Relevance of Emission Accounting Methods for the Classification of Green Hydrogen

Kritische Rohstoffe und Kreislaufwirtschaft (Thema 8):
Lebenszyklusanalysen von Energietechnologien
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Motivation (Motivation und zentrale Fragestellung)

Legislation must define when hydrogen is considered low-carbon or "green" to establish the policy framework necessary for the ramp-up of green hydrogen. The EU taxonomy and a Delegated Act (DA) complementing the RED II provide thresholds for greenhouse gas (GHG) emission savings of hydrogen [1, 2, 3]. In the taxonomy, emissions accounting can be performed using either a Carbon Footprint (ISO 14067) based on Life Cycle Assessment (LCA, ISO 14040/44) or the methodology provided in the DA [4, 5, 6]. Therefore, a comparison of the methodologies is needed to show the practical implications of methodology choice and give policy recommendations.

Method and Data (Methodische Vorgangsweise)

The emission accounting methodologies are compared for hydrogen from Proton Exchange Membrane (PEM) electrolysis produced with different power sources, such as the German electricity mix and electricity from solar and wind. In general, the DA also pursues a life cycle approach which includes emissions from inputs, processing, transportation and the combustion of the fuel. However, there are the following methodological differences between the DA methodology as compared to LCA:

- GHG emissions from the manufacturing of production plants are excluded
- Electricity from renewables (as defined in RED II) accounts for zero GHG emissions
- Differentiation between elastic and rigid inputs: emissions due to the diversion of the input from previous use must be accounted for rigid inputs (only relevant for hydrogen-based fuels)

The system boundary of this analysis includes the production but excludes downstream emissions. Hence, for both methodologies transportation and distribution, the application and end-of-life emissions are not considered. The carbon footprint is expressed as Global Warming Potential (GWP) measured in kg CO_2-equivalents (eq.) per kg H_2. Data is provided from the Annex of the DA [2], the Umweltbundesamt [7, 8] and the LCA database ecoinvent [9]. The LCA model from the project BEniVer (FKZ: O3EIV116C) is used.

Results and Conclusions (Ergebnisse und Schlussfolgerungen)

Figure 1 shows that the GHG emission intensity calculated with DA methodology is lower than with LCA. Therefore, in practice, the DA methodology will prevail as an emission accounting methodology to classify hydrogen as taxonomy compliant, because it is easier to meet the threshold. However, if other business partners prefer an emission assessment in accordance with ISO standards (LCA), the same product might have to be assessed using two different methodologies, leading to additional expenses.

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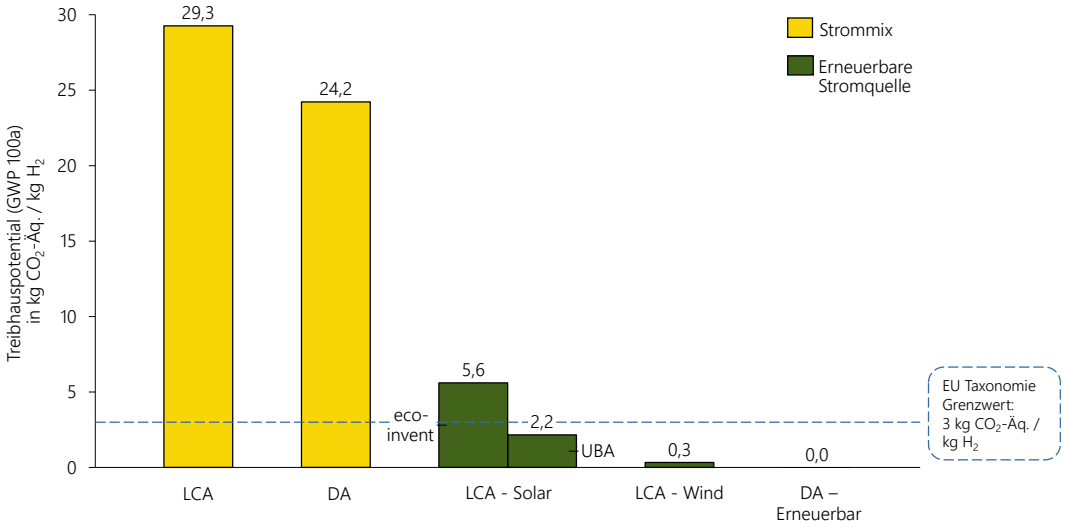

Figure 1: Carbon Footprint of hydrogen produced by PEM electrolysis with different electricity sources and accounting methods (LCA: Life Cycle Assessment; DA: Delegated Act) and using different data sources for upstream chain emissions of solar electricity (UBA [5]; ecoinvent [6])

It can further be seen that depending on the data source, the GHG emission intensity of hydrogen produced from solar power calculated by an LCA can either meet or exceed the threshold from the EU taxonomy. This indicates that the choice of data source has a significant impact and should therefore be standardized to increase comparability.

To address the identified issues the following options for policy actions are proposed:

- Increase comparability through standardization of the emission accounting methodology and the threshold for “green” hydrogen in regulations (e.g. within EU taxonomy)
- Provide an understandable methodology and sufficient assistance to enable application by non-LCA practitioners
- Provide standardized data sources (wherever possible)

Literature

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