Developing market opportunities based on certified sustainability

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Demand for hydrogen is on the rise, whether as a means of energy storage or as a replacement for natural gas. But only sustainably produced ‘green’ hydrogen is ecologically reasonable. However, there is still a lack of internationally standardised, mandatory criteria defining sustainability throughout the value chain. So how can producers and distributors prepare for EU-wide requirements and become marketable with the help of certification?

As the age of fossil energy carriers comes to an end, environmentally-friendly alternatives are taking on more significance. The German government believes that green hydrogen, produced using energy from renewable sources, will play a key role in the energy transition. This applies in particular to decarbonisation of industries, including heavy industries like steel or chemical production and parts of the transport sector such as aviation, maritime transport and heavy transport[1], whose energy demand cannot be covered solely by electricity from renewable sources.

However, Germany will not be able to cover the rising demand for hydrogen from its domestic production alone. Given this, in addition to expanding national production capacities, the German government is also funding international hydrogen projects to create additional import opportunities. A large part of the funds of the 'National Hydrogen Strategy' has been set aside for this purpose. The plan is to establish Germany as the lead market for H_2 technologies, which will be used in hydrogen-production plants throughout the member states of the EU as well as in third countries.

However, stakeholders have not yet been able to agree on a common definition of 'green' hydrogen. One of the reasons is that the requirements on origin and marketing differ depending on the market and legislation concerned.

Standardised regulations are expected

The EU has already taken a first step towards common criteria for the designation of hydrogen as 'green' and 'sustainable' for the fuel sector. The Renewable Energy Directive 2018/2001 (RED II) prescribes detailed requirements[2]. The goal is to save at least 70 per cent of greenhouse gases with renewable fuels of non-biological origin (RFNBO). These fuels include hydrogen, which is processed together with CO_2 into other climate-friendly fuels to power trucks, ships, and aircraft. Petrol station operators and other companies selling diesel or petrol are allowed to count it towards their renewable energy quota target.

This opens new opportunities for the marketing of green H_2 and marks an important step towards carbon neutrality for the industry. In accordance with the EU Commission's 2021 proposal for a revision of

RED II[3], in the future clear requirements should also be defined for industries that make products such as iron, steel, aluminium, chemicals and fertilisers as well as generating electricity and heat.

Two trading options

In the mass balance approach, hydrogen produced from renewable sources is distributed through the same infrastructure as conventional hydrogen. The quantities mixed along the value chain, for example during transport by truck or pipeline, are recorded and accounted.

This means that within one specific mass balance system, only the quantities of hydrogen that are actually produced using energy from sustainable sources will be labelled as certified green hydrogen and may be taken out of this mass balance system as certified green hydrogen. This enables the proportion of green hydrogen to be precisely identified at every step of the supply chain without the need for a separate infrastructure.

In contrast to mass balancing, the Book & Claim model separates the guarantee of origin, or certificate, from the physical flow of hydrogen. Like green electricity, producers obtain certificates for a defined quantity of green hydrogen. The economic operators that deliver the hydrogen to the end-users, e.g. suppliers, can then acquire these certificates.

In this way, they promote the production of sustainable hydrogen without necessarily acquiring it physically. The Book & Claim model only considers the emissions during production. The delivery of the hydrogen is not covered in the emission calculation.

EU project CertifHy

In 2014, a consortium of experts from the spheres of technology, politics and policymaking, and law launched the CertifHy project, the first EU-wide guarantee of origin (GO) system for green hydrogen. TÜV SÜD is one of the consortium partners in the project coordinated by HINICIO. The funding was provided by the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), a public private partnership supporting fuel cells and hydrogen in the EU, which was replaced by the Clean Hydrogen JU last year.

First available in 2017, the CertifHy system was aimed at increasing consumer transparency on an emerging growth market with increasing demand. Another objective of the project was to set incentives promoting the integration of renewable energies into processes in order to improve companies' carbon footprint. CertifHy uses the Book & Claim trading system, which means it considers only the emissions caused by hydrogen production. The maximum emission limit of sustainable hydrogen was set at 36.4 gCO_{2eq}/MJ_{H2} [4].

CertifHy offers two certification options for each requirement level: CertifHy GreenHydrogen, and CertifHy Low Carbon Hydrogen. The latter offers a low-threshold approach which can also be applied to hydrogen production that uses low-emission, conventional energy or carbon capture and storage (CCS). The associated register, in which producers can enter their certified H_2 quantities and transfer the certificates, is also called CertifHy.

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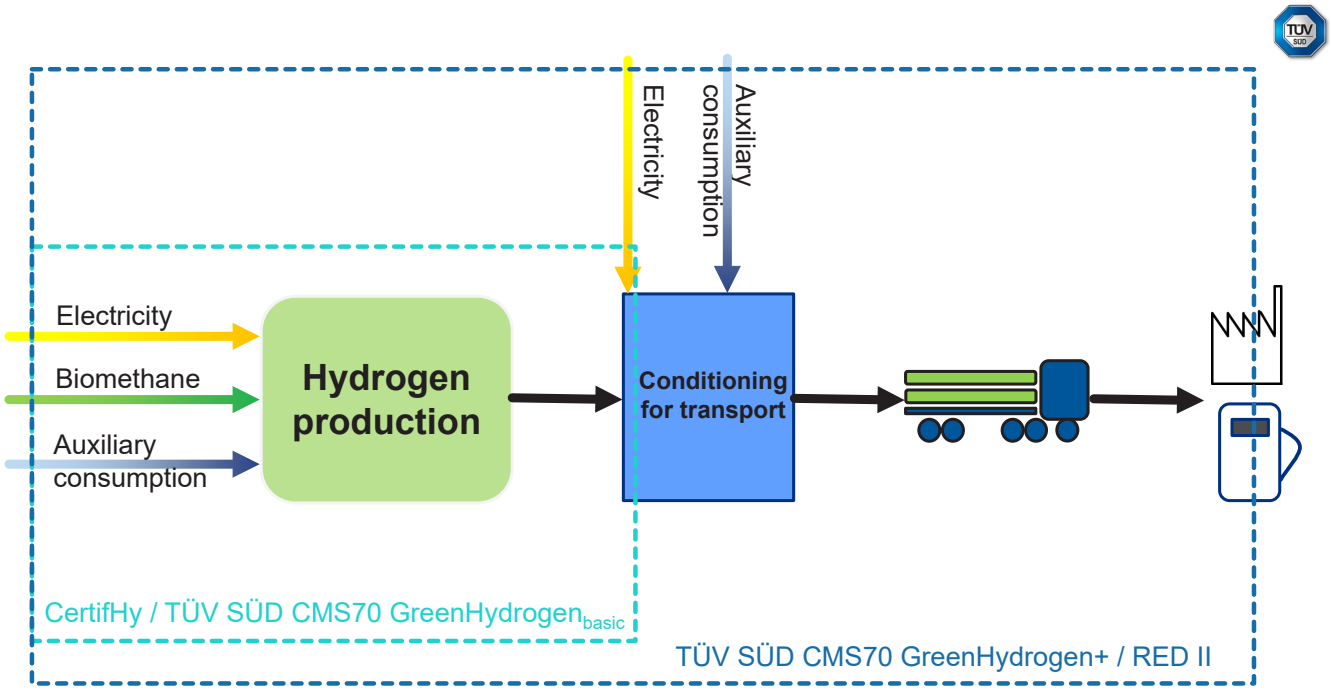
GreenHydrogen standard CMS 70

TÜV SÜD's GreenHydrogen standard CMS 70 establishes stricter requirements and looks at the entire production process[5]. The standard was introduced in 2011 and is based on the mass balance approach. Since 2021, the standard has also offered certification in accordance with the Book & Claim model. The CMS 70 standard also defines criteria for



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‘Distributors and producers thus promote environmentally compatible production of energy, thereby securing their competitiveness and viability in the future.’

the feedstock and energy used. It is internationally recognised and can be applied at global level.

It offers certification of the following processes. Electrolysis of water using electricity from renewable sources of energy; biogas, or biomethane, steam reforming; pyrolysis, or gasification and in-line catalytic reforming in waste incineration plants and electrolysis of saline solutions using electricity from renewable sources of energy.

For GreenHydrogen certification, the emissions caused by production, including upstream chains and preparation for transport, must not exceed the limit of 28.2 gCO_{2eq}/MJ_{H2}. This means that the hydrogen certified must reach a GHG reduction potential of at least 70 per cent compared to the reference value for biofuels defined in the Renewable Energy Directive (RED II).

The additional requirements of GreenHydrogen Plus include criteria for simultaneity between electricity generation and consumption, regionality and additionality of the electricity-generating plants, as well as the recording of greenhouse gases including transport and distribution to the end customers or filling stations. Even including downstream transport and distribution to end consumers/filling stations GreenHydrogen Plus must not exceed 28.2 gCO_{2eq}/MJ_{H2}.

Case study: emissions savings exceeded expectations by 50%

An operator of a PEM electrolysis plant, or proton exchange membrane, had itself certified according to the TÜV SÜD GreenHydrogen standard. The plant, which has a total output of 6 MW, obtains the electricity for the electrolysis stacks from hydroelectric and wind power. After generation, the hydrogen is first purified, then dried and finally temporarily stored. A smaller portion is compressed to 8 MPa for gas storage and later fed into the natural gas grid. This will be used to supply heat and as a substitute for natural gas. The larger part is further compressed to 22.5 MPa for filling lorries, which are used to supply H_2 filling stations.

TÜV SÜD experts verified the greenhouse gas balance from production and processing through the distribution routes to the end customer. The calculated emission value of 15 gCO_{2eq}/MJ_{H2} was not only almost 50 per cent below the required limit. The operator was also able to demonstrate an emission reduction of more than 80 per cent over the entire value chain compared to conventionally produced hydrogen.

Readiness for future challenges

It is already becoming apparent that proof of origin and sustainability will play a central role in the production and marketing of green hydrogen. Stakeholders that address future requirements at an early stage make sure that their hydrogen will be actually labelled ‘green’ and ‘sustainable’ when it is placed on the market later on. Distributors and producers thus promote environmentally compatible production of energy, thereby securing their competitiveness and viability in the future.

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