

Briefing Paper on the regulatory context for defining green hydrogen and its certification



Grant agreement no.: 633107

Deliverable No. 2.1

“Briefing Paper on the regulatory context for defining green hydrogen and its certification”

Status:

Final

Dissemination level:

“PU - Public”

Last update:

1 July 2015



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Date: 1 July 2015

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1 Introduction

The Annex I Work plan of CertifHy foresees under Task 2.1. among others a review of relevant EU legislation for defining green hydrogen. The focus is to be put on, notably, requirements for the characterisation of green gas, highlighting current criteria and parameters used to distinguish energy carriers with respect to climate and energy objectives. Moreover, an overview of relevant stakeholders to be engaged in a later stage of the project is to be prepared.

This Briefing Paper seeks to introduce the “yeast” of recent EU legislation and Commission communications on the qualitative assessment of energy carriers, without going into detailed technical issues. In addition, information on requirements stipulated by EU legislation regarding consumer disclosure of renewable energy (electricity) and Renewable Energy Guarantees of Origin schemes will be presented in this Briefing Paper. This may be put to good use in the WP2 survey activities and WP3 tasks.

The Paper is structured as follows. Chapter 2 succinctly reviews the essence of selected EU legislation to the extent that this is of relevance for defining green hydrogen. Some relevant Commission documents are dealt with in Chapter 3. EU legislation on renewable energy guarantees of origin and ‘green’ energy disclosure is explained in Chapter 4. Chapter 5 presents preliminary observations on possible criteria which green hydrogen has to meet.

2 Relevant EU legislation for defining green hydrogen

2.1 Treaty on the Functioning of the European Union

European primary law, the Treaty on the functioning of the European Union (TFEU) or 'Lisbon Treaty' has a specific chapter on energy. Main aims of the EU's energy policy are (TFEU, Article 194(1)):

- To ensure the functioning of the energy market
- To ensure the security of supply in the Union
- To promote energy efficiency and energy saving, and develop new and renewable forms of energy
- To promote the interconnection of energy networks.

In TFEU, Article 194 (2) it is stated that:

“Such measures [to achieve the aims above] shall not affect a Member State's right to determine the conditions for exploiting its energy resources, its choice between different energy sources and the general structure of its energy supply, without prejudice to Article 192(2)(c)”

where Article 192(2)(c) allows the Council acting unanimously and under certain conditions for environmental reasons to take measures significantly affecting a Member State's choice between different energy sources and the general structure of its energy supply.

In conclusion, in general Member States have the right, among others, to make choices on the energy mix of their respective energy supply, based on the subsidiarity principle. Yet, under special conditions the Council can adopt, for environmental reasons, measures on the energy mix that encroach to a certain, well-defined extent on a Member State's right to do so autonomously. All in all, the TFEU specifies the choice of energy mix as a shared competence between the Commission and the Member States with – at least for the time being – a major role for the subsidiarity principle. As far as areas such as fuel quality are concerned, including environmental and climate change characteristics, the TFEU appears to provide a solid legal basis for the Commission to claim its competence, over and above the subsidiarity principle.

2.2 Renewable Energy Directive

This section will set out amongst other things which requirements are imposed by the Directive 2009/28/EC on the use of energy from renewable sources, often referred to as the RES Directive or the Renewable Energy Directive (RED). It establishes a common framework

for, notably, the use of energy from renewable sources in order to limit GHG emissions and to promote cleaner transport.¹

Definition of renewable sources

‘Energy from renewable sources’ means energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases. In this connection, ‘biomass’ means the biodegradable fraction of products and waste and residues from biological origin from agriculture including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste.

Renewables targets

Each member State has a target share of energy from renewable resources in its gross final energy consumption for 2020. Moreover, the share of energy from renewable resources used in the transport sector must amount to at least 10% of final energy consumption in this sector by 2020. This target applies to all Member States.

Preamble 18: the 10% target for transport relates to renewable sources as a whole and not from biofuels alone.

Art 5(1) The gross final consumption of energy from renewable sources in each Member State shall be calculated as the sum of:

- a) gross final consumption of electricity from renewable energy sources;
- b) gross final consumption of energy from heating and cooling; and
- c) final consumption of energy from renewable sources in transport.

Gas, electricity and hydrogen from renewable energy sources shall be considered only once for target accounting.

Sustainability issues

Preamble 65 states that biofuel production should be sustainable. Biofuels used for (target compliance) and those that benefit from national support schemes, should therefore be required to fulfill sustainability criteria. Preamble 66 adds: “The sustainability criteria should also apply to bioliquids (in the heating and electricity sectors) in general”. Preamble 69 becomes more specific in that: “ The increasing worldwide demand for biofuels and

¹ This section is based on the following website:
http://europa.eu/legislation_summaries/energy/renewable_energy/en0009_en.htm

bioliquids should not have the effect of encouraging the destruction of biodiverse lands. Biofuels and bioliquids can qualify for the incentives only when it can be guaranteed that they do not originate in biodiverse areas (e.g. primary forests, certain highly biodiverse grasslands).” Preamble 70 adds on land use that: “The full carbon effects of such conversion (land use change and (preamble 85) indirect land-use changes) should be accounted for in calculating the greenhouse gas emission saving of particular biofuels and bioliquids.

Preamble 80 states that: “It is necessary to lay down clear rules for the calculation of greenhouse gas emissions from biofuels and bioliquids and their fossil fuel comparators.” In Preamble 81 further exigencies are specified: “Co-products from the production and use of fuels should be taken into account in the calculation of greenhouse gas emissions for the regulation of individual economic operators the energy allocation method is the most appropriate method (as against the substitution method)”.

The RES Directive takes into account energy from biofuels and bioliquids, if they meet certain GHG emission reduction norms as specified in the next paragraph. Art. 19 of the RES Directive sets methodological requirements for GHG reduction calculations.

Biofuels and bioliquids are produced using raw materials coming from outside or within the community. Biofuels and bioliquids should not be produced using raw materials from land with high biodiversity value or with high carbon stock. To benefit from financial support they must be qualified as sustainable in accordance with the criteria of the RES Directive. These are (Art 17 (2)-(6)):

- The GHG savings shall be at least 35% and with effect from 1 January 2017 50% and - for biofuels and bioliquids produced in installations in which production started on or after 1 January 2017 — with effect of 1 January 2018 at least 60%
- Support-eligible biofuels and bioliquids shall not be made from raw material obtained from land with high biodiversity value, nor land with high carbon stock, nor from land that was peat land in January 2008
- Agricultural raw materials cultivated in the Community and used for the production of support-eligible biofuels and bioliquids shall be obtained under good agricultural practice, viz. in accordance with the requirements and standards as indicated under the heading ‘Environment’ in part A and in point 9 of Annex II to Council Regulation (EC) No 73/2009 and in accordance with the minimum requirements for good agricultural and environmental condition defined pursuant to Article 6(1) of that Regulation.

Other issues

Preamble 28 stipulates that: “The Community and the MAS should strive to reduce total consumption of energy in transport and increase energy efficiency in transport”.

2.3 Fuel Quality Directive²

Directive 2009/30/EC, known as the Fuel Quality Directive (FQD), regards the specification of automotive fuels petrol, diesel and gas-oil³ and a mechanism to monitor and reduce greenhouse gas emissions (GHGs). It amends Directive 98/70/EC.

The FQD sets common fuel quality rules. Common fuel quality rules are an important element in, among others, reducing greenhouse gas emissions from transport. They also ensure that air pollutant emissions from vehicles are optimally reduced, a single fuel market is established and vehicles operate correctly everywhere in the EU.

The FQD imposes annual reporting requirements on Member States to monitor progress in complying with the Directive. Among others, it mandates rules to calculate life cycle GHG emissions from biofuels (Art 7a(3); Art 7d). The Commission is mandated to submit every three years a report on the implementation of the FQD, accompanied, where appropriate, by a proposal for amendments to this Directive (Art. 9)

The FQD requires a reduction of the greenhouse gas intensity of the fuels used in vehicles by 6% by 2020 (Art 7a(2)(a)). This legislation also regulates the sustainability of biofuels (Articles 7b and 7c, which are consistent with the RED). It has previously led to drastic reductions in the sulphur content of fuels, enabling the deployment of vehicle technologies to reduce greenhouse gas and air pollutant emissions, and delivering substantial health and environmental benefits. The FQD applies to all petrol, diesel and biofuels used in road transport, as well as to gasoil used in non-road-mobile machinery.

The greenhouse gas intensity of fuels is calculated on a life-cycle basis, meaning that the emissions from the extraction, processing and distribution of fuels are included. Direct life-cycle greenhouse gas emission reductions are calculated from a 2010 baseline of fossil fuel greenhouse gas intensity.

The 6% reduction target is likely to be achieved through the use of biofuels, electricity, the use of less carbon intense, often gaseous, fossil fuels and a reduction of flaring and venting at the extraction stage of fossil fuel feedstocks. This implementing measure proposes a methodology for calculating the greenhouse gas intensity of fossil fuels.

For biofuels to count towards the greenhouse gas emission reduction targets they must meet certain *sustainability criteria* set out in the Directive to minimise the undesired impacts from their production. The calculation of greenhouse gas emissions for biofuels is stipulated in the FQD in consistency with the RED. Also in line with the RED, the FQD imposes the following requirements:

² This section draws on website: http://ec.europa.eu/clima/policies/transport/fuel/index_en.htm

³ Used for *inter alia* non-road mobile machinery and agricultural tractors.

- Greenhouse gas emissions must be at least 35% lower than from the fossil fuel they replace. From 2017, this will increase to 50% and, from 2018, the saving must be at least 60% for new installations;
- The raw materials for biofuels cannot be sourced from land with high biodiversity or high carbon stock.

As global demand for biofuels rises, their production can contribute to the conversion of land such as forests and wetlands into agricultural land, leading to increased greenhouse gas emissions. These emissions from *indirect land use change* (ILUC) can significantly reduce or even wipe out the greenhouse gas savings from biofuels.

To account for this, in October 2012 the European Commission proposed amending the FQD and the RED to include ILUC factors in the reporting of the greenhouse gas emission savings from biofuels under the directive.

Food-based biofuels and bioliquids often contribute to land conversion. The Commission has therefore also proposed limiting the amount of food-based biofuels that can be counted towards the EU's target of reaching a 10% share of renewable energy in the transport sector by 2020. The proposed limit for food-based biofuels is 5%, the current consumption level.

This limit will allow non-food based biofuels to make a greater contribution to meeting the 10% target. Second- and third-generation biofuels produced from materials that do not create an additional demand for land, including algae, straw and various types of waste, have low or no ILUC emissions.

More information and useful documents relating to biofuels and indirect land use change can be found under the documentation and studies tabs above.

Besides reducing the greenhouse gas intensity of fuels, the legislation also governs other elements of fuel quality primarily linked to *air pollutant emissions*. Thanks to the mandatory introduction of sulphur-free fuels under the directive, by 2009 the average sulphur content of petrol and diesel was below 10 ppm.

2.4 Concluding remarks

The RED provides a definition of renewable sources. Green hydrogen has to comply with this definition to be eligible in principle for renewable energy target accounting and for renewable energy support. Green hydrogen should not be double-counted for, *inter alia*, these purposes.

Moreover, the RED provides broadly formulated criteria for the sustainability of biofuels and bioliquids, including:

- these should not have the effect of encouraging the destruction of biodiverse lands, including (biodiversity-adverse) indirect land-use changes;
- for support and target accounting purposes, GHG savings by biofuels and liquids have to meet certain progressively higher standards;
- in calculating GHG savings, effects of direct and indirect land-use changes have to be taken into account.

As food-based biofuels and bioliquids often contribute to land conversion, upper limits to food-based biofuels of 7% of the road-transport fuel mix has been agreed upon. Evidently, the ILUC (indirect land-use change) criterion will be less relevant for green hydrogen to the extent that (i) if produced from biomass, it will be produced from non-food materials such as wood residues and (ii) hydrogen will most likely not be produced from biofuels and bioliquids. But the GHG and other sustainability standards for the production of biofuels and bioliquids might be extended to green hydrogen as well.

The RED also states that in general due attention is to be paid to energy efficiency considerations. In this respect, one could think of criteria related to well-to-wheel energy and/or GHG efficiency for green hydrogen, if and when used for transport purposes. Both the RED and the FQD provide mutually consistent prescriptions for GHG emissions impact calculations. The FQD requires a GHG intensity reduction of the fuels used in vehicles by 6% by 2020.

3 Some European Commission communications, relevant for defining green hydrogen

3.1 COM(2012) 595 on a proposal for an amended Fuel Quality Directive

RES Directive 2009/28/EC established mandatory targets to be achieved by 2020 for a 20% overall share of renewable energy in the EU and a 10% share for renewable energy in the transport sector. Directive 2009/30/EC, an amendment to the first Fuel Quality Directive 98/70/EC, introduced a mandatory target to achieve by 2020 a 6% reduction in the greenhouse gas intensity of fuels used in road transport and non-road mobile machinery. This proposed second revision of the first Fuel Quality Directive seeks to start the transition to biofuels that deliver substantial greenhouse gas savings when also estimated indirect land-use change emissions are reported. The aims of the proposal are:

- Limit the contribution that conventional biofuels (with a risk of ILUC⁴ emissions) make towards attainment of the targets in the RES Directive. A 7% limit has now been agreed upon proposed in Article 3(4)d of the to be amended RED.
- Improve the GHG performance of biofuel production processes (reducing associated emissions) by raising the GHG saving threshold for new installations subject to protecting installations already in operation on 1st of July 2014
- Encourage a greater market penetration of the advanced (low-ILUC) biofuels by allowing such fuels to contribute more to the targets in the RES Directive than conventional biofuels
- Improve the reporting of GHG emissions by obliging MS and fuel suppliers to report the estimated ILUC emissions of biofuels.

Main features of the proposal include:

- The introduction of reporting estimated emissions from carbon stock changes caused by ILUC for the purposes of reporting the life cycle GHG emission savings from biofuels
- A review process to ensure that this methodology is updated and adapted in the light of scientific developments
- An increase of the minimum GHG saving threshold with effect from 1st July 2014
- Simplification of the calculation of GHG savings for European biofuel producers.

⁴ Indirect land use changes

3.2 COM(2012) 749 Ninth annual monitoring report on quality of petrol and diesel (reporting year 2010)

The first Fuel Quality Directive, Directive 98/70/EC, requires the Commission to publish an annual report on fuel quality in the MS. At the time of writing this memorandum, COM (2012) 749 is the most recent one. It summarises MS' submissions on the quality of petrol and diesel, as well as the volumes sold, for 2010. The main quality parameters on which average values and exceedances are monitored, are: research/motor octane number (RON/MOM), summer vapour pressure, distillation/evaporation at 100/150⁰C and the maximum sulphur content. For diesel the main parameters where exceedances were identified were sulphur content, distillation 95% point and cetane number.

3.3 COM(2014) 617 on a proposal for a Council Directive on laying down fuel quality related calculation methods and reporting requirements

The proposal elaborates the (proposed) mechanism for the Commission to monitor and reduce GHG emissions from biofuels. The main features are:

- The use of one average default value to represent the unit GHG intensity per fuel type
- Harmonised annual reporting by suppliers to MS and MS to the Commission needed for monitoring the reduction of GHG emissions in the Union and for updating the calculation methods to technical and scientific progress.

3.4 Concluding remarks

This chapter summarized some proposals on fuel quality related calculation methods for GHG emissions. To the extent that GHG reduction performance of green hydrogen will be a criterion, it is in order to bring the calculation methods to be applied in line with methods to calculate GHG emissions reporting of biofuels. Alternatively, at least divergences in calculation methods should be pointed out and justified.

Finally it is in order to mention that evolving emission standards for e.g. automotive fuels (Euro 6 norm according to Regulation 715/2007/EC) and light-duty passenger vehicles (130 g CO₂/km as per 2015 according to Regulation (EC) No 443/2009 and a Commission proposal of 95 g/km for 2020) may become a significant driver of hydrogen use in the transport sector, although not by definition green hydrogen.

4 Legislation on renewable energy guarantees of origin and 'green' energy disclosure

In this chapter current EU legislation regarding guarantees of origin of the sources for renewable electricity and for renewable heating or cooling will be set out. Moreover, information is presented about prevailing EU legislation on electricity disclosure. This encompasses legal requirements and options for disclosing ('the greenness' of) the electricity mix and marketed 'green electricity' products. These issues are covered by the Renewable Energy Directive in Section 3.1 below and the Electricity Market Directive in Section 3.2.

4.1 The Renewable Energy Directive

The currently prevailing Renewable Energy Directive (RED), Directive 2009/28/EC, establishes a common framework for, notably but not only, the use of energy from renewable sources in order to limit greenhouse gas emissions and to promote cleaner transport. It is in order to refer to its precursor, Directive 2001/77/EC, first as this Directive introduced the concept of Guarantees of Origin (GoO) for the first time.

Directive 2001/77/EC on the concept of Guarantee of Origin

Preamble 10 states: "This Directive does not require Member States to recognize the purchase of a guarantee of origin from other Member States or the corresponding purchase of electricity as a contribution to the fulfilment of a national quota obligation. However, to facilitate trade in electricity produced from renewable energy sources and to increase transparency for the consumer's choice between the electricity produced from non-renewable and electricity produced from renewable energy sources, the guarantee of origin of such electricity is necessary. Schemes for the guarantee of origin do not by themselves imply a right to benefit from national support mechanisms established in different Member States. It is important that all forms of electricity produced from renewable energy sources are covered by such guarantees of origin. Preamble 11 adds: "It is important to distinguish guarantees of origin clearly from exchangeable green certificates."

The main text sets out in Article 5 the legal meaning of a "Guarantee of origin of electricity produced from renewable energy sources" according to Directive 2001/77/EC, viz.:

1. Member States shall ensure that the origin of electricity produced from renewable energy sources can be guaranteed as such within the meaning of this directive according to objective, transparent and nondiscriminatory criteria laid down by each member State. They shall ensure that a guarantee of origin is issued to this effect in response to a request.

2. Member States may designate one or more competent bodies, independent of generation and distribution activities, to supervise the issue of such guarantees of origin.
3. A guarantee of origin shall:
 - specify the energy source from which the electricity was produced, specifying the dates and places of production, and in the case of hydroelectric installations, indicate the capacity;
 - serve to enable producers of electricity from renewable energy sources to demonstrate that the electricity they sell is produced from renewable energy sources within the meaning of this Directive.

Such guarantees of origin, issued according to paragraph 2, should be mutually recognized by the Member States, exclusively as proof of the elements referred to in paragraph 3. Any refusal to recognize a guarantee of origin as such proof, in particular for reasons relating to the prevention of fraud, must be based on objective, transparent and non-discriminatory criteria. In the event of refusal to recognize a guarantee of origin, the Commission may compel the refusing party to recognize it, particularly with regard to objective, transparent and non-discriminatory criteria on which such recognition is based.

Member States or the competent bodies shall put in place appropriate mechanisms to ensure that guarantees of origin are both accurate and reliable and they shall outline the measures taken to ensure the reliability of the guarantee system.

After having consulted the Member States, the Commission shall consider the form and methods that Member States could follow in order to guarantee the origin of electricity produced from renewable energy sources. If necessary, the Commission shall propose to the European Parliament and the Council the adoption of common rules in this respect.

Moreover, in the third footnote to indicative targets for year 2010 in the Annex of Directive 2001/77/EC an implicit remark is made on target accounting: “The percentage contributions of RES-E in 1997 and 2010 are based on the national production of RES-E divided by the gross national electricity consumption. In the case of internal trade of RES-E (with recognized certification or origin registered) the calculation of these percentages will influence 2010 figures by Member State but not the Community in total.

Directive 2009/28/EC

Whilst its precursor leaves some room for other purposes such as target accounting, the RED stipulates consumer disclosure as the only function of a “renewables guarantee of origin” (RE-GoO). Some relevant parts of the RED for the purposes of the CertifHy project are highlighted below.

Preamble 52 states that Guarantees of Origin (GoO) issued for the purpose of this Directive have the sole function of proving to the final customer that a given share or quantity of energy was produced from renewable sources. A GoO can be transferred, independently of the energy to which it relates, from one holder to another. Double counting and double disclosure of GoO should be avoided. Energy from renewable sources in relation to which

the accompanying GoO has been sold separately by the producer should not be disclosed or sold to the final customer as energy from renewable sources. It is important to distinguish between green certificates used for support schemes and guarantees of origin. Preamble 53 adds that MS should be able to require electricity suppliers who disclose their energy mix to final customers in accordance with Article 3(6) of Directive 2003/54/EC to include a minimum percentage of GoO from recently constructed installations. In repetition of preamble 11 of its predecessor, preamble 56 of the RED states that GoO do not by themselves confer a right to benefit from national support schemes.

Article 15 of the main text of the RED expands on the role of RE-GoO. It states the following:

For the purposes of proving to final customers the share or quantity of energy from renewable sources in an energy supplier's energy mix in accordance with Directive 2003/54/EC, MS shall ensure that the origin of electricity produced from renewable energy sources can be guaranteed as such within the meaning of this Directive, in accordance with objective, transparent and non-discriminatory criteria. To that end, MS shall ensure that a GoO is issued in response to a request from a producer of electricity from renewable energy sources. MS may arrange for GoO to be issued in request from producers of heating and cooling from renewable energy sources. Such an arrangement may be made subject to a minimum capacity limit. A GoO shall be of the standard size of 1 MWh. No more than one GoO shall be issued in respect of each unit of energy produced. MS shall ensure that the same unit of energy from renewable sources is taken to account only once. MS may provide that no support be granted to a producer when that producer receives a guarantee of origin for the same production of energy from renewable sources. The GoO shall have no function in terms of (target accounting). Any use of a GoO shall take place within 12 months of production of the corresponding energy unit. A GoO shall be cancelled once it has been used. MS or designated competent bodies shall supervise the issuance, transfer and cancellation of GoO. The designated competent bodies shall have non-overlapping geographical responsibilities, and be independent of production, trade and supply activities. MS or the designated competent bodies shall put in place appropriate mechanisms to ensure that GoO shall be issued, transferred and cancelled electronically and are accurate, reliable and fraud-resistant. A GoO shall specify at least:

- a) the energy source from which the energy was produced and the start and the end dates of production;
- b) whether it relates to electricity, or to heating or cooling;
- c) the identity, location, type and capacity of the installation where the energy was produced;
- d) whether and to what extent the installation has benefitted from investment support, whether and to what extent the unit of energy has benefitted in any other way from a national support scheme, and the type of support scheme;
- e) the date on which the installation became operational; and
- f) the date and country of issue and a unique identification number.

- An electricity provider may prove the share or quantity of energy from renewable sources in its energy mix for disclosure purposes (Directive 2003/54/EC) by using its GoO.
- MS shall recognize GoO issued by other MS exclusively (for disclosure purposes). It may only refuse to do so when it has well-founded doubts about its accuracy, reliability or veracity. The MS shall notify the Commission of such a refusal and its justification. If the Commission finds that such refusal is unfounded, the Commission may adopt a decision requiring the MS in question to recognise the GoO concerned.
- A MS may introduce — in conformity with Community law — objective, transparent and non-discriminatory criteria for the use of GoO in complying with disclosure obligations (Ref: Directive 2003/54/EC, Art. 3(6)). Where energy suppliers market energy from renewable sources to consumers with a reference to environmental or other benefits of the energy from renewable sources, MS may require those energy suppliers to make available, in summary form, information on the amount or share of energy from renewable sources that comes from installations or increased capacity that became operational after 25 June 2009.

4.2 The Electricity Market Directive

Directive 2009/72/EC, often referred to as the Electricity Market Directive (EMD), establishes common rules for the generation, transmission and distribution of electricity. It repeals the precursor of the EMD, Directive 2003/54/EC. The EMD lays down the rules relating to the organisation and functioning of the electricity sector, access to the market, the criteria and procedures applicable to calls for tenders and the granting of authorisations and the operation of systems. It offers a framework for the transition towards a liberalised, EU-wide Internal Electricity Market, in which in principle market actors across the Union can participate in a non-discriminatory, level-playing field fashion, but with safeguards for the protection of interest of retail customers.

For the purposes of the CertifHy project it is of significance that the EMD stipulates:

- in Art. 2(30) that ‘renewable energy sources’ means renewable non-fossil energy sources (wind, solar, geothermal, wave, tidal, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases);
- in Art. 3(7) that (the Member States) shall ensure high levels of consumer protection, particularly with respect to transparency regarding contractual terms and conditions, general information and dispute settlement mechanisms. [Note that disclosure of the supplier’s electricity mix is not explicitly stated under consumer protection. Nor is this done explicitly in Annex I to Directive 2009/72/EC on Consumer Protection.]
- in Art. 3(9) that Member States shall ensure that electricity suppliers specify in or with the bills and in promotional materials made available to final customers:
 - (a) the contribution of each energy source to the overall fuel mix of the supplier over the preceding year in a comprehensible and, at a national level, clearly comparable manner;

- (b) at least the reference to existing reference sources, such as web pages, where information on the environmental impact, in terms of at least CO₂ emissions and the radioactive waste resulting from the electricity produced by the overall fuel mix of the supplier over the preceding year is publicly available;
- (c) information concerning their rights as regards the means of dispute settlement available to them in the event of a dispute.

As regards points (a) and (b) with respect to the electricity obtained via an electricity exchange or imported from an undertaking situated outside the Community, aggregate figures provided by the exchange or the undertaking in question over the preceding year may be used.

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

4.3 Concluding remarks

In the first legal definition of the concept of guarantee of origin of electricity produced from renewable energy sources (RE-GoO), as laid down in Directive 2001/77/EC, the regulator less successfully sought to grapple with its purpose. The regulator, after a fierce controversy on whether to harmonise national approaches to support schemes, stated that RE-GoO are to facilitate trade in electricity produced from renewable energy sources and to increase the transparency for the consumer's choice. On the other hand, Directive 2001/77/EC states that: "it is important to distinguish guarantees of origin clearly from exchangeable [tradable] green certificates". To further add to confusion, in the Annex to Directive 2001/77/EC it is stated that internal trade of RES-E with recognised certification of the origin registered will influence target accounting results. Hence this Directive envisaged three GoO functions:

- Facilitation of RES-E trade (without further elaboration)
- Increase the transparency for the consumer's choice (without further elaboration)
- Target accounting in connection with EU-internal RES-E trade.

However, the Directive discards Tradable Green Certificates as guarantees (i.e. certificates) of origin. All in all, Directive 2001/77/EC failed to provide a fully logical and comprehensive concept.

The final and official version of the RED made a logically consistent choice, i.e. to restrict the purpose of a RE-GoO merely to proving to final customers the share or quantity of energy from renewable sources in an energy supplier's energy mix in accordance with Directive

2003/54/EC [later replaced by Directive 2009/30/EC]. As a result: “Guarantees of Origin (GoO) issued for the purpose of [the RED] have the sole function of proving to the final customer that a given share or quantity of energy was produced from renewable sources”.⁵

Furthermore, the RED provides (i) details to be certified by a RE-GoO and (ii) guidelines for the operation and supervision of national electronic platforms for administrating issuance, transacting and cancellation of RE-GoOs.

The EMD provides details suppliers have to disclose to their final customers on (the renewable feature of) the fuel mix underlying the total quantity of electricity they delivered the preceding calendar year. Also information on the environmental impact thereof in terms of CO₂ produced and radioactive waste should be disclosed.

As far as the definition of green hydrogen is concerned, it is fundamental how the guarantee of origin of green hydrogen is to be conceptualised at all by the present project and if so how it will be conceptualised. First it needs to be identified which purpose(s) it is to endorse. Next it is to be decided how this is to be done in a logically consistent way. Questions to be answered include:

- Should the GoO scheme to be proposed for hydrogen enable to prove the following:
 - Proving that a certain quantity of hydrogen was produced from a renewable energy source?
 - Proving that a certain quantity of hydrogen was produced from a renewable energy source for the sole function of consumer disclosure?
 - Proving that a certain quantity of hydrogen was produced from an energy source with a specific GHG emission (e.g. kg of CO₂-equivalent per MWh of hydrogen)?
 - Proving that a certain quantity of hydrogen was produced from an energy source with specific air pollutant emission levels (e.g. kg of a certain air pollutant emission per MWh of hydrogen)?
 - Proving that a certain quantity of hydrogen was produced in a highly efficient way?
- If the last question is to be answered positive should certain attribute standards be defined, e.g. a minimum share of renewables, a maximum level of CO₂eq. emissions, etc. for hydrogen specialty products, as differentiated by origin? And if positive, should these standards apply uniformly at EU-level or differentiated at national level?

⁵ In consecutive draft of the RED until just a few days before its political adoption at the end of the comitology procedure, the Commission proposed a (logically consistent) comprehensive concept (with opt-out options). Such an approach (if without opt-out options) was proposed for the first time in a one-page article: Jaap Jansen (2003): *A green jewel box?* Environmental Finance, page 27, March 2003. This was further elaborated in chapter 5 of: J.C. Jansen, K. Gialoglou, C. Egenhofer (2005): *Market Stimulation of renewable Electricity in the EU. What Degree of Harmonisation of Support Mechanisms is required?* CEPS Task Force report no. 56. Brussels. October 2005.

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- If attribute standards for specialty hydrogen products will have to be defined, should the CertifHy project have to attach a label to these products, e.g. green or low carbon or should this be left to market forces?
 - If left to market forces, should hydrogen GoO be the only way to prove compliance with set standards or to prove certain hydrogen product claims? If affirmative, a comprehensive hydrogen GoO tracking system would be necessary.

Regarding the set-up of a credible GH-GoO system, lessons will be drawn from experience gained from the operations of other energy-related certification systems in WP3 of the CertifHy project.

5 Conclusions

The challenge that the CertifHy project will address is to propose a well-founded definition of green hydrogen and to provide recommendations for the design of a green hydrogen Guarantees of Origin system. However, it cannot be excluded that policy and legal requirements for a (green) hydrogen Guarantees of Origin system at EU and MS levels will evolve over time. *Therefore, it is important to propose a future-proof Guarantees of Origin system with factual GoO attributes information that will enable market parties to define (e.g. dark green or light green) hydrogen specialty products.* By cancelling (surrendering) certain GoOs for which the underlying volume of hydrogen and its origin can be verified by the number of GoOs and the attribute information they contain, information disclosed by market parties concerning the delivery and use of hydrogen specialty products can be checked.

In contrast, it stands to reason to accommodate claims of specialty hydrogen products by way of the attributes of hydrogen GoOs. Based on the *acquis communautaire*⁶ regarding inter alia power disclosure and auto-motive fuels, the following *possible criteria for certification/ quality monitoring of hydrogen, and consequently the attributes a hydrogen GoO should be mandated to endorse*, can be identified:

- The renewable energy sources with which the hydrogen was produced with specification of details on their origin. Refer to the RED.
- GHG emissions per volume unit of hydrogen over the whole hydrogen supply chain. Refer to the RED and the FQD.
- Local pollutant emissions per volume unit of hydrogen over the whole hydrogen supply chain. Refer to the FQD.
- Specific attention for scores on sustainability criteria and parameters regarding the raw materials of bio-based hydrogen. Refer to the RED and the FQD.
- Energy efficiency is broadly correlated with per unit GHG and local pollutant emissions. A direct energy efficiency indicator as GoO attribute might be contemplated. Refer to the RED.
- Application of credible calculation methods to establish the values of the aforementioned parameters with due regard to calculation methods prescribed by:
 - Prescribed by Article 19 of the RES Directive
 - Prescribed by Articles 7a(3) and 7d of the revised Fuel Quality Directive 2009/30/EC
 - Proposed by COM(2012) 595 and COM(2014) 617.

⁶ The accumulated legislation, legal acts, and court decisions which constitute the body of European Union law.

Note that to the extent that biogas has been used for the production of hydrogen, in general the 60% GHG reduction standard - poised to be in force as of year 2018 - will have to be met.

The following fictitious case might apply:

- Quantity 1 of one hundred units of hydrogen that is produced by electrolysis from electricity generated by a combination of, say, 90% lignite-based electricity and 10% wind power
- Quantity 2 of one hundred units of hydrogen that is produced by natural gas.
- A 10% share of quantity 1 might be claimed to be 'green', whilst 0% of quantity 2 might be claimed to be green, whereas the CO₂ footprint of the total of quantity 2 might be much lower than that of the total quantity 1.

This fictitious case and disclosure experience with the RED suggest the following regarding EU-wide tracking of the origin of hydrogen:

- Mandate the attributes a hydrogen GoO has to endorse as a minimum, based on approved outcomes of the analysis of criteria they have to accommodate
- Introduce a comprehensive mandate to cover all hydrogen in the EU market by a hydrogen GoO tracking system. This will greatly improve the accuracy and trustworthiness of claims regarding the origin of hydrogen
- Mandate the disclosure of origin of any quantity of hydrogen transacted and the average origin of all hydrogen transacted by producers and suppliers of hydrogen in a certain Member State
- Mandate a standard label that has to be used for any hydrogen specialty product and 'grey'(non-specialty) hydrogen transacted or referred to in commercial messages. No attributes of specialty hydrogen products may be used in calculating the average values of attributes in the standard label of grey hydrogen transacted or used.
- The specification of any standard hydrogen label for a certain quantity of hydrogen need to be proved by the cancellation of the corresponding amount of GoO with the aggregate attribute values, corresponding with the label disclosed.

The suggested tracking and disclosure procedure accommodates proper reporting of a high carbon footprint of the grey hydrogen transacted by the producer of quantity 1 in the fictitious example above.

A remaining issue is whether in the case of quantity 1 of hydrogen 10% will be allowed to be disclosed to originate from wind power or that for the whole quantity average attribute values should be disclosed. If the RED is to be followed regarding the reporting of the biodegradable fraction of municipal waste as being renewable, the answer is affirmative. We note that the compromise decision on the biodegradable part as laid down in the Renewable Electricity Directive 2001/77/EC was made after protracted negotiations.