued adherence to these constantly evolving security standards would further ensure that the database and those maintaining it are always staying afloat of best practices in the rapidly changing world of cybersecurity. For greater security we also recommend that the database's development environment be split into separate development, testing, accepting and production servers, as is the case with RSPO PalmTrace.

3.4.4 Login authentication functionalities

The login screen is the primary point of entry into the database for virtually all users and thus must be configured with an appropriate amount of security following the 'Security by design' principle of **defence in depth**, which states that multiple security controls make attacks less successful due to layers of authorisation verifications. We recommend a multi-factor authentication login, as implemented in the TRACES database. For added flexibility, it is possible to give users various options to perform this authentication (such as password and SMS code), but for simplicity we recommend that if such options are given that no more than three are allowed, and that all options are at least two-step authentication. Passwords should be 'strong' and should be mandated to change every 90 days.

We recommend the use of additional security and logging tools. For protection against unauthorised entry initiated by automated programs, a Captcha system would ensure that the user was human. Furthermore, logging a user's login attempts and detecting any potential 'hacking' attempts. We recommend that such information be logged, and that users are only allowed a limited number of

[57] Hypertext Transfer Protocol Secure (HTTPS) is an extension of the Hypertext Transfer Protocol (HTTP), which is the primary protocol used to send data between a web browser and a website. In HTTPS, the communication protocol is encrypted using Transport Layer Security or, formerly, Secure Sockets Layer (SSL), which is a standard security technology for establishing an encrypted link between a server and a client, typically a web server (website) and a browser, or a mail server and a mail client.
[58] ISO 27001, Information Security Management. Available at: https://www.iso.org/isoiec-27001-information-security.html

failed login attempts before they are locked out of their profile and are required to reach out to support.

Since thousands of industry participants will be using the Union database, we recommend a web interface. Regarding authentication, the most secure options include configuring the front end of the web application to allow only whitelisted IP addresses, such as those from a company's VPN. This limits the number of people who can access the web interface and provides security since an external IP address within a network cannot be manipulated. It is undoubtedly more secure to only whitelist IPs from a company than allowing everyone access to the site, but the implication of this option is that companies without VPNs or fixed external IPs will not be able to access the database without re-registering every time they use the database. A possible workaround to this could be to not limit a given user to using only one IP address, and instead creating a system in which the user is sent an email when their account details have logged in using a different IP number than it used in the previous session. The system could be configured such that if more than five different IP numbers are logged for a single user account, it could block that user's access for a day and notify the database administrators.

Due to the large number of potential users we also recommend the use of active directory authentication. This method of authentication will permit administrators to more easily manage the users on the database, grant access, modify, add, and delete data as needed. Lastly, as discussed in section 3.2.1, we recommend that the database employ comprehensive 'know-your-customer' policies aimed at verifying the identification of every new registrant to the database before approving applications and providing user login credentials.

3.4.5 Differentiated database access rights (to ensure data security)

To enact the security measure of differentiated access rights, we recommend observing the 'security-by-design' principle of **least privilege**, which states that a given user should only have the minimum set of privileges allowed to perform a specific task. This necessitates defining specific user types and their corresponding privileges and ensuring that it is not possible for a user to do anything outside of what their user type allows them to do. This will also encompass differences in access rights among organisations: certain user types should not be available to all organisations, as implemented by Trace Your Claim. For instance, a trader should not have any options to convert feedstock to biofuel; that would capability would be strictly be reserved for a biofuel producer. Any exceptions should be dealt with by database administrators on a case-by-case basis.

Should an organisation have multiple users, we recommend that the database be configured such that each organisation has one or two primary users, with all other users in the same organisation configured as secondary users, as RSPO PalmTrace does. A primary user should have the rights to adjust the user rights of all registered secondary users within their organisation and manage the information and usability of those accounts. Thus, secondary users will only be able to perform activities for which they have been given access by the primary user. Any changes to the settings of the account must be performed by a primary user.

Furthermore, we recommend abiding by the 'security-by-design' principle of **separation of duties**, which stipulates that individuals must have distinctly different roles within the database to prevent fraudulent activities. This goes beyond primary and secondary users on the front end to also include administrators on the back end. For instance, it should not be possible for registered users to be promoted to administrators and gain access to their privileges, nor should administrators ever be able to use the database's front-end functionalities as a registered user and use the database to register volumes of biofuel.

3.4.6 Supporting languages

It is recommended that as a default the user interface of the database is available in English and the official languages of the Member States. Given that the Union database will have global application,

consideration should also be given to extending the scope to include languages relevant to the main countries which export feedstock and/ or fuel to the EU. In this regard, it should be noted that TRACES is available in 34 languages.

3.5 Set-up and Operation of the Union database summary

Category and Activity	Recommendation
Database set-up	
Database development process	Five activities will be critical to the development of the database: Database development and Beta Testing, Registration, Launch and Phase-in, Outreach and Education and Technical Support. We recommend setting up a technical working group (with broad representation) to support the database development and to retain the group for a period after launch (e.g. 12 months) A phase-in process of up to 12 months is seen as optimal.
Cost and financing of the set-up and ongoing operation of the database	We estimate that the Union database will cost a minimum of €500,000 to develop. The European Commission is seen as the party to fund the set-up of the database, and also the party to support funding of the on-going operation (with potential contribution by industry on a transaction basis).
Processes	
Validation process for registering new users	Differentiated approach to registering and validating different user types, to reflect the 'status' of the user type, the number of users that will need to be registered per user type, the practicality of validating these requests and importantly the voluntary scheme certification process.
Registering raw material and fuel volumes	Raw material volumes will need to be registered by a first gathering point or collection point (or by farms/plantations if they are individually certified). Fuel volumes can only be registered by a fuel producer and must be based on available raw material volumes held in stock.
Registering transactions	The Union database will need to implement a process for registering transactions between a 'seller' and 'buyer' along the supply chain. Proposed options are to *register, accept or decline* a transaction.
Accounting for unintentional mistakes	The Union database should provide options for correcting unintentional mistakes, on the basis that this process is managed in a robust and transparent way. Proposed options are to *modify, reverse or withdraw* a transaction, depending on the status of the transaction.
Accounting for irregularities identified by auditors	In the event that fraud is suspected or identified, then the economic operator's account should be immediately suspended, and subject to further investigation by the auditor and (where relevant) Member State. During this time the economic operator should be unable to undertake any further actions in the database. Any open transactions should also be blocked. We recommend a number of options for how to treat downstream trades. For example, to block/freeze/invalidate all related downstream trades; or to "Red flag" all downstream trades (but allow them to continue to be traded, so it enables identification of those consignments) – these trades should be marked as non-REDII compliant unless/until evidence can be provided to the contrary.

Category and Activity	Recommendation
Operation of the mass balance system	The Union database will need to facilitate economic operators to follow the rules of the mass balance chain of custody system, in line with the rules in Article 30(1) and a forthcoming Implementing Act on voluntary schemes. The database should only allow material with associated sustainability characteristics that is on an economic operator's account to be allocated to the next party down the chain (i.e. that it should not be possible to "go short" in the database).
Interaction with voluntary and national schemes' certification process	We see the Union database playing an entirely complementary role with the existing voluntary and national schemes certification process. A major benefit of the database will be to streamline and improve the robustness of the audit process. In time, the Union database has the capacity to become the central hub for the REDII sustainability system. For example, to cover the validation process for registration new scheme users and for schemes to publish lists of certification bodies and economic operators and their certificate status.
Data	
Data specification and units	The data mandated to be in the database should be kept to the core information required to demonstrate compliance. This aims to minimise administrative burden and helps the database to operate as smoothly and quickly as possible, avoiding that transactions take a prohibitively large amount of time to process. Core information includes: 'sustainability data' needed to demonstrate compliance with the REDII that will need to flow all the way through the supply chain in the database, and 'transaction data' that relates to the transfer of a specific consignment between a buyer and seller at each step in the supply chain. Ideally the Union database would generate the PoS and this would eventually replace the PoS from voluntary schemes. We propose that the database allows some flexibility in the units that volumes of raw material and fuel can be registered in, recognising that there is unlikely to be a one-size-fits all approach across the market. A pre-condition, however, is that an agreed set of standard unit conversion factors are used in the database.
Identifiers	A common coding structure (identifiers) will need to be implemented in the database, both from the perspective of *registering* data (e.g. users, raw materials or fuels), and for *transactions* between buyers and sellers (e.g. database generated PoS numbers). The system of identifiers should be developed by the database developer and informed by what the database needs to operate in practice.
Data entry methods	The process of data entry should be flexible to accommodate the needs of the various database users. It should aim for a low level of administrative burden for users and it should be secure. Options should include 'manual data entry' and 'mass data entry via upload' (e.g. CSV or XML). Manual data entry should be based on pre-defined drop-down selections, where possible, to ensure data standardisation and minimise the risk of user error. Automatic data population should also be implemented to streamline the data entry process. If the mass data upload option is permitted, then user guidelines and standard templates should be made available to facilitate this process and to help to ensure data integrity.

Category and Activity	Recommendation
Data validation	The database should deploy automated data validation checks to ensure that the data has been entered in the *correct format, is complete, is plausible,* and to check for any potential erroneous data.
Member States data specification	We recommend that the development of the Union database is taken as an opportunity to harmonise and streamline Member State data specification.
Exporting fuel data from the Union database	The Union database should enable fuel suppliers to 'check out' volumes of fuel to a Member State account of the database at the point at which fuel suppliers would currently report sustainability data to Member States. At this point, Member States will take responsibility for whether and how to count those fuel volumes towards their national targets. Fuel data should be transferred out of the Union database into the Member State's account. Options could include data transfer via a secure link (e.g. API), or otherwise CSV or XML data export. Alternatively, fuel suppliers should also be able to 'check out' volumes of fuel to a third country.
Exporting/retiring data for material not used for biofuels	Set up a mechanism to allow an agricultural producer to either export data out of the Union database to another database if the material is sold on to an alternative market (e.g. food or feed), or otherwise retire the material from the database to prevent the build-up of data in the Union database.
Reporting requirements and analytics	The Union database should facilitate Member States and the voluntary schemes in their monitoring duties, through user friendly reporting tools/analytics. Reporting functionality should also be provided for the economic operators that will be using the database.
System architecture – detailed specification	
Data privacy	As a minimum, this should consider following the 'Privacy by design' principle.
Data access and governance	The Union database will store very valuable commercially sensitive supply chain data, such as counterparty information of buyers and sellers and the volumes traded. This data needs to be protected and kept private to ensure that no commercial advantage is given to other economic operators. Data access should be based on a defined need, and not solely out of interest. A differentiated approach is recommended to reflect the specific needs of each stakeholder group. It is imperative that this aspect is comprehensively addressed in the set-up of the database to give economic operators the confidence to use the database as intended.
System security measures	As a minimum, this should consider following the 'Security by design' principle. Adherence to ISO 27000 series of cybersecurity standards.
Login authentication functionalities	We recommend a multi-factor authentication login, strong passwords, use of Captcha system, linking a user's account with an IP address and active directory authentication. 'Know-your-customer' registration policies could also be implemented.
Differentiated database access rights (to ensure data security)	It is recommended to observe the 'security-by-design' principles of least privilege and separation of duties.
Supporting languages	It is recommended that as a default the user interface of the database is available in English and the official languages of the Member States.

Appendix A. REPORTING ANALYTICS

Figure 8. Bioledger 'auditor dashboard' mock-up 1

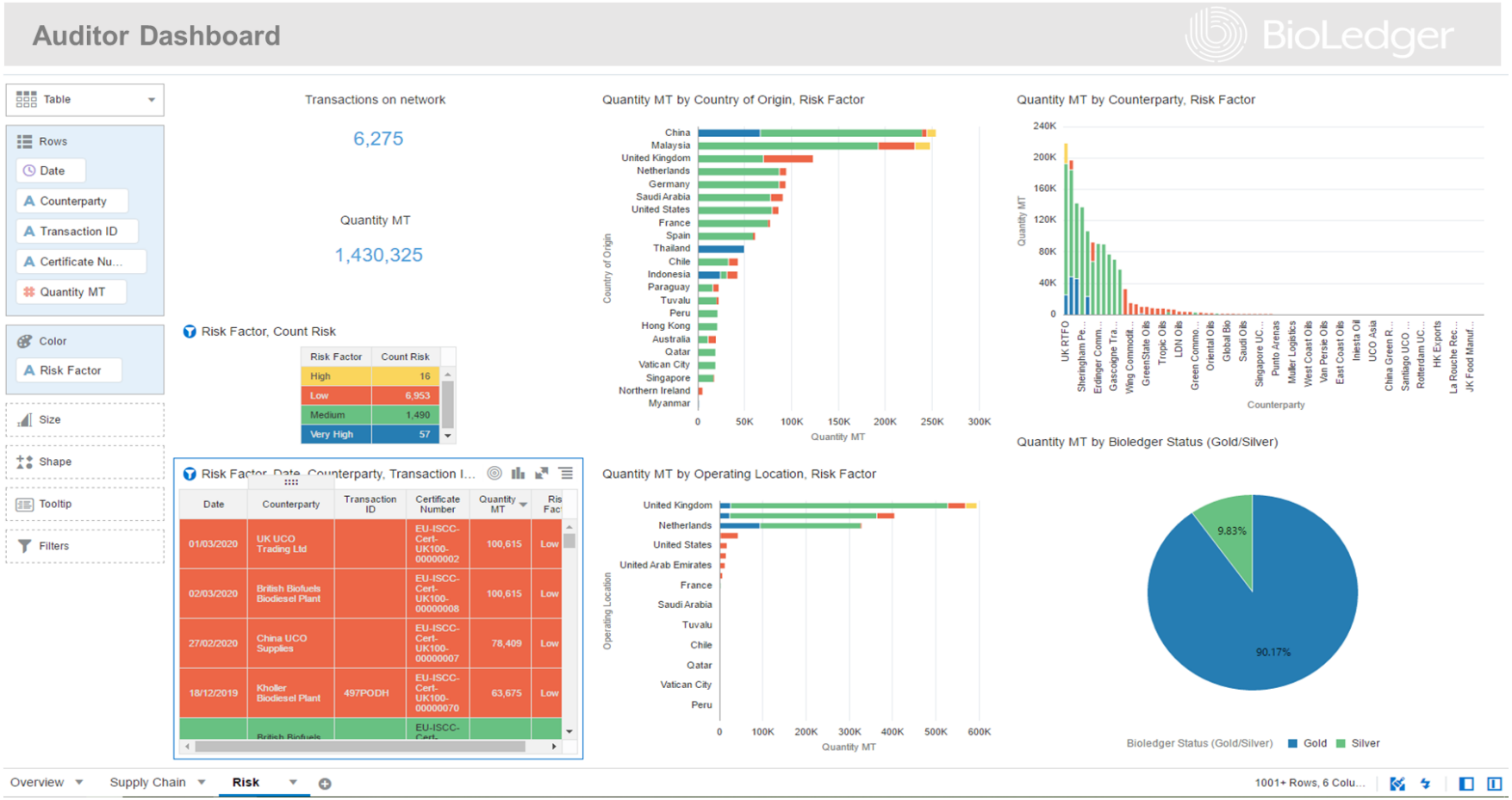
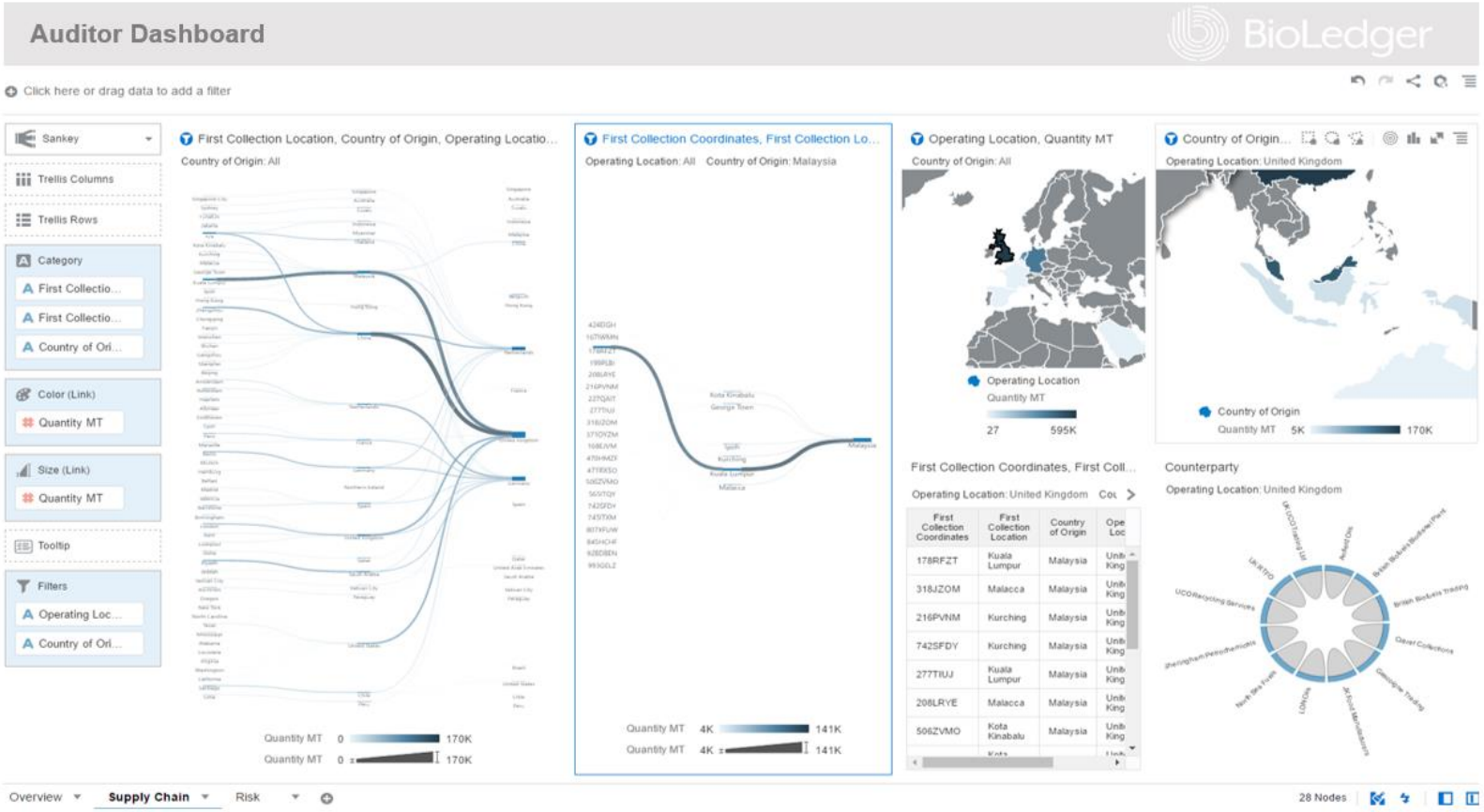


Figure 9. Bioledger 'auditor dashboard' mock-up 2



NAVIGANT
A Guidehouse Company

Scoping study setting technical requirements and options for a Union Database for tracing liquid and gaseous transport fuels

MJ-01-20-530-EN-N

ISBN: 978-92-76-21417-5
Doi: 10.2833/91335

Publications Office
of the European Union