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Governance for a Sustainable Hydrogen Economy

Lessons from Bioenergy in the EU

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Executive Summary

This study **analyses the EU's legal regime and its application for bioenergy sustainability criteria and certification processes in order to generate lessons for the case of renewable hydrogen**. Both types of products are not identical, as, for instance, the certification of bioenergy products requires a different chain-of-custody method than the certification of renewable electricity as a starting point for hydrogen production. However, there are also important parallels and common challenges. In particular, the lessons learned on the procedural issues for the certification of bioenergy are relevant for the emerging certification schemes for renewable hydrogen.

Section 2 presents the sustainability criteria for bioenergy as set out by the EU Renewable Energy Directive (RED III) as well as the provisions of the certification process. It shows that sustainability criteria are already detailed in EU law, for example related to GHG emissions, deforestation, and associated with that, potential biodiversity loss. However, various other environmental aspects (e.g. water consumption in water-scarce areas) as well as social aspects are not part of the binding set of criteria. This has been criticized by scholars who see the need for expanding the scope of the criteria.

Section 3 presents lessons learned from the implementation of the EU sustainability criteria and certification schemes for bioenergy. It uses a variety of academic sources and official reports to identify and analyse the issues that emerged over nearly 15 years of implementation, including but not limited to cases of exploiting loopholes and fraud that have undermined the credibility of the certification system. It identifies challenges in three areas: i.) limitations in the Commission's recognition procedure for certification schemes, such as the lack of governance requirements; ii.) challenges with oversight of recognised certification schemes by the EC and Member States; iii.) challenges related to the design of certification schemes and their interoperability. A key weakness is that certification schemes with differing levels of ambition and scope are required to mutually recognize certificates along the supply chain, which may lead to misleading claims. Specifically, final products that receive certification from a scheme with higher levels of ambition may contain inputs from earlier stages in the supply chain that have been certified by schemes with lower levels of ambition.

TABLE: CHALLENGES WITH THE IMPLEMENTATION OF THE EU CERTIFICATION SYSTEM FOR BIOENERGY

Category	Aspects
Limitations in the Commission's recognition procedure for certification (see 3.3.1)	• EU recognition procedure lacks robustness • EU recognition procedure lacks governance requirements
Challenges with oversight of recognised certification schemes by the EC and Member States (see 3.3.2)	• Insufficient oversight by EC and Member States over recognised schemes • Challenges in detecting violations due to insufficient reporting by Member States • Poor transparency and coordination (among schemes, Member States, and the EC) allow infringements and forum shopping
Challenges with the design and interoperability of certification schemes (see 3.3.3)	• Lack of harmonised definitions and comparable data • Fraud-prone system with limited sanctions • Mutual recognition lets weak schemes enable misleading claims

Source: Author.

To confront many of these challenges, the Commission has developed the Commission Implementing Regulation (EU) 2022/996, which sets out new rules for verifying sustainability criteria and GHG emissions-related criteria for both biofuels and renewable fuels of non-biological origin (RFNBOs). Among other aspects, such schemes must now incorporate inclusive governance structures, representing a wide range of stakeholders—such as farmers' and foresters' associations, environmental NGOs, local communities, academia, and fuel producers. The regulation also clarifies the interoperability of certification schemes within the supply chain. If a segment of the supply chain relies on a different voluntary scheme, it must be officially recognized by the European Commission and used strictly within its approved scope. This does not, however, eliminate the problem of mutual recognition across schemes with differing levels of ambition. To improve transparency and traceability, the regulation requires industry and certification holders to use the so-called Union database, which tracks the sustainability characteristics and GHG emissions performance of liquid and gaseous fuels across the entire supply chain - from the initial feedstock collection point to final consumption, including data on the feedstock's origin.

Section 4 provides a legal interpretation of the sustainability criteria applicable to renewable hydrogen (i.e. RFNBOs) in the EU and discusses to what extent the certification systems inherited from bioenergy would apply to renewable hydrogen and its derivatives. It is clear that the rules governing the recognition and oversight of certification systems are the same for biofuels and RFNBOs, including the rules stipulated in the implementing regulation CIR 2022/996. A degree of uncertainty remains with regard to the applicability of additional criteria related to land-use change and deforestation that go beyond the basic GHG emissions savings criteria. It is likely - though not entirely certain - that these additional criteria do not apply to RFNBOs. An exception would be renewable hydrogen derivatives that utilize biogenic sources of CO2 from biomass. Such derivatives would require certification of the biomass in alignment with the rules for bioenergy.

The final section presents the main lessons learned from bioenergy for promoting robust sustainability governance in the hydrogen sector and formulates a number of policy recommendations. Firstly, it highlights the importance of broadening the set of sustainability requirements for renewable hydrogen to include additional environmental, social, and governance criteria, noting that a range of stakeholders, including those from the business sector, support such requirements. Secondly, the section calls for a number of measures to strengthen the governance and oversight of certification systems. It calls for more transparency regarding the exact type of certifications applied at different stages of the value chain. It also suggests increased transparency in the Commission's procedures for recognizing certification systems and more rigorous oversight mechanisms to prevent fraud. In addition, the report suggests the importance of utilizing existing oversight powers to ensure the functioning of mandatory complaint mechanisms, which have been introduced with CIR 2022/996. Finally, it points out the importance of an increased harmonization of definitions and methodologies. The bioenergy sector has shown that the lack of harmonised approaches hampers transparency and reporting and may undermine the credibility of the sector.

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1 Introduction

The introduction and strengthening of sustainability criteria and certification procedures for bioenergy production and imports in EU law is a process that has already been underway for over 15 years. Sustainability criteria were first introduced in 2009 (Directive 2009/28/EC), amended in 2015 (Directive 2015/1513/EC), and strengthened in 2018 (Directive 2018/2001/EC) and 2023 (Directive 2023/2413/EC). This legal evolution has been the result of the pressure from European bioenergy producers who have cited the need to address unfair competition from outside the EU, as well as NGOs denouncing harmful environmental and social practices related to (first generation) bioenergy, in particularly (but not exclusively) with regard to deforestation.

As hydrogen production from renewable sources has become a major focus of the EU's energy policy over the past years, with ambitions to reach up to 10 million tonnes of domestic production and 10 million tonnes of imports by 2030 (EC, 2022), this also raises questions of sustainability. While the central question pertains to the total greenhouse gas (GHG) emissions caused by the renewable hydrogen production chain, other sustainability issues are also pressing, such as with regard to water consumption in areas of water scarcity or the social impacts on populations in producing regions.

This study analyses the EU's legal regime and its application for bioenergy sustainability criteria and certification processes in order to generate lessons for the case of renewable hydrogen. Both types of products are not identical, as, for instance, the certification of bioenergy products requires a different chain-of-custody method than the certification of renewable electricity as a starting point for hydrogen production. However, there are also important parallels and common challenges. In particular, the lessons learned on the procedural issues for the certification of bioenergy hold great relevance for the emerging certification schemes for renewable hydrogen. To confront the related challenges the Commission has developed

2 Sustainability Criteria and Certification for Bioenergy under EU law

Section 2 presents the sustainability criteria for bioenergy as set out by the EU Renewable Energy Directive (RED III) as well as the provisions of the certification process. It shows that while sustainability criteria are already detailed in EU law, they apply primarily to GHG emissions and deforestation, while other environmental aspects, such as water consumption in water-scarce areas, as well as social aspects are not part of the binding set of criteria. This has been criticized by scholars who see the need for expanding the scope of the criteria.

2.1 Sustainability and GHG criteria in EU law

In the decade following the year 2000, numerous reports as well as academic articles revealed major environmental impacts of a booming global market in biofuels (see, for instance, Fargione et al., 2008; Spracklen et al., 2008). Media reports showed that many biofuels were causing more GHGs than the savings they enabled, and that, at the local level, they had significant impacts on biodiversity due to deforestation (Butler, 2007). This motivated the EU to adopt measures to ensure the sustainability of biofuels. When such criteria were first introduced in EU law, the underlying justification was that "consumers in the Community would [...] find it morally unacceptable that their increased use of biofuels and bioliquids could have the effect of destroying biodiverse lands" (RED I - Directive 2009/28/EC, recital 69).

Consequently, sustainability criteria for the production and import of bioenergy into the EU were included in legislation for the first time in the 2009 Renewable Energy Directive (RED I). Since then, these criteria were amended in 2015, mainly in order to include provisions to limit indirect land use change (ILUC)[1], and then again in 2018 and 2023, with the adoption of RED II and III. The currently applicable sustainability criteria are those included in RED III, although these are still being transposed into national laws by the EU Member States[2]. Although GHG criteria and sustainability criteria are included in the same RED article and are often conflated, they form two separate sets of criteria. These are presented as follows:

GHG criteria (art. 29 (10) RED III): The use of bioenergy must achieve between 50% and 80% savings in GHG emissions compared to the use of fossil fuels, depending on the type of bioenergy (biofuels, biogas or biomass fuels) and the date at which the bioenergy production installation entered into operation (i.e., before 2015, between 2015 and 2021, or after 2021)

Sustainability criteria (art. 29 (3)-(9) RED III): Bioenergy shall not be produced from raw material obtained from certain types of land resources:

Firstly, from land with a high biodiversity value, meaning (in summarised terms):

- Primary forest and forest and other wooded land of native species;
- Forests and other wooded lands which are species-rich and not degraded, and has been identified as being highly biodiverse by the relevant competent authority;
- areas designated: (i) by law or by the relevant competent authority for nature protection purposes, or (ii) for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in IUCN lists;
- highly biodiverse grassland spanning more than one hectare;
- heathland.

[1] ILUC happens where pasture or agricultural land previously destined for food and feed markets is diverted to biofuel production, displacing the non-fuel demand to new, non-agricultural land.

[2] Member States had time until May 2025 to transpose RED III into national legislation; however, several countries did not meet this deadline (CAN Europe, 2025).

Secondly, from land with high-carbon stock, meaning (in summarised terms):

- wetlands;
- continuously forested areas (land spanning more than 1 ha with trees higher than 5 metres and a canopy cover of more than 30%).

Thirdly, from peatland.

The exact provisions are significantly more detailed and also encompass a sub-section on forest biomass specifically. However, the list above provides an overview of the main objectives and characteristics of the criteria. They focus on biodiversity value and carbon stocks attached to the land, which are potentially endangered by land use changes, primarily but not exclusively through deforestation.

The GHG and sustainability criteria are not a condition to produce or import bioenergy in the EU. It is a condition for bioenergy products to (i) contribute towards the renewable energy targets and obligations of Member States, and to (ii) receive financial support for bioenergy consumption (RED III - Directive (EU) 2023/2413, art. 29 (1)). As a result, non-sustainable and/or GHG-intensive bioenergy products are not eligible to receive subsidies, nor are Member States incentivised to import them as they do not contribute to reaching renewable energy obligations and targets, such as the collective target of 42.5% of energy from renewable sources in the European Union's gross final consumption of energy by 2030 (RED III, art. 3(1)).

Beyond the GHG and sustainability criteria outlined above, other types of potential environmental impacts from bioenergy are also mentioned in RED III. These include soil, water and air protection, the restoration of degraded land, and the avoidance of excessive water consumption in areas where water is scarce (RED III, art. 30 (4)). Box 1 outlines the modalities of compliance mechanisms under the RED, primarily through certification.

Box 1: The certification process under RED III

Compliance with the sustainability criteria must be proven by bioenergy producers themselves through a scheme pre-validated by the EC (art. 30 (4) and (5)). The information they provide must be checked by independent audits (art. 30 (3)). These audits are realised by private certification bodies. Commission Implementing Regulation (EU) 2022/996 sets out in detail how compliance with the requirements must be demonstrated and verified through certification schemes (see also box 3). Alternatively, Member States may create bilateral or multilateral compliance schemes to replace the private certification bodies and verify compliance with GHG and sustainability criteria, if such a scheme is validated by the EC (art. 30 (6)). However, the vast majority of producers of biofuels and bioliquids make use of the private schemes (see Staricco and Buraschi, 2022, p. 186).

In the process of recognising a certification scheme's validity, the EC can decide that the scheme also contains accurate information regarding water, soil, air, and land aspects. However, as outlined below in section 3.3, for the most part, the EC chose not to conduct such a validation. Some certification schemes voluntarily go beyond the mandatory GHG and sustainability criteria by also certifying bioenergy production processes with respect to soil, water, air, and land use. One such example is the ISCC Plus certification scheme (ISCC, 2022).

In terms of reporting, each organisation proposing a certification scheme to bioenergy producers must subsequently submit an annual report to the EC, providing information on the scheme and its use, including certain aspects of indigenous and local communities (Regulation 2018/1999/EC). In addition, water, air, and soil impacts are mentioned in EU Regulation 2018/1999, amended in 2023, on the Governance of the Energy Union. In its annex IX, part 1, it requires the Member States' integrated national energy and climate progress reports (ibid., art. 20(c)) to provide information "where available, [on] the estimated impact of the production or use of [bioenergy] on biodiversity, water resources, water availability and quality, soils and air quality within the Member State" (ibid., Annex IX, part 1 (h)). It is therefore limited only to production within the EU, excluding imports. Annex X of the regulation details Member State reporting requirements feeding into the 'EU bioenergy sustainability report' on energy from biomass, to be developed and published biennially by the EC. This requires information on the national measures taken to ensure adherence to the sustainability criteria and GHG-saving criteria for soil, water, and air protection in third countries and Member States "that are a significant source of [bioenergy]" (ibid., annex X

(f). This report was published for the first time alongside the broader State of the Energy Union report in 2023 (EC, 2023).

Under RED I, the EC was also required to report every two years on the impact of the increased demand for biofuels, on the availability of food, and on social sustainability in and outside of the EU. This has since been replaced by a more vague and less binding formulation in recital 87 of RED III, which states that "[t]he Union is committed to improving the environmental, economic and social sustainability of biomass fuel production. This Directive is complementary to other Union legislative acts, in particular any legislative act on corporate sustainability due diligence which lays down due diligence requirements in the value chain with regard to adverse human rights or environmental impact." In this vein, the RED does not specify sustainability criteria regarding water, soil, or air quality or consumption. Obligations are limited to reporting by certifiers, the Member States, and the EC itself. Among these reports, the biennial EU bioenergy sustainability report on energy from biomass provides the most substantive information.

2.2 Calls to broaden the scope of sustainability criteria

Overall, public perception of biofuels in the EU is generally positive, with some concerns, particularly when biofuel feedstocks compete with those used for food production (Løkke et al., 2021). At the same time, studies show that the level of public understanding of biofuel technologies is limited, which "embeds the risk of public opinion being swayed [...], for instance due to dominant discourses in public media [or] to singular events" (ibid.). It is therefore crucial for the sector to avoid scandals that may negatively impact the public's perception and undermine trust in its products.

A range of scholars have repeatedly called for an expanded set of sustainability criteria that also addresses other environmental aspects (such as soil, water, and air) and social impacts (e.g., effects on indigenous peoples' lands) (Gamborg et al., 2014; Mai-Moulin et al., 2021). Indeed, several studies show that the reduction of GHG emissions through the use of biofuels may come with trade-offs, including acidification, eutrophication, greater water footprint, and loss of biodiversity (Jeswani et al., 2020). A 2013 study on the topic of air, soil and water protection acknowledged that introducing mandatory quantitative criteria is not feasible, given the wide variety of crops and the prevailing local bio-physical, environmental and climatic conditions for producing bioenergy, and proposed instead to place greater emphasis on targeted management practices (ECOFYS, 2013). Such practices would require compliance with relevant legislation on soil, water and air, the creation of management plans at farm level for soil and water management, and the drafting of river basin management plans to identify regions at risk of water scarcity (ibid.).

In the 2016 impact assessment for the preparation of RED II, the EC clearly indicated that, although the inclusion of these issues in the sustainability criteria was requested by stakeholders during the public consultation, it decided not to reopen the topic due to industry concerns regarding the administrative burden that these additional criteria would bring about (EC, 2016). In addition, the EC argued that many of the private certification schemes that it recognizes already require good agricultural practices, including with regard to soil, water, and air, in addition to the already existing GHG and sustainability criteria in RED I (ibid., annex 10).

In fact, during the parliamentary debates for RED I, the European Parliament's Industry Committee proposed to include social aspects in the sustainability criteria (German & Schoneveld, 2012). However, the EC raised significant concerns about their compatibility with World Trade Organization (WTO) rules, especially with regard to labour standards, ultimately leading to this idea being abandoned (Afionis & Stringer, 2012). It is possible that the inclusion of this type of mandatory requirement in sustainability criteria was seen as an invasive trade-restrictive measure (Lydgate, 2012) that overstepped the 'red lines' of certain countries and would almost certainly have triggered action in the WTO (Ackrill & Kay, 2011). Most of the academic debate on the legal feasibility of social sustainability criteria with regard to WTO law took place during and shortly after the establishment of RED I, and many scholars considered this option to be problematic (de Beer & Smyth, 2012). Others disagree, however, and some believe that it would indeed be possible to include such criteria, especially based on the requirements that are already widespread in private certification schemes (Konopacky, 2012).

It should be noted that the legal regime for sustainability criteria applying to bioenergy in the EU does not take place in a vacuum. Indeed, other EU legal texts may also require

sustainability-related actions from providers selling their products in the EU. Such is the case of the sustainability reporting obligations to which companies above a certain size are subject, including third-country undertakings (Directive 2022/2464/EC, art. 1 (40a) - Corporate Sustainability Reporting Directive). The sustainability aspects to be reported on include “people and the environment”, including, for instance, human rights (ibid., art. 1(2)(b)(17)). Having said that, it should also be noted that reporting obligations are not equivalent to binding sustainability criteria.

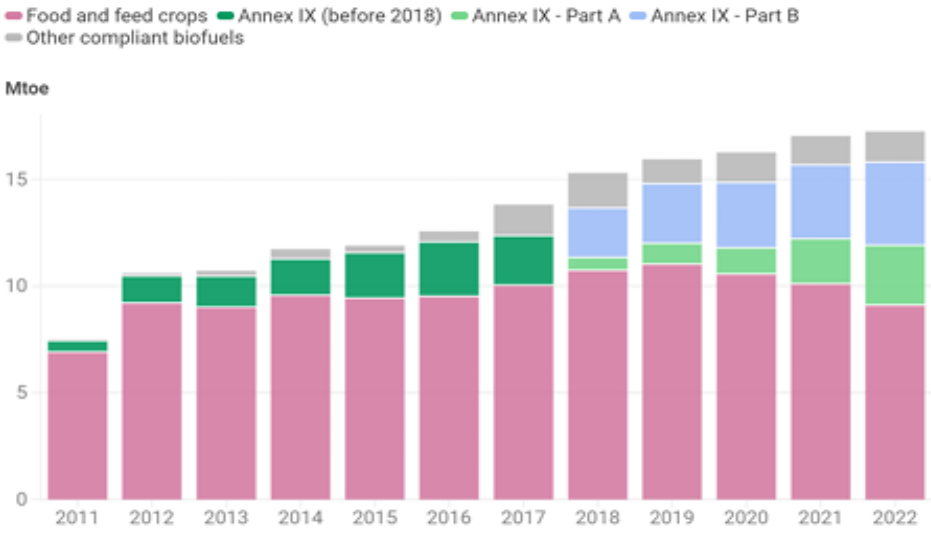
3 The Implementation of EU Sustainability Certification

This section presents lessons learned from the implementation of the EU sustainability criteria and certification schemes for bionergy. It uses a variety of academic sources and official reports to identify and analyse the issues that emerged over nearly 15 years of implementation, including but not limited to cases of fraud that have undermined the credibility of the certification system.

3.1 Trends in EU biofuel production and imports

In 2025, close to 15 years after RED I's deadline for transposition in EU Member States[3], some figures provide an idea of the impact of the EU sustainability criteria regime for bioenergy. For biofuels especially[4], data for the 2011-2022 period show that historically, biofuels were almost exclusively produced from crops (Suzan, 2024), as shown in Figure 1 below.

FIGURE 1: BIOFUEL CONSUMPTION IN THE EU IN 2022.



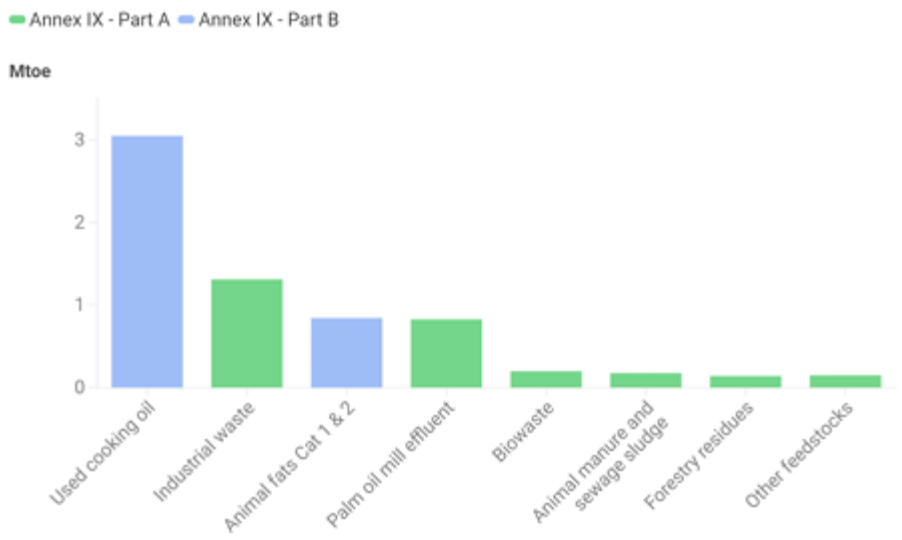
SOURCE: SUZAN, 2024

Although we can assume the majority of these biofuels officially complied with the GHG and sustainability criteria in order to benefit from subsidies and count towards Member States' renewable energy targets, food and feed crops still raise concerns with regard to sustainability. Indeed, sugar beet, corn, wheat, soy, or palm oil all require land and consume water. In some countries, they cause deforestation through land-use change (especially soy and palm oil, which are almost exclusively imported) as well as social and other environmental issues (e.g., soil degradation, water pollution, and over-consumption) (Tudge et al., 2021).

[3] By December 2010
[4] Therefore, focusing on final use for transportation, as defined in RED III, art. 2(33).

Although biofuel consumption from food and feed crops has declined since 2019, it still accounted for 60% of total biofuel use in 2022—ten years after the adoption of RED I. The remaining 40% were made of advanced biofuels and wastes (see box 2), the majority of which was used cooking oil (UCO), as Figure 2 shows.

FIGURE 2: ADVANCED AND WASTE BIOFUELS CONSUMED IN THE EU IN 2022.



SOURCE: SUZAN, 2024

Box 2: Advanced and waste feedstocks under RED.

In RED, Annex IX is dedicated to listing the advanced and waste feedstocks that can be used to produce biofuels or biogas for transport. These have the advantage of consuming much less land than food and feed crops. Furthermore, they should not cause land-use change as they are often a by-product of an existing industry. This categorisation allows for a calculation that doubles the energy content (RED III, art. 27 (2)).
Annex IX distinguishes feedstocks that can be processed only with advanced technologies (Part A) and those processed with mature technologies (Part B) (RED III, art. 28 (6)). As an example, Part A includes algae cultivated on land in ponds or photobioreactors as well as straw or nut shells, while until 2023, part B had counted only UCO and animal fats.

Recent reports and specialised press articles indicate widespread incidents of fraud regarding the import of UCO, especially from China and Malaysia. Chinese UCO has significantly increased its market share since 2021 (Carroll, 2023a), raising serious doubts about the sustainability of the fuel, to the extent that the EC opened a probe and adopted temporary anti-dumping duties (Carroll, 2024). Meanwhile, Malaysia exports three times as much UCO to the EU as it collects (T&E, 2024). It is, therefore, very likely that Chinese and Malaysian biofuels labelled as UCO are in fact originating from virgin palm oil (Carroll, 2023a).

It should be noted that the three feedstocks that raise the most issues in terms of sustainability and related fraud happen to be the three where the EU is at highest risk of import dependency. These are palm oil (100% imported, primarily from Indonesia (65%) and Malaysia (29%)), soy (87% imported, mostly from Brazil (46%), the US (24%), and Argentina (21%)), and UCO (56% imported, mainly from China (37%), Malaysia (13%), and Indonesia (11%)) (EC, 2024).

Current trends in EU biofuel production, imports, and feedstock types may be influenced by two sets of factors identified in recent reports on the implementation of bioenergy sustainability criteria: (A) the sustainability criteria are limited, allowing bioenergy to qualify as “sustainable” despite negative environmental and/or social impacts, and B) an unreliable certification system. The latter is due to the narrow scope of certification schemes validated by the European Commission, limited implementation of supervision and control mechanisms by both the Commission and Member States, and issues related to the design of the schemes. However, the European Commission has begun addressing these issues,

for example, through the issuance of an Implementing Regulation (see box 3 and the forthcoming sections). These aspects will be described in the following.

3.2 Limitations of EU sustainability criteria

In 2016, the European Court of Auditors (ECA) released a report analysing the EU system for the certification of sustainable biofuels (ECA, 2016). It focused on the implementation of RED I, given that the audit covered the 2011-2015 period. One of its main conclusions was that when assessing the candidate voluntary schemes that required validation the EU failed to include "some important sustainability aspects necessary to ensure the sustainability of biofuels", and particularly "negative socioeconomic effects, such as land tenure conflicts, forced/child labour, poor working conditions for farmers and dangers to health and safety" (ECA, 2016, p.8). The ECA report also examined reports that the EC is required to produce on various sustainability aspects of biofuels, including social aspects and the impact on food prices. According to this review, the reports "do not provide enough data to assess the impact of the demand for biofuels on social sustainability" (ibid., p. 22).

A 2022 International Energy Agency (IEA) report comparing the biofuels sustainability criteria in policy frameworks from various countries found different approaches in terms of non-GHG or non-deforestation related sustainability criteria (such as impacts on water consumption and pollution) as well as of social criteria (IEA, Bioenergy: Task, 39, 2022)[5]. Indeed, certification schemes in Australia (regarding biofuels), the Netherlands (regarding solid biomass), and at the international level (ICAO-CORSIA, regarding sustainable aviation fuels) integrate criteria on both water (depletion and pollution) and social aspects (IEA, 2022, p. 43-44, 48). The report acknowledges that such requirements are integrated only to a limited extent, and that the environmental criteria "may be needed in jurisdictions where the environmental regulation is weak" (ibid., p. 49). The report ends up recommending the integration of water pollution and depletion in sustainability criteria. The same goes for socio-economic factors; if this is not possible, it recommends that efforts should be made to promote adequate regulations in key producing countries (ibid., p. 3).

Finally, the recently published Union bioenergy sustainability report provides a wealth of information about how Member States track information about biofuel consumption and their reporting to the European Commission (EC, 2024). Although they are obliged to "report local environmental impacts related to the use and production of biofuel, bioliquids, and biomass fuels on water, air, soil quality, and biodiversity in their Progress Reports", the information on these aspects, if provided at all, is very limited (ibid., p. 96). This is also the case for palm oil and soy production (ibid., p. 99, 103-111), where water-related issues are considered an important concern.

3.3 Challenges related to the reliability of certification systems

There is ample literature on the challenges of biofuels certification schemes. Many studies point out the advantage of working with private certification schemes, which can be tailored to a targeted feedstock or regional conditions. The developers of the respective schemes should then possess the specific expertise needed to define management requirements targeted at the local conditions (ECOFYS, 2013, p. 3). In addition, this system allows bioenergy producers to choose a more ambitious certification scheme if they wish, with higher requirements than those in RED III (See Mai-Moulin et al., 2021; Ramirez-Contreras & Faaij, 2018). However, the literature also pointed to the risk of a 'race to the bottom' or 'forum shopping', in which producers often choose the less demanding certification scheme (See, for instance, Stattman et al., 2018).

The Commission Implementing Regulation (CIR) 2022/996 (of 14 June 2022) on rules to verify sustainability and greenhouse gas emissions saving criteria (…) is intended to solve some of the issues highlighted. It applies general rules to reinforce the quality and credibility of certification schemes and auditors (please see box 3). However, for the moment, there is no reliable information on its performance, as it has only been in effect since December 2023 (CIR 2022/996, art. 28).

[5] Hereinafter referred to as IEA, 2022.

Box 3: Commission Implementing Regulation (EU) 2022/996

Commission Implementing Regulation (EU) 2022/996 sets out rules for verifying sustainability, greenhouse gas emissions savings, and low indirect land-use change risk criteria for biofuels, bioliquids, biomass fuels, and renewable fuels of non-biological origin (RFNBOs). It was published on 14 June 2022, with mandatory application starting from 17 December 2023 (art. 28). The implementing regulation was adopted to implement provisions of RED II, specifically by defining technical and environmental requirements for voluntary and national certification schemes to demonstrate compliance with the sustainability criteria and GHG emission savings for biofuels and RFNBOs (see Chapter 2 of this report), ensuring accountability for RED targets for both products. Among other aspects, such schemes must incorporate inclusive governance structures, representing a wide range of stakeholders—such as farmers' and foresters' associations, environmental NGOs, local communities, academia, and fuel producers. They must also ensure effective internal monitoring, complaint-handling procedures, transparent operations, and credible audit processes.

The regulation also clarifies the interoperability of certification schemes within the supply chain. If a segment of the supply chain relies on a different voluntary scheme—such as for sustainability or traceability—it must be officially recognized by the European Commission and used strictly within its approved scope (Article 8). This provision aims to prevent past misuse related to scheme boundaries and non-transparent recognition practices. To improve transparency and traceability, the regulation requires industry and certification holders to use the Union database (art. 18) which tracks the sustainability characteristics and GHG emissions performance of liquid and gaseous fuels across the entire supply chain - from the initial feedstock collection point to final consumption, including data on the feedstock's origin. The database was first promulgated in RED II, became operational in January 2024, and is intended to prevent double-counting of certified products moving across borders (IEA 2022, p. 107-108).

In alignment with these provisions, the European Commission has recognized several voluntary schemes. For low ILUC-risk biofuels, examples include the Austrian Agricultural Certification Scheme (AACS) and 2BSvs. As of May 2025, CertifHy, RedCERT, and ISCC EU are officially approved to certify RFNBOs in accordance with EU requirements.

Implementation challenges can be distinguished according to the stage of certification which they occur at, i.e., during the recognition procedure for a certification scheme or during its execution once it is validated by the EC. In addition, a number of more fundamental challenges related to the overall design of the system can be identified. The most important challenges are presented in the following, clustered according to these three categories, and summarized in table 1 below.

TABLE 1: CHALLENGES WITH THE IMPLEMENTATION OF THE EU CERTIFICATION SYSTEM FOR BIOENERGY

Category	Aspects
Limitations in the Commission's recognition procedure for certification (see 3.3.1)	• EU recognition procedure lacks robustness • EU recognition procedure lacks governance requirements
Challenges with oversight of recognised certification schemes by the EC and Member States (see 3.3.2)	• Insufficient oversight by EC and Member States over recognised schemes • Challenges in detecting violations due to insufficient reporting by Member States • Poor transparency and coordination (among schemes, Member States, and the EC) allow infringements and forum shopping
Challenges with the design and interoperability of certification schemes (see 3.3.3)	• Lack of harmonised definitions and comparable data • Fraud-prone system with limited sanctions • Mutual recognition lets weak schemes enable misleading claims

SOURCE: AUTHOR

3.3.1 Limitations in the Commission's recognition procedure for certification

EU recognition procedure lacks robustness

The procedure for recognising certification schemes has been criticised for its lack of rigour and robustness. For instance, when the ECA visited various previously validated schemes for its 2016 report, only one required on-site checks in producers' facilities (such as farms). Most others relied either on self-declaration or "on the controls carried out by the national authorities responsible for cross-compliance within the CAP [Common Agricultural Policy] control system, even though the schemes do not have access to the results of these controls when certifying the farmers" (ECA, 2016, p. 21). Since December 2023, CIR 2022/996 requires the initial audit of a new scheme participant (e.g. a soy or a biofuel producer) or a re-certification of an existing scheme participant under a revised regulatory framework to be always conducted on-site (CIR 2022/996, Art. 10 (1)). In some specific cases (e.g., group audits), when on-site audits are replaced with desk audits, "the same level of assurance" should be provided, such as through the use of high-quality satellite images (Ibid., recital para. 7 and art. 12 (4)). Self-declarations are also considered insufficient in some limited cases (ibid., art. 12 (4)), although they are not banned as a general rule.

EU recognition procedure lacks governance requirements

In addition, the EC initially failed to check the schemes' governance before validating them (ECA, 2016, p. 27). This includes the schemes' management, such as whether it has sufficiently trained workers and managers to ensure quality oversight and transparency through an adequate representation of a variety of stakeholders. This is despite the fact that research shows that certification schemes that integrate non-governmental organizations (NGOs) in their board lead to stronger criteria and tend to act more transparently compared to boards consisting of only industry representatives (ECA, 2016, p. 27; Kemper & Partzsch, 2018). With CIR 2022/996, the EC now requires certification schemes to "establish a governance structure to ensure that the scheme has the necessary legal and technical capacity, impartiality and independence to perform its duties" (CIR 2022/996, art. 3 (1)). Moreover, these schemes should "to the extent possible" include "a broad range of representatives" in their governance structure, such as environmental NGOs or "indigenous and local communities potentially affected by the scheme", while no "stakeholder group shall have a dominant position in the decision-making process" (CIR 2022/996, art. 3 (2)). It remains to be seen how the schemes and the EC interpret the formulation "to the extent possible" with regard to board composition diversity and how the EC will judge these new requirements for (re-) recognizing certification schemes in the future.

3.3.2 Issues related to the oversight of recognised certification schemes by the EC and Member States

Insufficient oversight by EC and Member States over recognised schemes

The supervision of authorised schemes also raises important questions. Once a certification scheme is recognised and a producer decides to request it, auditors have to carry out periodic verifications to ensure that the producer does in fact comply with the criteria allowing for corresponding claims. Of course, auditors themselves must respect the rules they are tasked with applying. Nevertheless, the 2016 ECA report found various examples of auditors limiting themselves to simple documentary checks while entirely foregoing on-site inspections, which is a requirement of the respective schemes (ECA, 2016, p. 28-29). This ECA report is based on data gathering realised over 10 years ago and the situation may have changed. Nevertheless, in the past, it was argued that both EC and Member States had no authority to perform checks and verify whether a certification operation complies with the validated standards (ECA, 2019, p. 259; IEA 2022, p. 127).

Looking ahead, CIR 2022/996 may provide certain improvements. Firstly, as explained in subsection 3.3.1, a number of checks must be conducted on site and cannot be replaced with simple remote documentary checks. Secondly, RED III entrusts the "competent authorities" of Member States to "supervise the operation of certification bodies" (RED II and III, art. 30 (9)). Certification bodies now have to provide all relevant information upon request for such verification, and Member States have to inform a certification scheme in case they detect a non-conformity (ibid.). The EC can also perform verification, though only upon request by a Member State (ibid., art. 30 (10)). These rules are detailed further in CIR 2022/996, mostly to ensure that certification bodies are adequately supervised by Member States and that they provide the information as required (CIR 2022/996, art. 17).

Challenges in detecting violations due to insufficient reporting by Member States

In addition, in 2016 the ECA highlighted difficulties in detecting violations of the rules of voluntary schemes - some of which may be recognized by the EC as evidence of compliance with the RED. This was due to the absence of a specific complaint system and the fact that the EC didn't verify whether complaints addressed to the schemes were correctly dealt with (ECA, 2016, p. 29). The existing general EC complaint system was not designed to address these concerns, as it is limited to addressing breaches of EU law by Member State authorities and does not cover issues related to voluntary schemes (ibid.).

Additionally, it appears that Member States are deficient in reporting fraud in the biofuels sector, as is evident in the 2023 Union bioenergy sustainability report (EC, 2024). Indeed, out of the 27 Member States, 21 submitted information regarding observed cases of fraud. However, only four observed actual (or potential) cases of fraud[6], while a handful of minor cases of non-compliance, non-conformity, and inaccuracy were identified in three Member States (EC, 2024, p. 10 - 11). Such low numbers are surprising, given the substantial media coverage on fraud, such as the mislabelling scam to sell biofuel from soy as UCO detected in 2012 and prosecuted in 2019 (Moskowitz et al., 2023). The suspicion of massive UCO fraud from Malaysia and China were also starting to emerge in 2022 and 2023, though it has not been reflected in the reporting by Member States. As a result, the Union bioenergy sustainability report recommendation to Member States was to significantly increase the quality of their fraud reports (EC, 2024, p. 138).

Again, CIR 2022/996 is designed to enable improvements for both highlighted issues, as it orders certification schemes to provide accessible complaint procedures and to allow them to be filed via the internet or mail (Art. 5 (3)). Moreover, the schemes must keep track of complaints made, provide a summary to the EC in an annual activity report, and, upon request by the EC or a Member State, provide all documents related to a complaint and its handling (ibid., art. 5(4)). While it remains to be seen to what extent the EC and Member States will make use of this control function, the regulation has begun to have an effect. Indeed, in its 2022 obligatory annual report to the EC, the 2BSvs sustainability certification scheme indicated that it updated its website to allow complaints to be filed online (2BS, 2023).

Poor transparency and coordination allow infringements and forum shopping

Proper supervision of certification schemes and control of certified products is also hampered by insufficient information sharing between entities (between schemes, between Member States and between Member States and the EC) in order to track infringements and limit forum shopping by producers and suppliers. Until recently, it was still possible for producers to shop around for schemes: if the first scheme(s) requested improvements to production methods, the producer could go to another one to avoid realising any changes, as there was no obligatory communication of reports between schemes (ECA, 2016, p. 32).

CIR 2022/996 has addressed this issue by making forum shopping more difficult. Indeed, certification schemes must now publish the list of their certified economic operators (e.g., soy or biodiesel producers) together with their certificate status (ongoing since which date, suspended, withdrawn, etc.) (CIR 2022/996, art. 6 (b)). In the event of critical or major non-conformities, these must be published as well. The economic operators with a suspended or withdrawn certificate must be publicly listed on the scheme's website for at least two years. In addition, before certifying a new economic operator, the schemes must now ask them whether they "or their legal predecessor" have been certified over the past five years, and whether such certificates were suspended or withdrawn, or whether they withdrew from the scheme before the first surveillance audit (CIR 2022/996, art. 7 (1)). If the economic operator fails to provide this information or a justification for its own withdrawal before the surveillance audit, the certification scheme must exclude it (ibid., art. 7 (2)).

However, the ECA still recently regretted that the EC does not have access to full information about the country of origin of the feedstocks used to produce biofuels. While some Member States track this information, they do not make it public, which raises issues of transparency and undermines trust in the system (ECA, 2016, p. 43). This issue of public scrutiny and transparency aimed at creating trust is also an IEA recommendation, which is best served by efforts to coordinate and exchange information between authorities in Member States and between Member States and third countries about certification bodies and verifiers (IEA, 2022, p. 5). The EC is also not setting a good example by not providing figures about UCO imports (Moskowitz et al., 2023). It even resisted a recommendation

[6] For false reporting for advanced biofuels, false content, illegally harvested wood and fraud in the water sector. See EC, 2024, p. 89

formulated by the European Ombudsman to publish existing documents that indicated the country of origin of all the UCO produced and imported in the EU (European Ombudsman, 2022).

Again, the CIR 2022/996 seeks to address these issues. It requires Member States to "establish cooperation frameworks with third countries for the supervision of certification bodies auditing in their territories, where relevant", and to the extent possible (CIR 2022/996, art. 17 (5)). Additionally, the Union database[7], initially established under RED II, and then further specified and referred to in RED III (art. 31a) and CIR 2022/996 (art. 18), is designed to facilitate the traceability of liquid and gaseous renewable fuels and recycled carbon fuels. It has been operational since January 2024 although not fully deployed yet. This represents a positive step (as elaborated below) since Member States previously responsible for gathering data about the origin of the biofuels consumed in their country did not always link their national registries for double counting of certificates (IEA, 2022, pp.107-108.). Member States will now have to require the economic operators to "enter in a timely manner accurate data into the Union database on the transactions made and the sustainability characteristics of the fuels subject to those transactions" (RED III, art. 31a (2). CIR 2022/996 adds that certification bodies must verify the accuracy of information entered into the database (CIR 2022/996, art. 17 (1c). Since the Union database became operational in January 2024, its uptake by the industry has been limited (at least through the end of 2024), in part due to a criticised and confusing rollout (Carroll, 2023b; Moskowitz et al., 2023). As of May 2025, the mandatory implementation of the database by economic operators was not yet finalised and remained subject to coordination with the Member States (ISCC, 2025). It remains to be seen whether the database will achieve its intended outcomes.

3.3.3 Challenges with the design and interoperability of certification schemes

Lack of harmonised definitions and comparable data

Another challenge is related to the lack of harmonised and unambiguous definitions as well as comparable data. This complicates the effective verification of the origin of biofuels and impedes efficient information exchange. The harmonisation of definitions was proposed in 2016 by the ECA for waste substances in particular (ECA, 2016, p. 10). This recommendation was considered to be largely implemented by the same institution in 2019 (ECA, 2019, p. 260). Nevertheless, the ECA still recently found issues with the classification of products within Annex IX of RED III, which includes biofuels from waste (ECA, 2016, p. 34). There are also discrepancies between individual Member States, whereby some classify a product in one category and another in different one. To avoid this, definitions must be formulated in a way that is unambiguous (IEA, 2022, p. 3). Measurement units shall also be harmonised, especially for reporting that is necessary for the Union bioenergy sustainability report (EC, 2023, p. 132). Indeed, comparable data would greatly help in the search for infringements, although the EC does not compare already existing data and does not detect inconsistencies in Member States' declarations about sustainable biofuels (ECA, 2023, p. 43). Wide discrepancies can be found between some Member States from one database to the other (ibid., p. 44).

Fraud-prone system with limited sanctions

Additionally, prior to the entry into force of CIR 2022/996, the certification system for biofuels included only limited sanctions to address instances of fraud. In the case of major and critical non-conformities by the economic operator, it just lost its certification (IEA, 2022, p. 118). With the entry into force of CIR 2022/996, economic operators with a suspended certificate cannot make sustainability claims until suspension has been lifted, nor can they join another scheme during this period (CIR 2022/996, at 4 (2)). If the economic operator, or its legal predecessors, is found guilty of a critical non-conformity, other schemes may exclude the operator for two years (ibid).

If a certification scheme itself is suspected by a Member State of not "operating in accordance with the standards of reliability, transparency and independent auditing" under which it was recognised by the EC, then the EC "shall investigate the matter and take appropriate action" (RED II, art. 30 (8)). However, the notion of appropriate action is not clearly defined, and it seems evident that Member States are fully responsible for the process of identifying fraud.

[7] The Union database is also sometimes referred to as the Union Database for Biofuels (UDB), as this was the original name. The EC itself uses both the terms Union database and Union Database for Biofuels.

Mutual recognition allows weak schemes to enable misleading claims

As authorities only register the certification scheme applied at the last interface (biofuel seller), there is the risk of a weaker scheme used at the start of the chain (feedstock production). compared to the one presented at the end of the chain. This is a practice seen in the case of Argentinian biodiesel, whereby soy is cultivated under a low-threshold standard but then “elevated” to a higher one for its sale through this administrative procedure (see box 4, Staricco & Buraschi, 2022).

Box 4: The challenge of mutual recognition in the Argentinian biodiesel sector

As Argentinian biodiesel producers only consume 3% of domestic soy production, they struggle to impose any sustainability certification scheme on soy suppliers. Nevertheless, they still sell biodiesel to European buyers with the ISCC label, which is more demanding than RED requirements. However, the soy is actually cultivated under the 2BSvs standard, which only applies RED requirements. The trick is that ISCC is obliged to recognise 2BSvs as an equivalent, EU-RED compliant, certification.

The problem is not likely to be resolved with CIR 2022/996, as it requires recognised certification schemes to accept evidence from other recognised schemes within the supply chain of a single product (CIR 2022/996, art. 8). Although Article 8 stipulates that only certification schemes officially recognized by the European Commission may be used, these may still differ in ambition and scope. Hence, sustainability requirements that are addressed in an overarching scheme but absent in a subordinate one are still subject to mutual recognition, provided that elements such as feedstock type, geographical scope, and other parameters align. As a result, when two schemes have different levels of requirements, mutual recognition may lead to a product being labelled as more sustainable than it is.

4 Sustainability Criteria and Certification for Renewable Hydrogen in EU law

This section provides a legal interpretation of the sustainability criteria applicable to renewable hydrogen (i.e., RFNBOs) in the EU and discusses to what extent the certification systems inherited from bioenergy would apply to renewable hydrogen and its derivatives. It is clear that the rules governing the recognition and oversight of certification systems are the same for biofuels and RFNBOs, including the rules stipulated in the implementing regulation CIR 2022/996. A degree of unclarity remains with regard to the applicability of additional criteria related to land-use change and deforestation that go beyond the basic GHG emissions savings criteria. It is likely- though not entirely certain - that these additional criteria do not apply to RFNBOs. An exception would be renewable hydrogen derivatives that utilize biogenic sources of CO2 from biomass. Such derivatives would require certification of the biomass in alignment with the rules for bioenergy.

4.1 Sustainability criteria applicable to renewable hydrogen according to EU law

On 13 June 2024, the Renewable Gas, Natural Gas and Hydrogen Directive (H-Directive) was adopted (Directive 2024/1788/EC). It entered into force 20 days later and must be transposed by Member States by August 2026 (ibid., art. 94 & 96). Article 9 of the directive, covering the "certification of renewable gas and low-carbon fuels" requires renewable gases to be certified in accordance with articles 29, 29a and 30 of RED III. In its article 2 (2), the H-Directive defines "renewable gas" as "biogas [...] and renewable fuels of non-biological origin" (RFNBOs), as defined under article 2 (36) of RED III.

Article 2 (36) of RED III defines RFNBOs as "liquid and gaseous fuels the energy content of which is derived from renewable sources other than biomass". Therefore, RFNBOs cover hydrogen produced by electrolysis using electricity from renewable sources, and its derivatives (e.g., ammonia, methanol, etc.) (EC, 2024a). In the same directive, article 29 is entitled "Sustainability and [GHG] emissions saving criteria for biofuels, bioliquids and biomass fuels", article 29a "[GHG] emissions saving criteria for [RFNBOs] and recycled carbon fuels", and article 30 "Verification of compliance with the sustainability and [GHG] emissions saving criteria".

In sum, renewable gas includes RFNBOs and biogas, both of which are required to apply the RED III articles regarding sustainability criteria, GHG savings criteria, and the corresponding certification compliance rules. Going forward, there are two possible interpretations: i.) the first is that article 29 only applies to biogas, article 29a only to RFNBOs, and article 30 to both; ii.) the second would be that article 29 applies to both biogas and RFNBOs, in the sense that RFNBOs would have to apply this provision with regard to the sustainability aspect, given that GHG criteria are settled under art. 29 for bioenergy and under art. 29a for RFNBOs.

The first interpretation seems to be the most practical and obvious one based on the articles' titles. It states that no sustainability criteria for RFNBOs are defined under EU law. In that case, RFNBOs only have to respect GHG emissions rules as per article 29a (1) (70% savings compared to a fossil fuel option) as detailed in the delegated act setting a methodology for assessing these savings (Commission Delegated Regulation (EU) 2023/1185), with the delegated act defining when hydrogen can be considered as a RFNBO (by applying rules such as additionality and temporal correlation, see Commission Delegated Regulation (EU) 2023/1184).

However, because of a lack of clarity in the formulation of the law, an in-depth examination is required before fully excluding the second interpretation[8]. Indeed, article 9 of the H-Directive can be read in a way that interprets all three articles 29, 29a and 30 of RED III to apply to both biogas and RFNBOs, since the text makes no distinction in sub-paragraphs that biogas applies articles 29 and 30, whereas RFNBOs apply articles 29a and 30. Moreover, article 30 of RED III repeatedly refers to both articles 29 and 29a, explicitly requiring certification bodies to apply both the GHG and sustainability criteria (RED III, see art. 30 (1), 30 (3), 30 (4), 30 (6) and 30 (10)). This option, analysed in detail by Mauger, Villavicencio-Calzadilla and Fleming (2024), consists of applying bioenergy's sustainability criteria to the production of RFNBOs, which is, however, quite an ill-matched fit. Ultimately, this study suggested that EU law should adopt RFNBO-specific sustainability criteria encompassing the main issues of water consumption (in arid lands) and social aspects (ibid., p. 153 – 156), which, as explained in section 2 above, are two aspects missing from the current bioenergy sustainability criteria.

As a result, for this study, RFNBOs are considered only subject to articles 29a and 30 of RED III, and therefore only to GHG emissions savings criteria in addition to the two 2023 delegated acts. As a consequence, no sustainability criteria as understood for bioenergy (e.g., concerning land use) apply to RFNBOs.

4.2 The certification regime applicable to renewable hydrogen and its derivatives according to EU law

Since art. 30 of RED III applies to RFNBOs, as stated above, the rules that apply to certification schemes and auditing bodies to control the compliance of economic operators with the scheme they choose to claim also apply. These rules are supposed to ensure the traceability and transparency of RFNBOs – both those produced in or imported into the EU – if they are to count towards renewable energy targets (RED III, art. 30 (1)), and are meant to help avoid fraud, as detailed in sections 2 and especially 3 above.

In addition, the CIR 2022/996, which details the regime to ensure sound monitoring, auditing and complaint procedures and is expected to solve many related caveats and reduce fraud for bioenergy (see sections 3 above and 5.4 below), also applies to RFNBOs (ibid., art. 30(8)). Information on the impact of CIR 2022/996 is still unavailable, as it only entered into force at the end of December 2023. Information regarding the effect of the CIR 2022/996 is still missing, yet it should allow many of the lessons learned from the bioenergy sector to apply. Moreover, the Union database presented earlier for bioenergy (section 3.3.2) also applies to RFNBOs. Indeed, art. 31a (1) of RED III applies to "liquid and gaseous renewable fuels", and renewable fuels are defined in the directive as bioenergy and RFNBOs (ibid., art. 2 (22a)).

As of early 2025, three RFNBO certification schemes have been recognised by the EC: ISCC, CertifHy and REDcert (EC, 2024c). In addition, three other certification schemes are pending a recognition decision from the EC: KZR INiG System, CCEE Hydrogen and Derivatives Certification System, and RSB EU RED Fuel Certification (EC, 2024c). Based on the first three recognised certification schemes, it appears that the EC did not amend its procedures, despite criticism formulated by various entities, including the ECA, with regard to the recognition process for bioenergy certification schemes (section 3.3.1), including the governance of the assessed schemes and the additional sustainability criteria proposed by some schemes.

The final question pertains to renewable hydrogen derivatives using CO2 of biogenic origin, for example for the production of methanol (Hinicio, 2024). It is not entirely clear whether these derivates are required to use biogenic CO2 from biomass that is certified for its sustainability according to EU rules. The 2023 delegated act establishing a methodology for assessing these savings offers an answer in its annex, which describes how to calculate whether the final product achieved a 70% savings in GHG emission or not (CDR 2023/1185, Annex, A.10.c)). It specifies that when "the captured CO2 stems from the production or the combustion of biofuels, bioliquids or biomass fuels complying with the sustainability and greenhouse gas saving criteria and the CO2 capture did not receive credits for emission savings from CO2 capture and replacement […]", it can be considered as "emissions from

[8] Out of 3 interviews carried out with legal academics specialised in the EU regime for hydrogen (including its certification), 2 considered that the writing of article 9 was confusing but that only the first interpretation made sense. The third one considered that the writing of article 9 was clear enough to point towards the first interpretation.

existing use or fate". This category of emissions reduction does count towards the 70% of GHG emissions savings required under art. 29a (1) of the RED III in order for the RFNBO to count towards Member States' shares of renewable energy. This aspect is confirmed by the EC in a 2024 Q&A document on the implementation of hydrogen delegated acts (EC, 2024b, p. 12).

In summary, for a hydrogen derivative using CO2 from a biogenic source to be counted as an RFNBO under EU law, it must use a biogenic source that has been certified for its compliance with the EU sustainability criteria. In practical terms, this would entail the combination of a certification scheme for the biogenic CO2 source and another one for the RFNBO steps in the supply chain.

5 Lessons Learned and Recommendations for the Implementation of EU Sustainability Criteria for Renewable Hydrogen

Many of the issues highlighted in the preceding sections with regard to sustainability criteria and certification for bioenergy are likely to also apply to renewable hydrogen (RFNBO), although with some differences. The following section presents the main lessons learned from bioenergy for promoting robust sustainability governance in the hydrogen sector and formulates a number of policy recommendations.

5.1 Need and potential for incorporating broader sustainability criteria into EU hydrogen governance

As explained in the previous section, the current sustainability criteria that apply to the production of RFNBOs concern their GHG emissions as well as the need to supply the electrolysers with electricity from renewable sources. However, many scholars argue that it would be possible to create measurable sustainability criteria for environmental and social aspects (Blohm & Dettner, 2023), and some authors suggest that these should be included in certification schemes (Riemer, 2022). The industry itself recognises the importance of selected sustainability issues when defining certification schemes. A study by Goodwin et al. (2024) explored the relevance and potential for integrating more holistic sustainability criteria into certification schemes for hydrogen. The research combined archival analysis with a comprehensive survey targeting energy sector and sustainability professionals involved in hydrogen's role in the energy transition. The findings revealed a strong consensus on the importance of broader sustainability considerations: over 60% of respondents rated all proposed sustainability criteria as at least "very important." These criteria spanned several key dimensions, some mentioned in the following. From an economic perspective, local economic development and employment were highlighted. Environmental criteria focused on the impacts of hydrogen production on biodiversity, ecosystems, and conservation values, as well as water-related issues such as water rights, quality, and stress. Governance-related aspects were also emphasized, particularly the participation of all relevant stakeholders. Social dimensions, including human rights, cultural acceptability, and land and land use rights, were likewise deemed significant. Among the top priorities identified were water consumption, water quality, and biodiversity. This may also extend to encompass the potential local pollution caused by the desalination of water. These results demonstrate not only the relevance but also the stakeholder support for incorporating broader sustainability dimensions into hydrogen certification schemes.

During the revision process of RED II (which led to the adoption of RED III in 2023), the European Parliament's Committee on Industry, Research and Energy (ITRE) proposed an amendment to insert a new recital 3a (European Parliament, 2022). This new recital proposed that RFNBOs should meet sustainability criteria, “including regarding land and water use and must not be in competition with the needs of local communities provision for water, land and energy and must be in line with the objectives of the SDGs as well as the Paris Agreement and international agreements on biodiversity and the environment”. In that regard it would also be beneficial if the European Commission provided clarity on the interpretation of whether the sustainability aspects outlined in Articles 29, 29a, and 30 of RED III apply exclusively to biofuels, bioliquids, and biomass fuels (as this study argues), and not to RFNBOs, as ambiguously presented in the H-Directive (see Section 4.1).

Significantly, some certification schemes already include environmental (e.g., regarding water and land) and social (e.g., regarding human and labour rights, indigenous peoples' rights, etc.) criteria. Two of them have been identified so far: GH2 and RSB-GFC (Gallegos, 2024). Both are currently not in the process of being recognised by the EC as a valid scheme in the EU. Failing to integrate mandatory environmental criteria (beyond GHG emissions and the source of electricity) and social criteria into the law means that the more ambitious ones will be required to recognise less ambitious ones (CIR 2022/996, art. 8). This risks reproducing the Argentinian biodiesel case in the renewable hydrogen sector (see section 3.3.3). At the same time, adding more requirements at this early market stage risks further slowing down the market ramp-up (Gallegos, 2024, p. 27). Such criteria may also be perceived as non-tariff barriers to trade or overly prescriptive by RFNBO-producing countries. However, there is also a risk involved in waiting for potential future disclosure of non-sustainable production methods to consumers and the wider public, which could undermine trust in the product, as was the case with biofuels before additional sustainability criteria were introduced - as a response to reports and articles revealing biofuels' environmental impacts (see also section 2.1).

5.2 Enhancing transparency in the case of mutual recognition of certification schemes

In cases where it is not feasible to incorporate broader sustainability requirements across different certification schemes— thus requiring mutual recognition of various schemes along the value chain—it would be beneficial to require the final certification body to provide transparent documentation of this. Specifically, the final certification should clearly indicate which certification schemes are applied to which segments of the value chain. Indeed, CIR 2022/996 specifies that the sustainability and GHG emissions savings characteristics shall be documented and passed on from economic operator to economic operator through the supply chain to be included in the documentation accompanying the physical shipments of raw material or fuels (art. 18 (1) and (2)). Therefore, the final consumer should have access to this information and know whether different certification systems were used upstream.

All this information will also have to be entered into the Union database in order to ensure traceability (although implementation is still pending as of April 2025 (ISCC, 2025)). However, only aggregate data shall be made publicly available, due to the protection of commercially sensitive information (RED III, art. 31a (6)). The Commission shall in addition publish and make publicly available annual reports about the data contained in the Union database, including the quantities, geographical origin, and feedstock types for the production of fuels (ibid.). To improve clarity, this could be supplemented with information on the proportion of biofuels or RFNBOs certified under the various schemes at different stages of the value chain. This would provide the needed transparency for stakeholders to engage with the European Commission and economic operators on questions related to sustainability certification.

5.3 Need for a transparent EC recognition procedure for certification schemes

The lack of transparency in the recognition process followed by the EC for bioenergy certification schemes has been identified as problematic and was criticised by the ECA (see section 3.3.2). During the first wave of recognitions over 10 years ago, the EC failed to check both the schemes' governance and the non-mandatory criteria (such as on social aspects) proposed by some schemes, even though it had the power to do so. CIR 2022/996 has improved the situation when it comes to the governance of the schemes themselves, but not the transparency of the recognition process by the EC. A look at the EC's dedicated webpage shows that no assessment report has so far been published with regard to the qualities of the certification schemes requesting validation, neither for bioenergy schemes nor for RFNBO schemes. Also, no information about such assessments has been included in the final decisions published so far either (see, for instance, the decision validating ISCC EU as an EC-RFNBO certification scheme, EC, 2024d). By making the assessment report on the certification schemes recognition procedure accessible to the public, the EC could enhance transparency and, consequently, credibility.

5.4 Strengthening of oversight to mitigate the risk of fraud, boost transparency and ensure a functioning complaint system

As section 3.3 details, the fight against fraudulent behaviour against the EU bioenergy sustainability framework over the past couple of decades has proven to be challenging. If fraud is to be avoided, it is essential that some of the problems identified are resolved, such as the lack of on-site controls. While improvements to the certification and audit regime have been implemented with CIR 2022/996 and its entry into force in early 2024, as highlighted earlier, it remains to be seen whether this will reduce the frequency of fraud (see section 3.3.1). It is particularly important that auditors regularly conduct controls on-site, in order to track infractions of the established criteria.

That said, it should also be noted that it will be easier to control and prevent fraud in the case of RFNBOs than with bioenergy producers. While the bioenergy supply chain often relies on a large number of producers (typically farmers), renewable hydrogen is expected to come from a smaller number of large-scale, industrial facilities. Also, while bioenergy can be produced from a wide range of feed products (palm oil, wheat, rapeseed, soy beans, etc.), RFNBOs only use water and electricity. As a result, renewable hydrogen should be easier to control.

In addition to the aforementioned point, CIR 2022/996 (art. 17) reinforces and further specifies the control powers that Member States have over certification schemes and auditing bodies. This provision requires that certification entities provide documents as required by the EC and Member States in order to control their activities and to prepare reports. It also requires Member States to cooperate both with each other and with third countries to improve the supervision of the certification entities (CIR 2022/996 art. 17 (3), (4), and (5)). Moreover, Member States are required to provide comprehensive information to the European Commission to support its reporting obligations, in contrast to the 2023 Union bioenergy sustainability report, which documented only a limited number of fraud cases (see sections 3.2 and 3.3.2). It is crucial that both the EC and Member States make use of their control and reporting powers in order to ensure more transparency in the fields of both bioenergy and renewable hydrogen, and to improve the fight against fraud.

Finally. as highlighted in section 3.3.2, a specific complaint system was not in place in the certification system of bioenergy during the past decade. CIR 2022/996 is also designed to facilitate improvements in this area. It stipulates, that voluntary schemes shall establish complaint procedures on their websites and that these procedures shall ensure the protection of persons who report infringements or lodge complaints. Indeed, in response, most voluntary schemes have introduced such mechanisms. However, certification schemes are left with a discretionary margin on how they should deal with complaints and whether they should impose sanctions on economic operators or auditing bodies. To ensure that complaint systems fulfil their intended function, it will therefore be important that the EC and Member States make use of their existing power to request “all documents related to a complaint and its handling” from certification schemes (CIR 2022/996, art. 5 (4)). This oversight function is likely to play an important role in maintaining the credibility of the overall certification system.

5.5 Importance of internationally harmonized definitions and methodologies

The lack of harmonised and unambiguous definitions and methodologies as well as comparable data poses another challenge (see section 3.3.3). For renewable hydrogen, this poses a real risk, given the current use of different terminologies (green, clean, low-carbon) to assess the attributes of hydrogen based on the different certification schemes (Gallegos, 2024, p. 9 - 10; Riemer, 2022, p. 3). This raises concerns about the comparability of data—such as greenhouse gas emissions—and, potentially in the future, other environmental or social indicators. It also creates uncertainty regarding the quality of the final products being traded and contributes to the development of a fragmented international market. There is a risk that hydrogen and its derivatives from different processes could be labelled as sustainable, despite certain processes being significantly less sustainable than others. As the case of bioenergy has shown, a lack of harmonised definitions hampers information sharing and reporting about a product, enables fraud, and does not build trust.

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