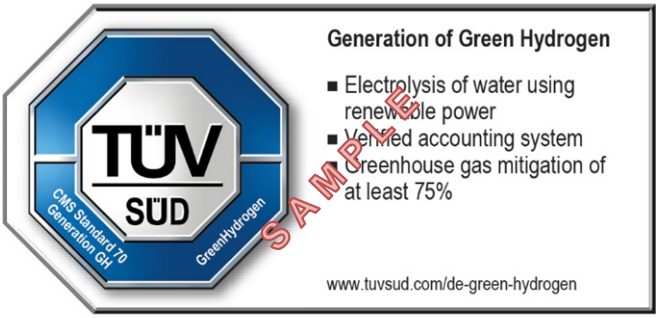
Industrie Service

TÜV SÜD Standard CMS 70

Production of green hydrogen (GreenHydrogen)



TÜV SÜD Standard CMS 70
GreenHydrogen

Content

Changes compared to previous versions

11/2021	Basic applicability for all generation processes for the production of hydrogen from renewable energies, such as electrolysis or pyrolysis/gasification of biomass or biogenic residues,
	Consideration of the program requirements of ISO 17029
	Division into basic requirements and additional requirements
	Standardisation of GHG reference values
	Consideration of requirements as formulated in principle in REDII
	Claims requirements
	Negligibility for energy/GHG balancing is regulated
	Precise system boundaries
	Use of green hydrogen for heating and cooling purposes with lower GHG emission thresholds
	Sustainability requirements for biomass, biomethane, glycerine
	Market value-based allocation is permitted in the GHG calculation, enthalpy-based allocation is omitted.
01/2020	General: Various editorial adjustments/precedents
	Revision regarding REDII
	Isolated revision due to CertifHy; e.g. enthalpy-based allocation according to BAT if hydrogen is by-product.
	Adaptation of the required power quality to the requirements of the TÜV SÜD standard "Product EE01
	Adjustments regarding mass-balanced or certificate-based deliveries of certified green hydrogen
12/2017	General: Various editorial adjustments/precisions of otherwise unchanged criteria
	Addition of another hydrogen generation process: Electrolysis of saline solution (chlor-alkali electrolysis?)
	Compression of the generated green hydrogen to at least 30 bar for the GHG balancing
	Addition of the technology mix option
	Clarification on the accounting methodology Energy allocation
	Addition of the requirements for the certification scheme

Abbreviations

Biofuel NachV	Ordinance of the Federal Republic of Germany on requirements for the sustainable production of biomass for use as fuel of 30.09.2009
CMS	TÜV SÜD Industrie Service GmbH, Carbon Management Service
EEG	German Renewable Resources Act
EU	European Union
LCA	Life Cycle Assessment
LOHC	Liquid Organic Hydrogen Carrier
BAT	Best Available Technology - Best Available Technology
REDII	EU Directive 2018/2001
GHG	Greenhouse gases

Terms and definitions

Green hydrogen	Hydrogen produced from renewable energy sources or/and waste as well as residual materials/by-products in accordance with this standard.
GreenHydrogen	Certified hydrogen according to the TÜV SÜD Standard GreenHydrogen in compliance with the requirements for the certificate holder and the basic requirements for hydrogen
GreenHydrogen+	Certified hydrogen according to the TÜV SÜD Standard GreenHydrogen in compliance with the requirements for the certificate holder and basic and additional requirements for hydrogen
Renewable energy	energy from renewable, non-fossil energy sources, i.e. wind, solar (solar thermal and photovoltaic), geothermal, ambient, tidal, wave and other ocean energy, hydropower, and energy from biomass, landfill gas, sewage treatment plant gas and biogas; biogenic fraction from household and industrial waste, certified renewable hydrogen
Biomass	Biomass is defined as the biodegradable fraction of products, wastes and residues of biological origin from agriculture and forestry (plant and animal substances) and from their further processing, as well as biodegradable fractions of waste including industrial and municipal waste of biogenic origin; peat is not considered as biomass under this standard.
Biogas	biomethane, gas from biomass, landfill gas, sewage treatment plant gas, as well as hydrogen produced by water electrolysis and synthetically produced methane, if the electricity used for electrolysis and the carbon dioxide or carbon monoxide used for methanation can both be shown to originate from renewable energy sources.
Biomethane	Biogas upgraded to natural gas quality and ready to be fed into the natural gas grid.
Mass balanced	Mass-balanced certified hydrogen is a product for the production of which renewable raw materials (apart from electricity) were verifiably used in the value chain and the certified hydrogen quantities are delivered in the form of hydrogen. For mixing reasons, physically certified hydrogen does not necessarily have to be detectable in the delivered hydrogen. The supply contract always includes both physical hydrogen and the associated green quality. Physical hydrogen and green quality are not traded separately at any time.
Sustainability	Biomass or biomethane is considered sustainable if the criteria for the sustainability of biofuels and bioliquids according to REDII are met.
Produktionscharge / production batch	A production batch is the hydrogen produced by a hydrogen production installation between any two points in time selected by the certifier of that production installation for which the quantity of certifiable hydrogen is calculated.
Greenhouse gases	Greenhouse gases in the sense of the Kyoto Protocol are CO_2 , CH_4 , N_2 O, HFCs, PFCs, SF_6,NF3, each with current values of relative global warming potential according to IPCC. Greenhouse gases in the sense of the European Renewable Energy Directive are CO_2, CH_4 and N_2 O with the relative greenhouse potentials 1 (CO_2), 25 (CH_4) and 298 (N_2O) (each in t $CO_{2Äq}$/t GHG) defined therein.
Swap transactions	Swap transactions are trading transactions in which both a supply contract and a purchase contract for hydrogen are concluded with the same trading partner for the identical delivery quantity and delivery period only with the difference that one contract includes the green attribute and the other does not. De facto hydrogen is neither delivered in one direction nor in the other, but only the green attribute / certificate is transferred from one trading partner to the other. Swap transactions are thus equivalent to certificate-based deliveries.
Certificate-based (book & claim)	In the case of purely certificate-based certified hydrogen, it is permissible to market the physical hydrogen and the "green" properties/proofs/certificates for the certified hydrogen separately. The produced hydrogen may only be used or passed on as hydrogen of fossil origin, while the green attribute remains available for marketing and can be transferred to conventionally produced hydrogen.

Foreword

According to current scientific knowledge, greenhouse gas emissions are the cause of anthropogenic climate change. Climate change is the greatest challenge of our time. Today, climate change is already causing great economic damage and problematic human fates. Against this background, greenhouse gas emissions should be avoided or reduced from the outset.

The significant reduction of greenhouse gas emissions is therefore also crucial in the production and use of hydrogen, which is seen as a promising energy carrier of the future.

- can be produced from renewable energies,
- has no CO_2- and only very low emissions of air pollutants during combustion,
- can be transported by pipeline
- has good storage capacity and
- is suitable as a starting material for further derivatives (e.g. synthetic methane, methanol, ammonia).

Beyond the current applications (e.g. in the chemical, mineral oil and steel sectors), hydrogen will increasingly be used in the transport sector and as a storage medium for renewable energy (power to gas). For this - as well as for other mobile and stationary applications - it is to be demonstrated that hydrogen produced from renewable sources has significantly lower greenhouse gas emissions than conventionally produced hydrogen or fossil fuels.

The present standard is based on European legislation but is in principle applicable worldwide.

This standard assumes that existing national regulations or those of an association of states for the production of hydrogen from renewable energies are complied with in the countries concerned. If no such regulations exist in countries, the basic requirements formulated in this standard apply.

A certificate for the production of hydrogen from renewable energy sources can be issued if the basic requirements are met and the hydrogen has a greenhouse gas reduction potential of at least 70 percent compared to a fossil fuel benchmark for fuels or combustibles. The certification mark GreenHydrogen can be used for this purpose.

Beyond the basic requirements, additional requirements are formulated in the standard. If these additional requirements are met, TÜV SÜD's GreenHydrogen+ certification mark can be used in addition to the certificate. GreenHydrogen+ can also be used.

The additional requirements are intended to ensure that, as the use of hydrogen increases, the necessary expansion of renewable energies is promoted and additional bottlenecks are avoided as far as possible in technical, temporal and spatial terms.

Developments are underway in the European Union (EU) to develop and establish a guarantee of origin system for hydrogen from renewable energy[1]. When this guarantee of origin system is fully operational, established and widely accepted, it is intended that this system will be used for the verification of hydrogen produced from renewable sources (H_2-GO) in the associated verification systems. It is intended that the TÜV SÜD GreenHydrogen certification standard will be recognized as an independent criteria scheme from that time and in those countries that have joined the H_2-GO scheme, and can then be shown as an additional quality on an H_2-GO.

Should fully functional, established and widely recognised guarantee of origin systems for hydrogen from renewables emerge outside the European Union, the aforementioned will apply analogously.

With the additional requirements of this "GreenHydrogen+" standard, the certified hydrogen has in particular the following additional features compared to a mere guarantee of origin system[1]:

- Mass balanced
- Electricity from renewable energies from new plants
- Simultaneity between electricity generation from renewable energy and electricity consumption of the electrolyser
- Avoidance of grid bottlenecks when supplying electricity between the regenerative power generation plant and the electrolyser
- Increased requirements for the use of certified hydrogen for heating purposes only.

1. Scope of application, system limits and basics

1.1. Scope of application

This standard defines requirements for the production (generation) and marketing of hydrogen using renewable energies. The standard can be applied worldwide. Hydrogen is designated as GreenHydrogen if the requirements for the certificate holder

[1] see http://certifhy.eu/

and the basic requirements are met in accordance with this standard.

The basic requirements are initially the national regulations existing in the respective country or those of the associated association of countries. If no such regulations exist, the basic requirements specified below must be complied with.

The smallest unit of quantity for certified hydrogen is 1 MWh based on the lower calorific value.

1.2. Technologies

In principle, there are no restrictions on the applicable technologies for regenerative hydrogen production as long as the basic requirements of the standard are met. Technologies for the production of hydrogen as a by-product are also applicable.

The following procedures are understood to be common:

1. Electrolysis of water using electricity from renewable sources
2. Steam reforming of sustainable biomethane
3. Pyrolysis/gasification of sustainable biomass or sustainable, biogenic residues (e.g. glycerine)
4. Electrolysis of aqueous solutions of hydrogen chloride (hydrochloric acid) and aqueous alkali chloride solutions using electricity from renewable sources.

In addition to regenerative hydrogen production, "Carbon Capture and Storage CCS" can be applied for remaining CO_2 emissions if an environmental impact assessment accepted by the competent authority is available in accordance with the requirements of EU Directive 2009/31/EC, which, among other things, proves that the carbon is sufficiently permanently bound and appropriate monitoring is carried out for this.

"Carbon Capture and Utilization CCU" and derived negative CO_2 emissions can only be applied if it can be demonstrated beyond reasonable doubt that fully fossil carbon is replaced in equivalent quantities and double counting can be excluded.

1.3. Usages

Certified hydrogen may be used for mobility applications, for material use (e.g. steel production, hydrogenation of oils, production of artificial fertilisers) or as a storage medium for energy use.

Certified hydrogen for the purpose of steam/heating or cooling production shall achieve a 70 % greenhouse gas reduction compared to the fossil fuel benchmark of 80 g CO_{2eq}/MJ.

1.4. System boundaries

The system boundary for fulfilling the basic requirements is the production plant, including ancillary units such as water treatment, on-site energy supply, hydrogen purification, up to the filling/weighing point or injection into a gas network or transfer point at the pipeline. The production of the energy and feedstocks biomethane, biomass, glycerine, waste, LOHC and ammonia is outside the system to be certified unless adequate evidence is not available. The processing, storage, compression/liquefaction and other processing steps up to the delivery of the hydrogen at the plant gate or injection into a hydrogen network or natural gas network are within the system boundary.
The system limit for the hydrogen to be certified is up to the achieved purity of at least 99,9 % and up to the achieved overpressure of at least 3,0 MPa.

1.5. Standards and legal bases

a. Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (Renewable Energy Directive II), hereinafter: REDII;

b. Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 of the European Parliament and of the Council, Regulation (EU) 2018/1999 of the European Parliament and of the Council and Directive 98/70/EC of the European Parliament and of the Council as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652

c. EN ISO 14067:2018 Greenhouse gases - Carbon footprint of products - Requirements and guidance for quantification (ISO 14067:2018);

d. DIN EN ISO 14040 Environmental management - Life cycle assessment - Principles and framework;

e. DIN EN ISO 14044 Environmental management - Life cycle assessment - Requirements and guidance.

f. DIRECTIVE 2009/31/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC and Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC and 2008/1/EC of the European Parliament and of the Council and Regulation (EC) No 1013/2006

1.6. Validity

The present standard (version 11/2021) is valid from 01.12.2021.

The previous version of this standard (version 01/2020) can still be used for initial certifications until 30.11.2022.

Certificate holders have time after the introduction of a revised standard until the next upcoming re-certification to adapt their certified system to the requirements of the revised standard, but at least 12 months. The re-certification audit following the expiry of this period is carried out on the basis of the revised standard.

2. Communication and use of advertising claims / assertions[2]

In the case of advertising statements in connection with certification, the requirements of the TÜV SÜD Group's Testing and Certification Regulations must be observed. If the certification is publicly announced, all statements made in this context must be covered by the certification in terms of content. No misleading communication may be made. Certification marks may be used by the certificate holder and by purchasers or redistributors provided that they have concluded a certification mark use agreement with the TÜV SÜD Certification Body and comply with the requirements set out therein.

The following statements on certified hydrogen can be communicated:

Certified hydrogen produced with renewable energies and emitting x% less greenhouse gases compared to the reference value of fossil production.

Green hydrogen certified according to TÜV SÜD GreenHydrogen *Standard.*

GreenHydrogen *certified by TÜV SÜD*

In case of passing on only proofs without delivery of hydrogen[3]:
Proof of production for green hydrogen certified according to TÜV SÜD GreenHydrogen *Standard.*

GreenHydrogen *production certificate certified by TÜV SÜD.*

Any claims/statements/claims deviating from this should be agreed with the certification body of TÜV SÜD Industrie Service.

3. Requirements for the certification scheme

3.1 General

The certification program meets the requirements of ISO 17065 and ISO 17029 as well as ISO 19011.

3.2 Requirements for conformity assessment bodies

The conformity assessment body shall present a valid accreditation or official authorisation for

- have certifications of products, processes or services (e.g. according to standards ISO/EIC 17065
  or
- Validation/verification bodies according to ISO 17029

The conformity assessment body shall have a competence management system for the personnel involved in the certification process according to ISO 17065 or ISO 17029.

The evaluating personnel (auditor) shall demonstrate qualification as an external auditor according to ISO 19011 or equivalent.

The Conformity Assessment Body shall have established a dedicated hydrogen certification area/scope.

The auditors must be trained for this hydrogen sector and the certification of hydrogen from renewable energies and must have completed at least 3 trainee audits before they are appointed as auditors.

Conformity assessment bodies assessing conformity according to this TÜV SÜD standard must notify the certification body of TÜV SÜD Industrie Service GmbH in advance and demonstrate compliance with the aforementioned requirements.

3.3 Certification cycle, certification process flow

The certification cycle is divided into certification audits and surveillance audits. The certification audit mainly examines systems, processes, tools, etc., while the surveillance audit examines compliance with the requirements of the standard in the previous accounting period and any changes to the system compared to the certification audit, and verifies the quantities of hydrogen produced and the GHG emissions. As a rule, the certification cycle

[2] Assertion / Claims in the sense of ISO 17029

[3] In the case of green hydrogen certified as certificate-based, the buyer and the public must not be given the impression that the certified hydrogen is also supplied physically/mass-balanced or that the hydrogen supplied comes from the plant that uses the certificates for its hydrogen supply.

consists of a certification audit, two annual surveillance audits (at least once within 12 months after the certification audit) and a re-certification audit (3 months before the expiry of the validity of the certificate or the validity of the conformity assessment) or the final audit.

The certification process with the individual process steps is based on the requirements of ISO 17029 Section 9.
Even before the audit, a document check must be carried out, in which the greenhouse gas balance is an essential test component.
An exemplary audit plan with a document list and with the activities for collecting evidence is set out in
Annex I Audit Checklist.
Minimum contents of the monitoring manual and monitoring report are set out in Annex II Monitoring Manual and Monitoring Report.
The structure of the audit report is set out in Annex II Audit Report.
A model of the certificate is set out in Annex IV Model Certificate.

3.4 Risk assessment

Conformity assessment bodies shall maintain a risk management system for testing, assessment and decision making. This shall include an analysis of the risk of non-conformity of the certificate holder with the present standard. The risk analysis shall consider at least the following indicators:

a. Degree of certainty to be obtained
a. Number of company locations
b. Complexity of the company and manufacturing processes relevant to the audit
c. structural and procedural organisation
d. Outsourcing
e. Corporate culture with regard to quality and safety as well as error communication (existence of a quality-assuring management system)
f. Qualification of personnel and personnel management
g. Result of previous assessments
h. internal control mechanisms
i. Monitoring and effectiveness of internal control measures
j. Reporting of controls
k. Misleading claims or misuse of certification marks

The risk analysis shall be used to determine the quantity and depth of testing to be performed. This concerns at least:

a) Audit type
(b) verification of measurement data and original supporting documents
c) Checking of business transactions (purchase / sale)

In addition, the inspection frequency must be used to determine whether additional inspections are necessary during the year.

3.5 Materiality

The threshold for data materiality has been defined taking into account that information is material if the outcome of the assessment could be changed by omitting, misstating or misreporting that information. Accordingly, this standard defines the threshold for materiality of energy inputs as a total of 5% based on the amount of energy sold or, for non-energy inputs, based on total GHG emissions.

3.6 Confidence threshold / degree of certainty

Conformity assessment is based on a decision taken at initial certification, without confirmation of compliant hydrogen quantities, with limited assurance and with reasonable assurance during surveillance and closure audits. Conformity assessments confirming compliant hydrogen quantities based only on a limited assurance decision are not permitted under this standard.

3.7 Record keeping requirements

Notwithstanding the requirements of ISO 17029 in clause 9.11, the project-specific document checklist, audit plan, checklist/audit notes, audit reports, audit evidence, review report and certification decision shall be documented and retained securely for 10 years.

4. Requirements for the certificate holder

4.1 Certification scope

The scope of certification must be documented in writing by the certificate holder and forms the basis of the certification contract. A change in the scope of certification must be applied for again in writing. At least the following must be taken into account:

- Production process
- Generation sites with total output and average total annual work done
- Purpose of production
- Energy sources used
- Owner of the plant
- Mode of transport, transport routes

- Service providers that perform functions relevant to certification.
- First marketer of the GreenHydrogen attribute

The certificate holder may nominate other companies to be added to the scope of certification, provided that they fulfil the condition of being contractually associated with the certificate holder and assume the corresponding obligations arising from the certification; e.g.

- resellers of the GreenHydrogen, provided they market the certified product (sub-certificate holders).

4.2 Organization and documentation

The certificate holder appoints an audit representative who provides all the necessary information for certification and is responsible for communicating the certification requirements within the company.

The certificate holder undertakes to provide at least the following documents and information at the beginning of the certification process:

- A description specifying the process for producing the green hydrogen in the required detail (concept description, block diagram).
- GHG accounting with all assumptions, calculations and sources for determining the greenhouse gas emissions. The calculations must be fully documented, verifiable and comprehensible. Uncertainties or estimates must be named and explained.
- Monitoring Manual, which regulates the process and responsibilities for the determination, reporting and quality assurance of the data relevant to certification for monitoring. This also includes a detailed monitoring plan that regulates how the parameters to be determined are measured, recorded, quality assured and documented. In justified exceptional cases, calculations may be used instead of measured data. All relevant data or data used or measured in the calculations shall be documented.
- Accounting for the amount of GreenHydrogen produced, stored and sold.
- forecasts of production and sales volumes for the current year and the following year.
- Verification of the required energy and input material quantities as well as for all GHG-relevant variables.

4.3 Monitoring

The certificate holder shall use a reliable procedure to continuously monitor and ensure coverage between generation, storage and delivery. It must be possible to exclude any double marketing.

The certificate holder has set up a monitoring system which is suitable for recording and documenting all incoming and outgoing energy and material flows. The monitoring system shall be integrated into the quality management system of the company. If no quality management system is in place, a quality management system suitable for ensuring compliance with the requirements of the standard must be set up for certification.

In order to determine the greenhouse gas balance and the generation quantities must:

- The electricity meters and natural gas meters are calibrated and calibrated according to the national regulations;
- the measuring equipment for hydrogen and other relevant substance streams shall be suitable, monitored and regularly calibrated;
- the calculations must be comprehensible and conservative;
- data collection and data management carried out in accordance with ISO 14040/14044 - Ecobalancing, unless otherwise regulated by law, and
- the monitoring and its evaluation must be consistent, accurate and plausible.

4.4 Rights and permissions

The certificate holder shall have the exclusive right to market the green hydrogen produced. The right may cover the entire production or a precisely defined share of a production source.

With the certification application, the certificate holder confirms that all relevant technical, legal and other prerequisites for the operation of the plants required for the production and preparation of hydrogen are fulfilled.

5. Basic requirements for hydrogen

5.1 Renewable and climate protecting

GreenHydrogen is hydrogen produced from renewable energy that also meets the criterion for greenhouse gas reduction potential. The greenhouse gas reduction must be at least 70 %[4] compared to the reference value for biofuels according

[4] see Article 25 REDII

to Annex V REDII of 94 g CO_{2eq}/MJ. This corresponds to a GHG value of 28.2 $gCO2eq/MJ_{Hi}$.

The system boundary for energy balancing is the production plant, including ancillary units such as water treatment, on-site energy supply, hydrogen purification, up to the filling/weighing point or feed into a gas network or transfer point at the pipeline.

The actual marketable production volume is certified. This results from the hydrogen produced minus any losses during processing, storage and transport.

5.2 Energy sources and input materials

Proof of the use of electricity from renewable sources must, unless the electricity is demonstrably generated and consumed on site or with direct line without using the general power grid, be provided by canceling guarantees of origin or comparable certificates (RECs) for the purpose of generating green hydrogen. Within the EU, the origin of the electricity must be proven in accordance with the RED (Guarantees of Origin GO).

Evidence of the use of biogas or biomethane must be provided by means of evidence from a national renewable gas register or equivalent.

The biogas/methane and other biomass used are certified as sustainable in accordance with REDII.

5.3 Mixed production

In production plants using renewable and non-renewable resources, only the share of hydrogen produced from renewable raw materials or renewable energy shall be taken into account in the calculation of the quantity of certified hydrogen.

For the purposes of this calculation, the contribution of each energy source shall be calculated on the basis of the energy content (using the net calorific value in the case of hydrocarbons).

5.4 Proportionate production

Certified hydrogen is the share of a production batch that corresponds to the share of energy from renewable sources in the total energy consumed by the hydrogen production plant for the production of the production batch in question.

5.5 Balance sheet period

The maximum balance period is 12 months. Within a balance period, the balance may be temporarily negative (temporarily more GreenHydrogen sold/delivered than produced). At the end of the balance period, however, the balance must be balanced by the production of corresponding quantities of certified hydrogen.

5.6 GHG emission threshold outside the accounting periods

If the hydrogen production plant was already in operation before the initial certification, the greenhouse gas emission value of the hydrogen of the production plant must be below the threshold value of 91 gCO2eq/MJ.[5] The accounting period to be used should preferably be 12 months and the start of the accounting period must not be more than 24 months prior to the initial certification. Compliance with this threshold must also be ensured during periods in which hydrogen production is not certified as GreenHydrogen.

The above threshold corresponds to a state-of-the-art steam reforming of natural gas in large plants.

5.7 Durability and usability

The evidence of the certified attribute can be used for a maximum of 12 months after the end of the production period. If the quantities of hydrogen produced are certified on an annual basis, the evidence shall be valid for the production year and for the following year.

5.8 Greenhouse gas balancing

The greenhouse gas balance for hydrogen shall meet the requirements of a Life Cycle Assessment (LCA) according to ISO 14040 and ISO 14044 as well as Annex V (biofuels, bioliquids and their fossil fuel comparators) and Annex VI (biomass fuels and their fossil fuel comparators) of REDII by applying them mutatis mutandis to hydrogen.

The LCA requirements are considered to be fulfilled if the balance has been carried out in accordance with the GHG Protocol, ISO 14067 or PAS 2050.

The accounting must be documented in writing, in particular all assumptions and allocations made for the calculation of the greenhouse gas balance.

The system boundary considered for determining the greenhouse gas impact of the hydrogen produced must include all life cycle stages extraction and processing of raw materials up to the production and delivery of a marketable product at the factory gate or feed-in to the hydrogen / natural gas grid (well to gate).

Emissions from the following activities are not included in the baseline requirements:

[5] See https://certifhy.eu/publications-and-deliverables.html

- Construction of the hydrogen production plant and associated plant components/auxiliary equipment,
- Transport and delivery of hydrogen to consumers,
- Administration and facility management
- Use/combustion of the hydrogen

The system boundary shall include all production stages necessary to achieve a hydrogen purity of at least 99,9 $\%_{vol}$ and an overpressure of at least 3 MPa.

If the hydrogen at the transfer point has a pressure lower than 3 MPa, the system boundary can be set to this transfer point if an additional energy consumption, which would be necessary to reach a pressure of 3 MPa, at an isentropic efficiency of 60 % and a single compression stage, is taken into account.

The greenhouse gas emissions of the electricity used for hydrogen production are considered to be zero for electricity from wind power, photovoltaics and hydropower.

For wastes and residues, life cycle GHG emissions up to the collection of these materials are considered to be zero. Further downstream processing and transport must be taken into account in the GHG accounting.

If hydrogen is produced as a by-product, such as in chlor-alkali electrolysis, it is possible to allocate the GHG emissions proportionally to the products (allocation). Both energy-based and market-value-based [6]allocation are permissible.
In the case of chlor-alkali electrolysis, the production technology oxygen depolarized cathode can alternatively be used as a "Best Available Technology BAT" value to determine a comparative value for allocation.

5.9 Negligible energy and material flows

Individual energy or material flows whose energy share and share of GHG emissions amount to less than 1 % of the total energy demand or total GHG emissions do not have to be continuously recorded and monitored, provided that these energy and GHG shares in total are at the same time less than or equal to 5 %. For these negligible energy and material flows, conservatively estimated values shall be used on a flat-rate basis.

[6] e.g. currently published average value of an industry association not further back than 3 years.

6. Additional requirements for hydrogen GreenHydrogen+

Compliance with the additional requirements for hydrogen GreenHydrogen+ requires compliance with the basic requirements under section 5.

6.1 System boundary GreenHydrogen+

The system boundary for fulfilling the additional requirements for hydrogen GreenHydrogen+ does not end at the producer's factory gate, but includes the transports and any conversions up to the delivery point to the customer or up to the delivery to the filling station. If the recipient of the certified hydrogen is not the end customer or consumer/user of the certified hydrogen, the latter must also be certified in accordance with this standard with regard to energy, greenhouse gas and mass balance when passing on certified hydrogen.

6.2 Renewable and climate protecting

Produced hydrogen for steam/heating or cooling production shall have a GHG reduction of at least 70 % compared to the biofuel reference value set out in Annex V REDII. This corresponds to a GHG value of 24 gCO_{2eq}/MJ_{Hi}.

6.3 Energy sources and input materials

Statutorily subsidised electricity from renewable energy that receives an increased payment per kilowatt hour fed into the grid (production support) is not recognised for GreenHydrogen+ unless it was purchased in a nationally regulated auction as defined by REDII.

6.3.1 For the use of electricity from renewable sources in an electrolyser, the following requirements shall also be met:

6.3.1a New installation

The renewable electricity production installation shall be commissioned at the same time as or after the hydrogen production installation. This means that renewable electricity installations shall be considered to have started up at the same time as the electrolyser if they started up no earlier than 11 months before the electrolyser, or after the electrolyser started up.

6.3.1b Grid supply and simultaneous generation:

Where electricity from renewable energy sources is purchased from the grid, the production of renewable electricity shall occur at the same time as the consumption of electricity for

the production of renewable hydrogen. It shall be demonstrated that

- the production of hydrogen takes place in the same quarter of an hour as the production of electricity from renewable energy sources[7], or that
- more electricity is generated from renewable energy sources in the bidding zone of the electrolyser in the single quarter hour than the average annual generation of the respective country two years before the production period.

6.3.1c Grid supply and regionality or avoidance of grid bottlenecks

At the time of commissioning of the electrolyser producing renewable hydrogen, there shall be no bottlenecks in the electricity grid between the electrolyser and the renewable electricity generating plant. The electricity generating plant shall be located in the same bidding zone as the electrolyser. If there are neither systematic bottlenecks in the electricity grid nor price differences between two bidding zones, the electricity-generating facility may also be located in an adjacent bidding zone.

6.3.2 For the material use of biomethane or biomass, the following must additionally be demonstrated:

For the production of certified hydrogen "GreenHydrogen+" from glycerine, other biomass (pyro-reforming) or from biomethane (steam-reforming), a mass balance sustainability proof according to REDII is required. This proof contains records that ensure traceability of these delivery quantities, the origin and sustainability of biomass.

6.4 Mass balanced delivery

GreenHydrogen+ must be delivered on a mass-balanced basis. The physical hydrogen and the certified renewable, climate-protecting (green) attribute must be marketed together (bundled) at all times.
For the mass-balanced delivery and purchase of "GreenHydrogen+", the corresponding delivery notes for hydrogen must also show the GreenHydrogen+ attribute.
Contractually, the hydrogen and the certified GreenHydrogen+ attribute must be marketed together.

On-balance sheet storage of produced/supplied but not marketed quantities of GreenHydrogen+ (residual quantities) or the transfer of green hydrogen from one balancing period to the next period is only possible to the extent that hydrogen storage facilities are physically available. The principle thus applies that only as much balance credit can be transferred from one balancing period to the next balancing period as is covered by physical hydrogen stocks at the site. If the amount of balanced GreenHydrogen+ in the balance exceeds the physical amount of hydrogen in the plant, only the physically existing hydrogen can be transferred to the next balance period.
The entire supply chain from the generating plant to the delivery to the end consumer is part of the scope of certification or must undergo a separate certification according to this standard or according to the TÜV SÜD Standard Accounting EE including GHG balancing. Mixing of certified green hydrogen and conventional hydrogen in tanks, tubes, gas cylinders and pipelines (stationary or mobile) is permitted, but swap transactions are not recognised for GreenHydrogen+.

6.5 Greenhouse gas balancing

The system boundary for balancing the greenhouse gases for hydrogen GreenHydrogen+ does not end at the producer's factory gate, but includes transport and any conversions up to delivery to the customer.

[7] The simultaneous generation can be proven by the certification according to TÜV SÜD Standard "Generation EE" module Generation EE+.

Annex I: Audit checklist

Audit checklist will be sent on request

Annex II: Monitoring Manual and Monitoring Report

Monitoring manual will be sent on request

Annex III: Structure of audit reporting
Outline of the report will be sent on request

Annex IV: Model of certificate

Certificate sample will be sent on request