

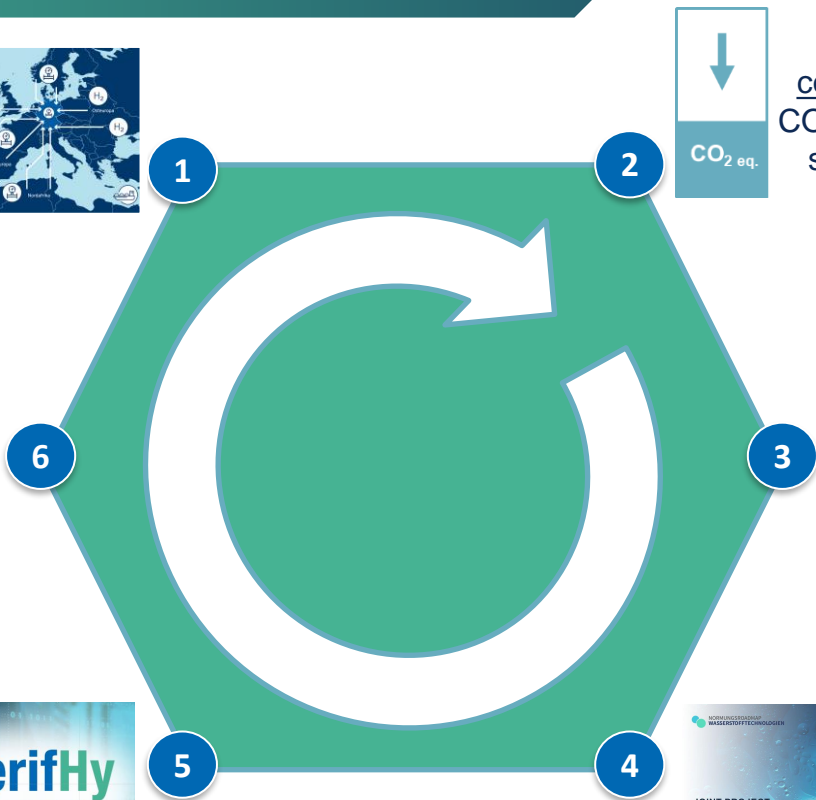
Regulation, Codes & Standards: A Guidebook into Hydrogen Trade

Role for Standards and benefits of a digital product passport

European Hydrogen Week, 20th November 2023

Prof. Dr. Gerald Linke, CEO DVGW

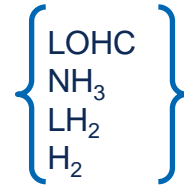
Survey of the different „standardization“ work needed for a successful transition towards a H2 economy



Trading partners:
Global & standardized
H2-ramp up

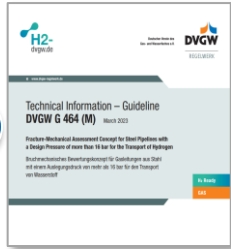


H2 as commodity:
CO₂ threshold standards



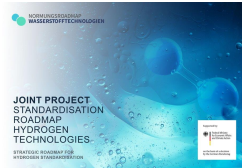
H2 alternatives:
Footprint methodology standards

Assessment of progress:
Standardized approach



The H2-infrastructure:
Safety standards

Logistic of change:
Transition standards



The H2 industrial appliances:
Production standards



1 Trade Platforms für Hydrogen

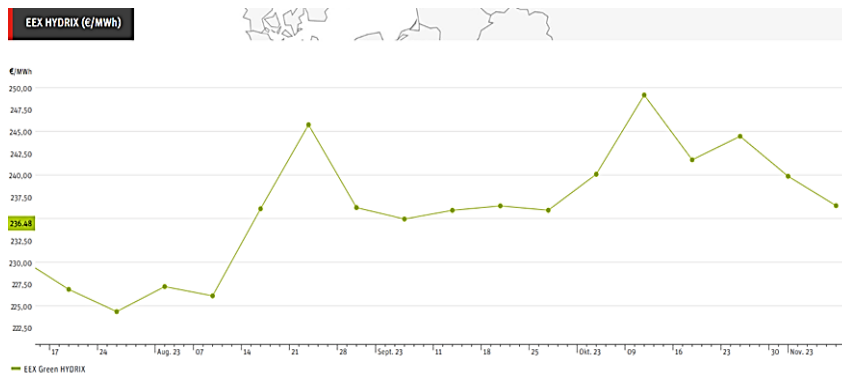
The H2Global Mechanism

- Electrolysis based hydrogen and derivatives, production in non-EU only
- Public Grant based Ramp-up mechanism, double auction model
- HINTCo: Government backed off-taker, concludes longterm supply purchase contracts and short-term demand sales contracts
- Difference will be compensated by grants, Analogy to CfD mechanism
- 5 Billion subsidies € (t.b.d)
- Hydrogen supply from 2024 on



HYDRIX by eex

- Stock exchange based price index for hydrogen
- Starts with electrolysis based hydrogen
- Takes price signals from the market participants to the platform – „Hydrogen Supporters“
- Hydrogen price is published once a week, as median from reported data
- Active since 2023



Certification for Renewable Hydrogen is a central prerequisite for a market ramp-up

Trade

- Clearly defined product qualities are necessary
- Guaranteed via hydrogen certificates or guarantees of origin (GO)
- Applies at national, European and international levels
- Certificate or GO increases the value of the hydrogen

Regulatory acceptance

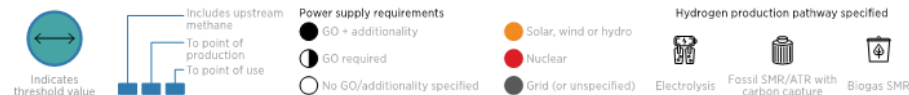
- Necessary for financial support of hydrogen projects
- Crediting of renewable hydrogen towards GHG reduction targets or GHG reduction quotas
- Emission values must be determined and certified, proof of sustainability must be provided

Green products

- Producers and suppliers must demonstrate green product qualities

TITLE	LABEL	EMISSIONS THRESHOLD (kgCO ₂ e/kgH ₂)	BOUNDARY	POWER SUPPLY REQUIREMENT FOR ELECTROLYSIS	HYDROGEN PRODUCTION PATHWAY	CHAIN OF CUSTODY MODEL
Australia Smart Energy Council Zero Carbon Certification Scheme	Renewable H ₂	No threshold	■ ■ ■ ■ ■	● ○ ○ ○ ●	☎ ☎	Unclear
China China Hydrogen Alliance Standard and Assessment for Low-carbon Hydrogen, Clean Hydrogen, and Renewable Hydrogen Energy	Renewable H ₂	4.9	■ ■ ■ ■ ■	○ ○ ○ ○ ●	☎ ☎	Not specified
	Clean H ₂	4.9	■ ■ ■ ■ ■	○ ● ○ ○ ○	☎ ☎	Not specified
	Low-carbon H ₂	14.5	■ ■ ■ ■ ■	n/a	☎	Not specified
European Union Certify Green and Low-Carbon Hydrogen Certification	Green H ₂	4.4	■ ■ ■ ■ ■	● ○ ○ ○ ●	☎ ☎	B&C
	Low-carbon H ₂	4.4	■ ■ ■ ■ ■	● ● ● ○ ○	☎ ☎	B&C
Germany TÜV SÜD CMS 70	Green H ₂ (non-transport)	2.7	■ ■ ■ ■ ■	● ○ ○ ○ ●	☎ ☎	B&C
	Green H ₂ (transport)	2.8	■ ■ ■ ■ ■	● ○ ○ ○ ●	☎ ☎	Mass
Japan Aichi Prefecture Low-Carbon Hydrogen Certification	Low-carbon H ₂	No threshold	■ ■ ■ ■ ■	● ○ ○ ○ ●	☎ ☎	B&C
International Green Hydrogen Organisation Green Hydrogen Standard	Green H ₂	1.0	■ ■ ■ ■ ■	● ○ ○ ○ ●	☎	Not specified

*Aligned with REDII methodology and may be updated once EU delegated act is finalised.



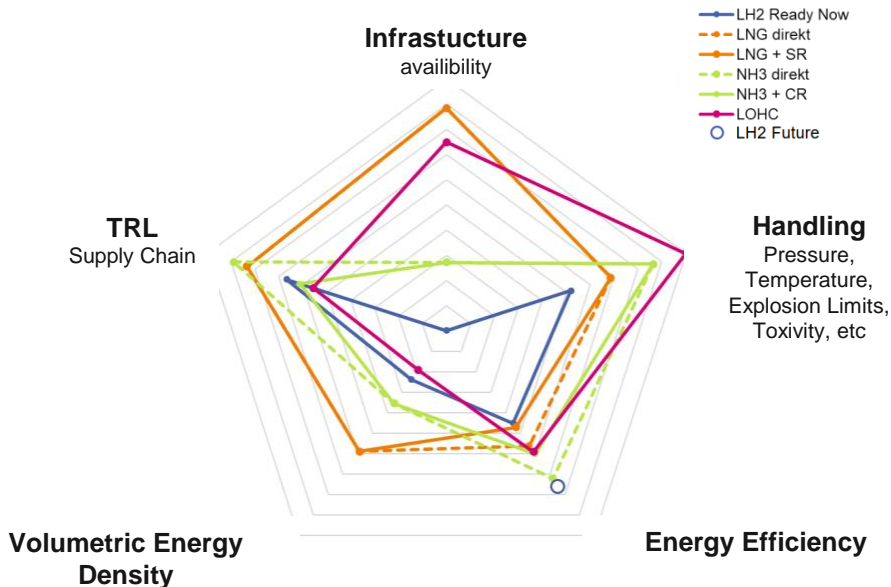
Notes: ATR = autothermal reforming; B&C = book and claim; GO = guarantee of origin; SMR = steam methane reforming.

Quelle: IRENA and RMI (2023), Creating a global hydrogen market: Certification to enable trade, International Renewable Energy Agency, Abu Dhabi; and RMI, Colorado.

2 Hydrogen Import via Terminals

German activities on H2 Terminals

- Terminals build under the **LNG acceleration act** are required to be H2 ready and to be used to import H2 or H2 derivatives by 2043
- In addition, **several terminal projects are under development** such as Wilhelmshaven, Stade, Rostock, Hamburg and Lubmin with earlier start-up times
- Import vectors under consideration are SNG, NH3 and LOHC
- The project 'LNG2Hydrogen' will provide recommendations for the sustainable & long-term use of LNG terminal sites as logistic hubs for H₂ & its derivatives.
 - Derivatives under evaluation: SNG, LH₂, MeOH, NH₃, LOHC, DME
 - Analysis & evaluation of today's technically feasible options
 - GAP analysis for R&D, rules and regulations
 - Development of design parameters & planning measures of future-proof terminal infrastructures
 - Definition of H₂ readiness for terminals



EBI study: Comparison of different H2 import vectors

Fracture mechanics evaluation as state of the art

Results of Research Project SyWeSt H2 in national and European Standardisation

From Research to Rules & Standards

- Selected results of SyWeSt H2
 - 100% suitability proven for all steel materials typically used in Germany and Europe
 - No relevant variance of test results for all tested pipeline materials, types and test locations
 - Confirmation of the results from ASME B31.12 and addition of a bilinear and conservative model
- Main DVGW-Technical Rules for steel pipes
 - G 463 – Design and construction for high pressure gas steel pipelines (> 16 bar)
 - G 466-1 – Operation and maintenance for high pressure gas steel pipelines (> 16 bar)
 - G 464 – Fracture-mechanical assessment concept for steel pipelines (> 16 bar)
 - G 458-1 – Subsequent increase of operating pressure of gas steel pipelines (> 16 bar)



The German gas transport infrastructure is 90% H2 Ready
DVGW technical rules are applicable for Hydrogen

Standardization Roadmap Hydrogen

- GAP Analysis of the complete H2 technical rules and standards
- Working Group on Certification: 'Sustainable Aspects and Verification for Hydrogen'
- Ongoing standardization in ISO/TC197:
'Hydrogen technologies – Methodology for determining the greenhouse gas emissions associated with the production, conditioning and transport of hydrogen to consumption gate'
- Identified requirement:
'how to evaluate sustainability criteria of hydrogen and hydrogen derivative' base on EU regulation requirements
- Coordination ongoing on national level



7 verifHy – Hydrogen-READY Database

verifHy
HydrogenREADY
Database

- Bundled info on H2 suitability of products, components and materials of all gas grid operators
- Automated evaluation and assessment
- Enables grid operators to design their asset planning thoroughly
- Work can be embedded in target network planning processes



verifHy: DVGW verifHy



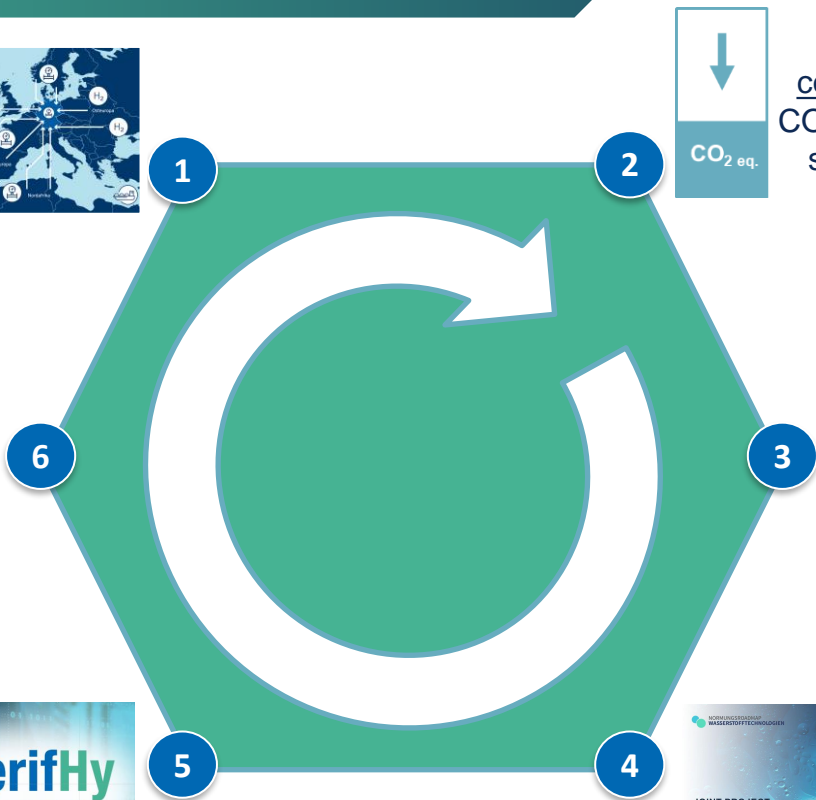
Measuring the Hydrogen Market Ramp-up

DVGW H2 Market Index



- Indices allow economic developments to be measured and evaluated in real terms
- H2Market Index: Structured survey via questionnaire, wide stakeholder involvement
- Mapping the expectations and perceptions of stakeholders and market players on
 - Innovation level
 - Infrastructure development
 - Regulation
 - Market development
- Comparison of actual market conditions and political goals, basis for readjusting
- Creating comparability of developments over time via regular updates
- Scientific partner: Energiewirtschaftliches Institut der Universität Köln

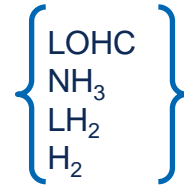
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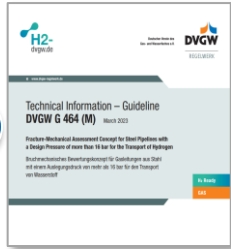


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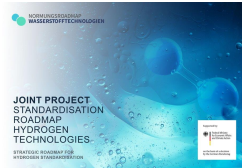
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