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Hydrogen technologies

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Insights for a responsible energy transition

The hydrogen opportunity

Climate change is no longer a future threat. Its effects are already being felt through heatwaves, floods, rising sea levels, and coastal erosion, impacting the daily lives of millions worldwide. To mitigate the climate crisis, achieve net zero and meet the goals of the Paris Agreement, ***it is crucial to decarbonize energy systems and industries***.

Hydrogen can be a key actor in this endeavour. When produced sustainably, low-emission hydrogen can reduce emissions, enhance energy security and drive economic growth worldwide. In other words, it could be one of our most effective levers against one of the biggest threats of the 21st century.

Against this backdrop, during COP28 in Dubai, United Arab Emirates, 45 countries launched a Hydrogen Declaration of Intent to work towards mutual recognition of certification schemes for low-carbon hydrogen and its derivatives.

Initiatives like UNIDO's Global Programme for Hydrogen in Industry look to accelerate global uptake of low-emission hydrogen and drive net-zero industrial development by sparking hydrogen projects in developing and transition economies and addressing key enablers.

The hydrogen market

Today	Tomorrow (foresight)
The world produces and consumes about 95 million tonnes of hydrogen per year[1]. Almost all of this hydrogen is produced without carbon abatement[1]. There is no mutual recognition of certification schemes for hydrogen produced in various global jurisdictions.	By 2030 (IEA's Net Zero Emissions by 2050 Scenario), hydrogen demand reaches next to 150 Mt/year, with around 40 % of demand coming from new applications[2]. Hydrogen technologies and applications evolve with responsible oversight to achieve lower emissions. The hydrogen market is transparent, harmonized and fosters international trade by mutual recognition of certification schemes.

1 Source: IEA (2024), Global Hydrogen Review 2024, IEA, Paris
2 Source: IEA (2023), Global Hydrogen Review 2023, IEA, Paris

What is ISO/TS 19870?

ISO/TS 19870, *Hydrogen technologies – Methodology for determining the greenhouse gas emissions associated with the production, conditioning and transport of hydrogen to consumption gate*, provides a unified framework for calculating the greenhouse gas emissions in the hydrogen supply chain. From the extraction of raw material and the transport of hydrogen all the way to its consumption gate, this technical specification supports global climate goals by offering a transparent, consistent benchmark for evaluating hydrogen's climate change impact.

This methodology embraces both the **attributional** and the **consequential** approaches.

Attributional	Consequential
A "snapshot" of current environmental impacts of specific hydrogen products or systems. E.g.: Calculating the carbon footprint of one kilogram of hydrogen by summing emissions from all processes within the system boundary and allocating them to the different co-products.	Evaluates the environmental impact of the hydrogen supply chain on associated products or systems. Can be used for policy analysis, planning and strategic decision-making. E.g.: Evaluating the avoided emissions by producing hydrogen from municipal solid waste.

It's important to note that this methodology **does not**:

- Feature a threshold to qualify hydrogen as "clean" or "sustainable". Thresholds and benchmarks will be determined by national legislation.
- Replace national requirements or methodologies that may be set by law by sovereign countries.

The benefits of ISO/TS 19870

1. Enhanced transparency in the hydrogen market
2. Increased consumer and investor trust
3. Informed decision-making on hydrogen deployment
4. Facilitated certification and sustainability assessment of hydrogen
5. Advanced competition between hydrogen pathways
6. A common benchmark methodology for low-emission hydrogen pathways

Who is this document for?

ISO/TS 19870 covers all stages of the hydrogen supply chain and aligns with other international or national standards on environmental assessment and management. It is aimed at **industry stakeholders** as well as **policymakers**, **regulators** and **certification bodies**, such as technicians, entrepreneurs and investors.

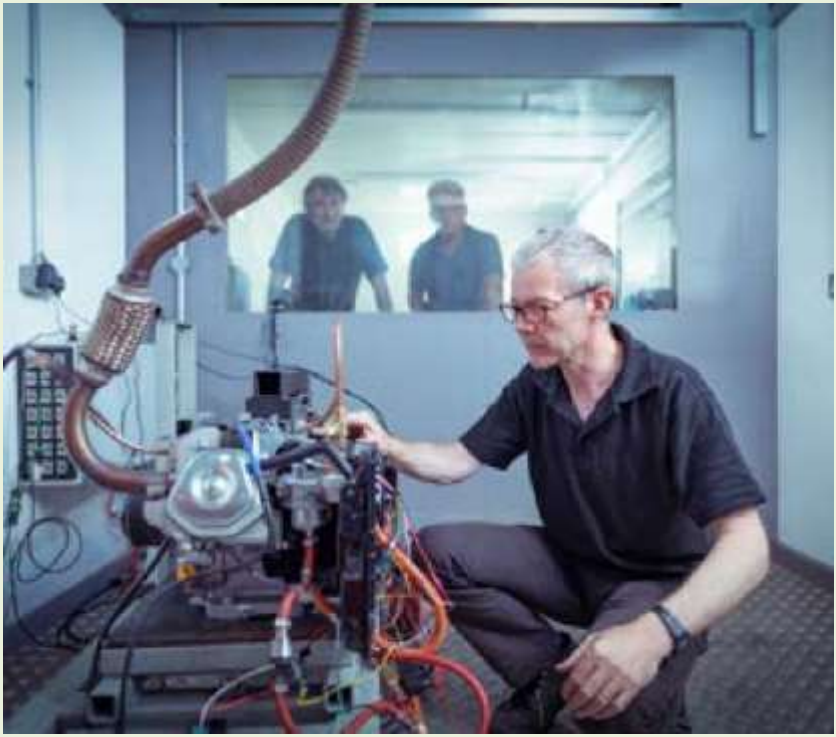
Overall, this methodology is suited to any organization within the hydrogen chain, regardless of size and location.

ISO/TS 19870 for industry stakeholders

- **Boosting investor confidence:** Using ISO/TS 19870 can reassure investors that hydrogen projects are reliable and transparent. Clear, standardized roadmaps reduce uncertainty, making it more attractive to invest in the hydrogen market.
- **Driving industry growth:** Strategies based on ISO/TS 19870 create a stable environment for hydrogen businesses to grow. This stability encourages innovation and helps the hydrogen industry thrive.
- **Boosting efficiency:** The document offers practical advice on how to account for greenhouse gas emissions in hydrogen-related operations. Following this guidance can help promote a global, unified market, improving performance across the hydrogen supply chain.

ISO/TS 19870 for policymakers and regulators

- **Connecting with international benchmarks:** ISO/TS 19870 helps align national policies with the global sustainable development agenda, making it easier for countries to work together on hydrogen projects.
- **Creating strong regulations:** Policymakers can use this methodology as a guide to develop policies that ensure hydrogen strategies are transparent, efficient and promote decarbonization.
- **Fostering new technologies:** By incorporating ISO/TS 19870 into policies, policymakers create a supportive environment for new hydrogen technologies to develop. Regular updates to ISO/TS 19870 provide fresh guidelines to help policymakers stay ahead.
- **Promoting global cooperation:** ISO/TS 19870 provides a common approach that makes it easier for countries to collaborate on hydrogen projects.



The future of hydrogen

Emerging technologies

The hydrogen market is ripe for innovation – from production to storage and consumption. In fact, by 2030, it is expected that nearly 40 % of demand will come from new applications.

This will coincide with the **broader adoption of technologies** like electrolysers, biomass gasifiers, more efficient reformers, thermochemical conversions, carbon capture technologies, natural/geological hydrogen extraction and others, which are all expected to boost market growth.

Hydrogen is typically stored and transported as a compressed gas in high-pressure containers. However, the industry is increasingly looking at new ways to store and transport hydrogen, such as in cryogenic liquid state, converted to ammonia or liquid organic hydrogen carriers, and potentially even in solid form, such as metal hydrides, in the future.

In terms of applications, industry will likely account for most hydrogen demand until 2030. Mainly used today as a feedstock for the **chemical industry** and in **oil refining**, low-emission hydrogen is increasingly being deployed to substantially cut emissions in traditionally carbon-intensive industries, such as heavy-duty transport, steelmaking and concrete, and to offset high-emission products, such as fossil fuels with synthetic fuels.

Policy and investment outlook

The future of the hydrogen market will depend largely on the level of government support across geographies as well as investor appetite.

Government policies

In the past eight years, 60 countries have adopted a hydrogen strategy, driven by a desire to diversify and secure energy sources, foster economic growth and reduce carbon emissions.

These strategies typically set out production and hydrogen capacity targets while simultaneously supporting investment, infrastructure, research and international collaboration.

Investment trends

The hydrogen market is benefitting from significant momentum. In 2024, the total investments throughout publications grew to USD 680 billion, from USD 390 billion in 2022.

However, only 11 % of total investments were real committed capital. Total investment committed throughout announcements is estimated at USD 75 billion (2024). To accelerate global energy system decarbonization, the sector needs to increase its committed investments eight-fold by 2030.

This methodology will play a critical role in helping build trust in hydrogen as a new asset class.

A call to action

Engage and innovate!

We need low-emission hydrogen to solve climate change. Built on a foundation of trust and consensus, companies and countries can cooperate to foster a just energy transition, and the hydrogen market can be a key lever in global decarbonization.

This methodology helps create a common international benchmark around hydrogen, facilitating harmonization that promotes market growth.

REFERENCE: ISO

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