

# The role of Quality Infrastructure in Scaling Up Renewable Hydrogen

**EURAMET EMN for Energy Gases Workshop**  
**Measurement solutions for Energy Gases**  
**21 March 2023**

# 1

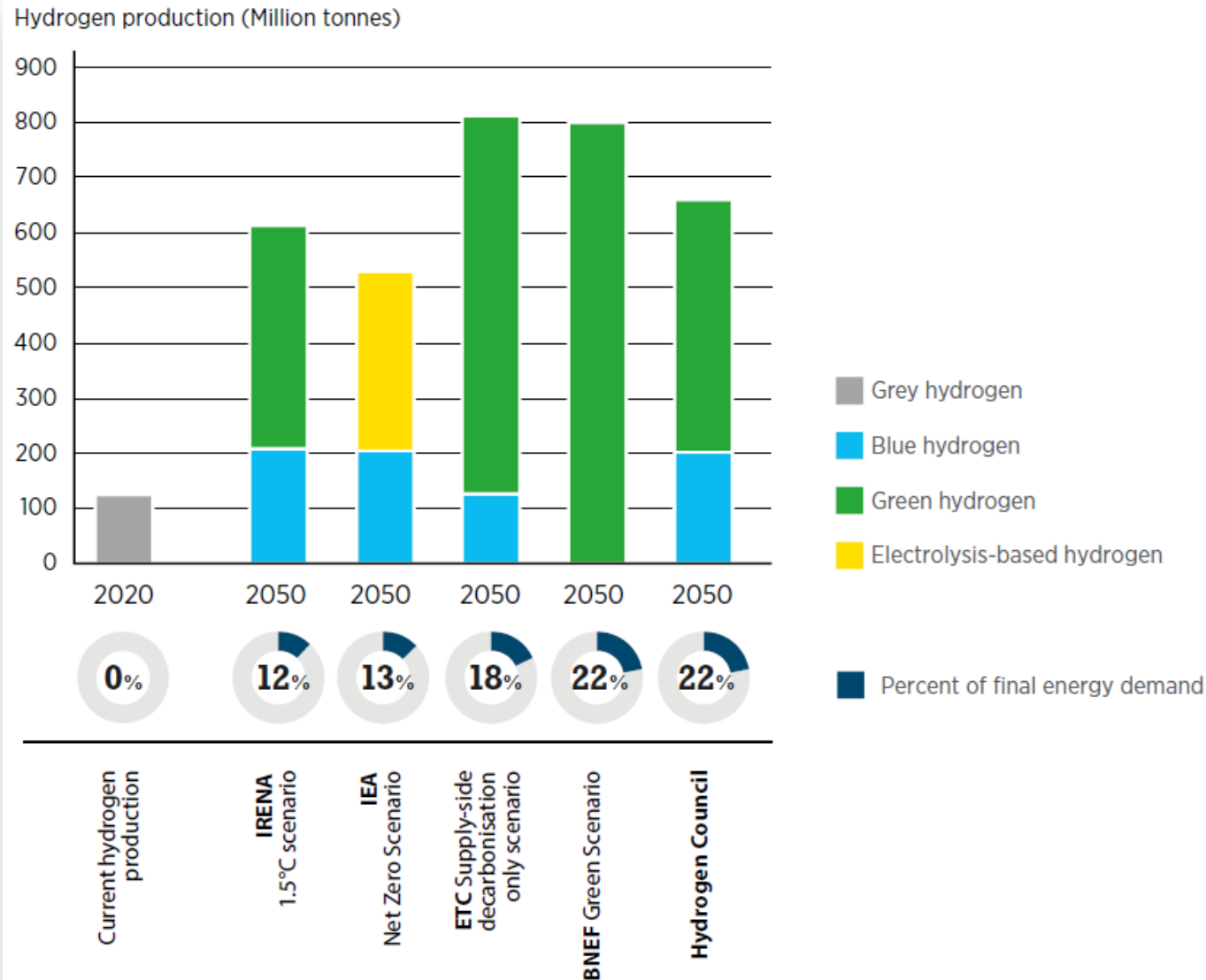
## Background: IRENA insights on Green Hydrogen

# Countries with low-carbon H2 strategies as of end of 2022



Source:  
<https://www.irena.org/publications/2022/Jan/Geopolitics-of-the-Energy-Transformation-Hydrogen>

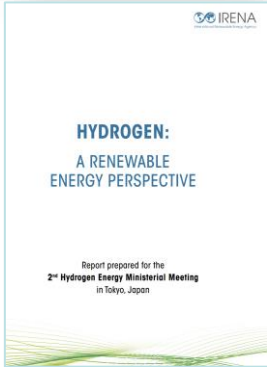
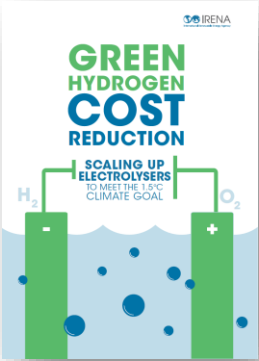
# Converging estimates for global hydrogen demand in 2050 - Green would dominate



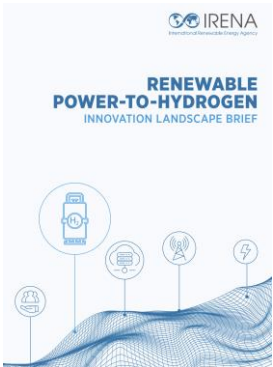
Source:  
<https://www.irena.org/publications/2022/Jan/Geopolitics-of-the-Energy-Transformation-Hydrogen>

# Need for a full value chain approach - IRENA's analysis

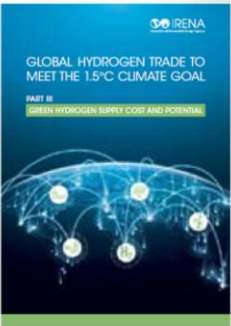
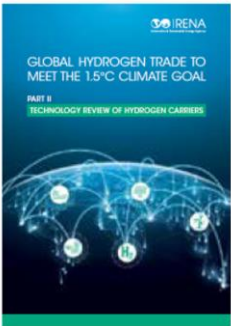
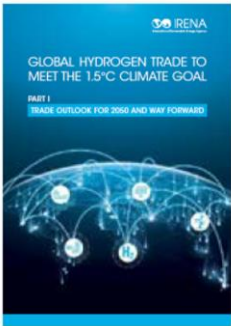
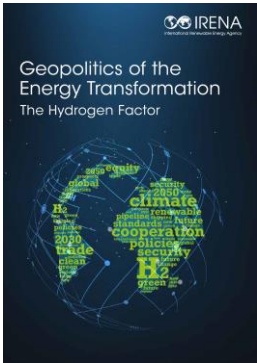
## Supply



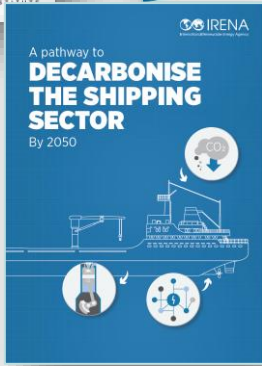
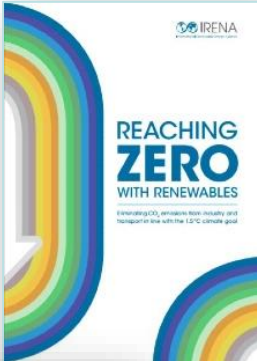
### Sector coupling



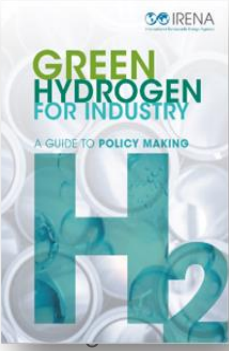
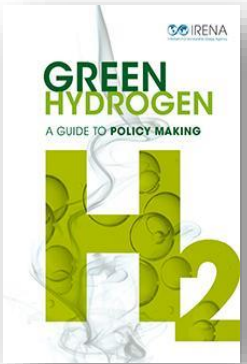
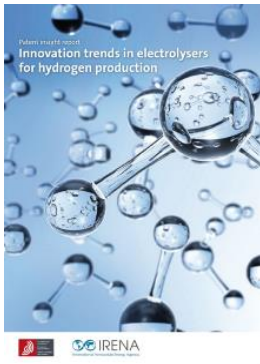
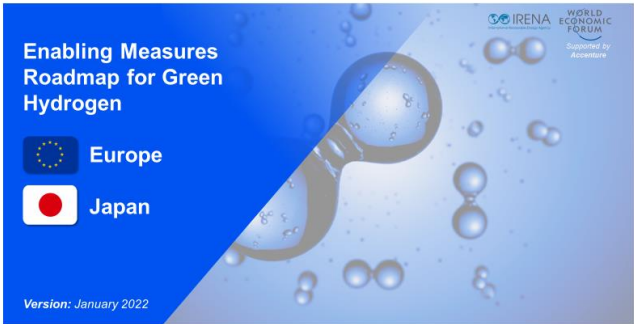
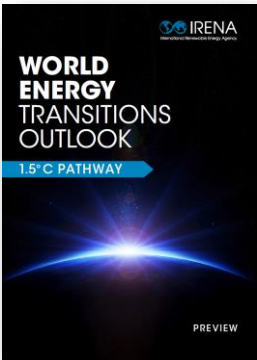
## Trade



## Demand



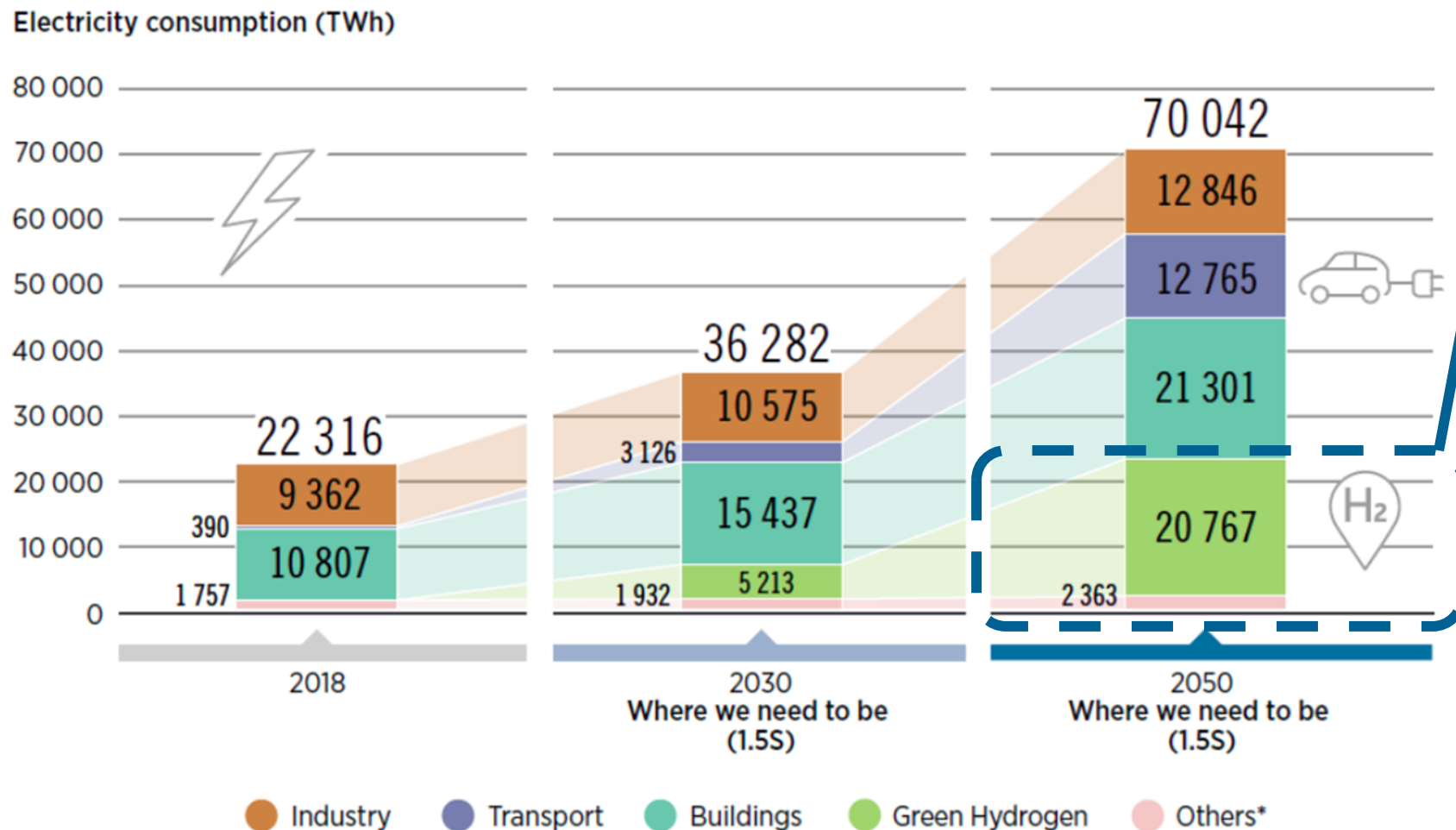
## Cross cutting & Innovation Frameworks and Policies





# Needed supply of green hydrogen in a 1.5°C decarbonisation scenario

Electricity consumption by sector, 2018, 2030 and 2050 (TWh/yr) in the 1.5°C Scenario

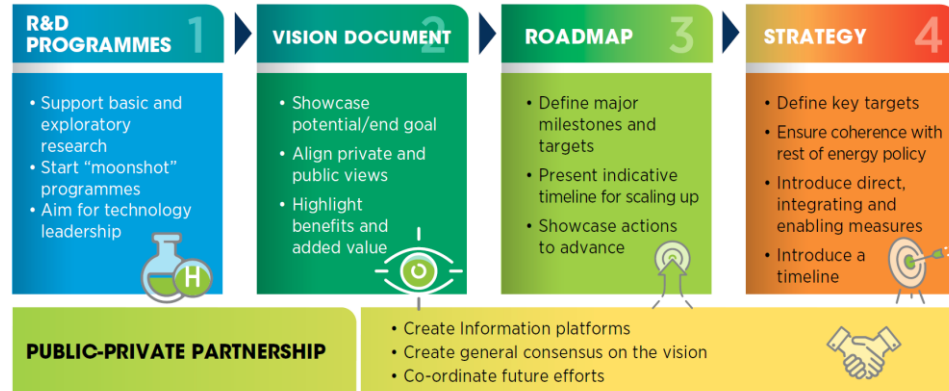


## Key considerations

- 1- By 2050 more than 20,000 TWh of electricity demand for green hydrogen production – that is almost **as much electricity as we consume globally today**
- 2- We need a smart approach to **integrate electrolyzers in power systems**, synergies with renewable generation
- 3- Key to **innovate to reduce the cost of electrolyzers** – *standardisation supporting economy of scale and trade of technology to accelerate cost reduction trend*

# Policies to enable cost competitiveness – QI will play a key role

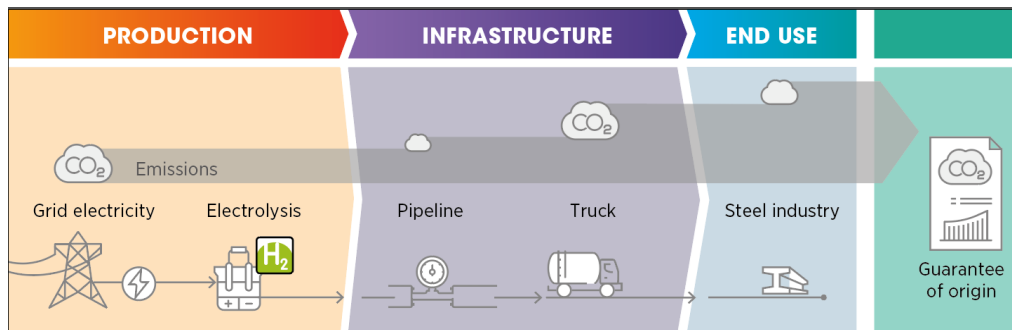
## 1. National hydrogen strategies



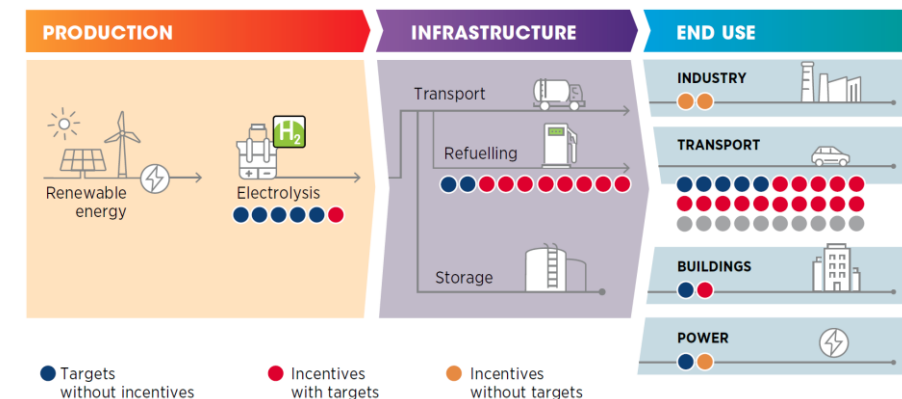
## 2. Governance system and enabling policies

- ✓ Advisory council and sectoral tables
- ✓ Workforce development
- ✓ **I. Codes, standards and regulations (performance, safety)**
- ✓ Level the playing field
- ✓ Research priorities

## 3. II. Certification (carbon content)



## 4. Establish policy priorities



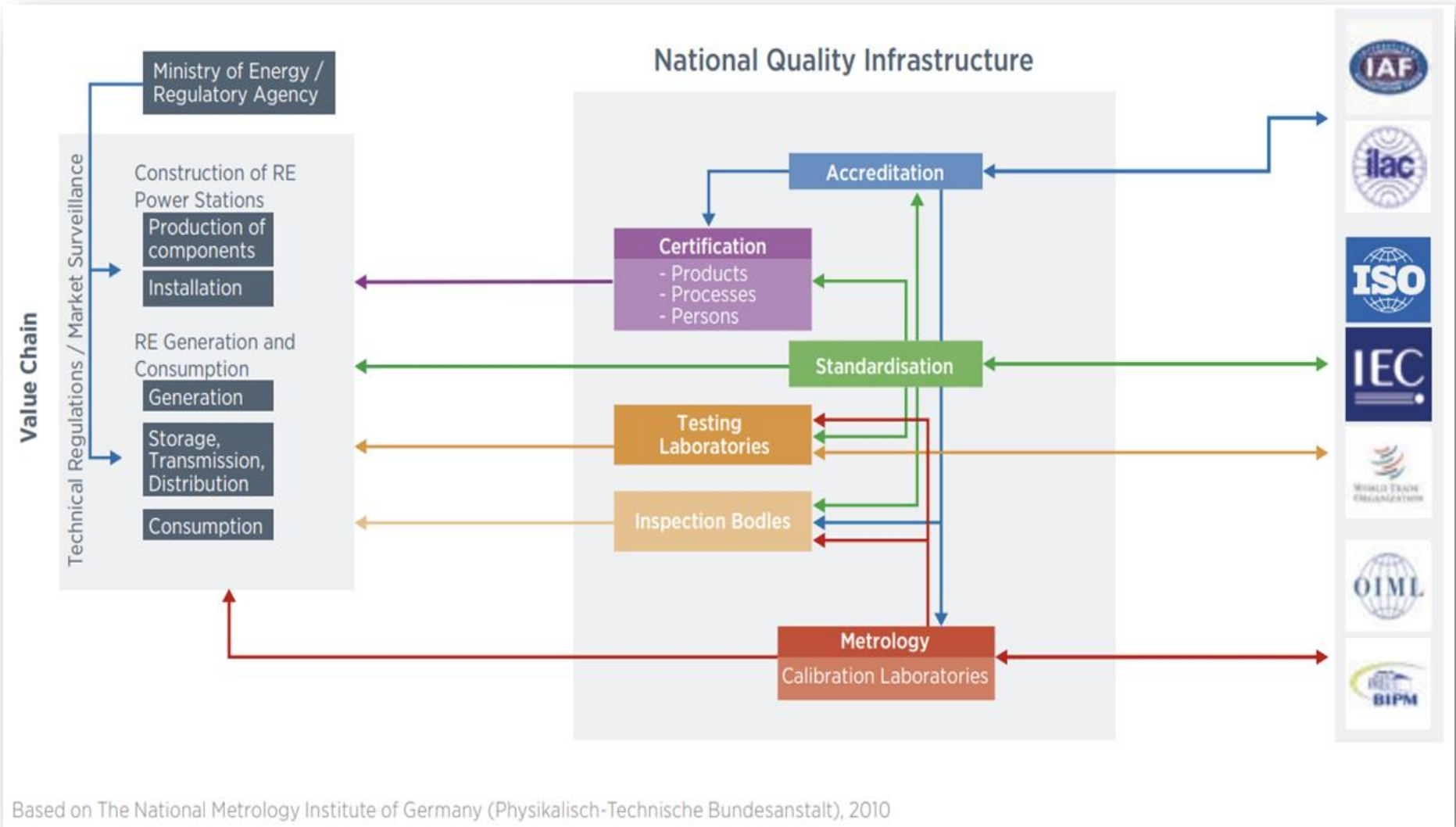
2

## **IRENA QI for Green Hydrogen Project**



# Objective of the Project

- Guide countries on how to develop a robust **quality infrastructure** (QI) for the production and trade of **green hydrogen** (GH2) in support of their national and multilateral strategies
- QI consists of all activities which provide confidence that a technology will meet the expectations of consumers, investors and other stakeholders



# Project outputs

The primary outputs of the project are as follows:

- A **roadmap** on the development of the quality infrastructure to overcome existing quality, sustainability and safety challenges in green-hydrogen production and trade is defined and communicated.
- For **a selected country**, as result of a national stakeholder engagement process, recommendations are defined for **an action plan** to overcome existing quality, sustainability and safety challenges in green-hydrogen production and trade.

## Quality Infrastructure for Green Hydrogen (2022 - 2023)

**\*Performance, reliability, safety, sustainability**

***What exists, what's for H2 in general and for GH2 in particular, who's doing what, what are the gaps***

- **Standards:** available, challenges to adopt int standards, gaps, engagement in int processes
- **Testing:** test methods, laboratory equipment and competence, link to other industry sectors, key parameters, develop services locally or cooperation
- **Certification:** industry certification, international certification
- **Accreditation:** needed competencies
- **Metrology:** traceability, calibration equipment and competency, key parameters, develop services locally or cooperation

## Other two related IRENA projects

**Carbon accounting standards and certification for GH2 (2022)**

**\*Carbon content in hydrogen / GoO**  
***Mapping who's doing what, different methods***

- Standards
- Certification

















**Carbon accounting standards and certification for GH2 derivatives (2023)**

**\*Carbon content in Ammonia, Methanol and Steel**  
***Mapping who's doing what, methods***

- Standards
- Certification

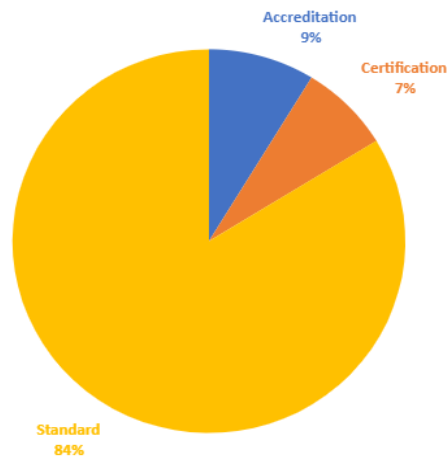
# Stakeholders/Partners for this project

Liaison organization to ISO TC 197/SC1 since Feb 2023

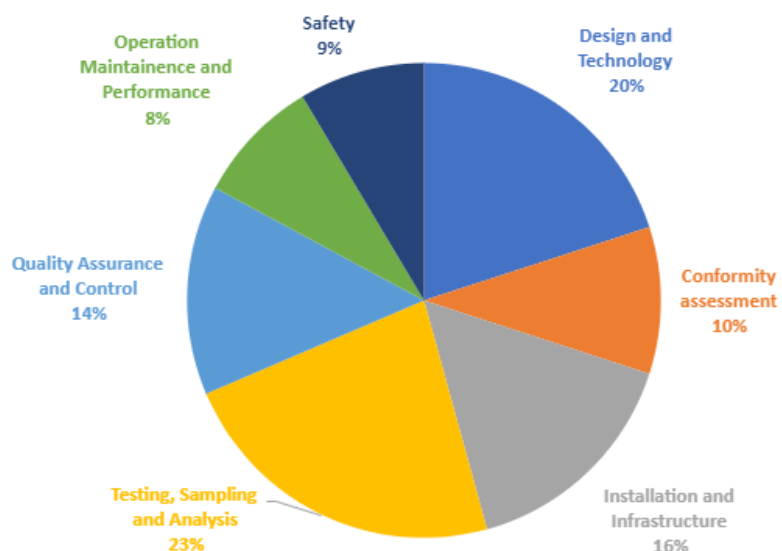
	Standards	Certification	Metrology
	      <p>Guidance <b>UK Low Carbon Hydrogen Standard: emissions reporting and sustainability criteria</b></p>	    <p><b>AMMONIA ENERGY ASSOCIATION</b></p> 	   <p>Physikalisch-Technische Bundesanstalt National Metrology Institute</p>
Knowledge repository	 <p><b>CLEAN HYDROGEN MISSION</b></p>  <p>FUEL CELLS AND HYDROGEN JOINT INITIATIVE</p>  <p>FUEL CELLS AND HYDROGEN OBSERVATORY</p>	 <p><b>HydrogenTools</b></p>  <p><b>dena</b> Deutsche Energie-Agentur</p> 	 <p><b>Hydrogen Program</b></p> <p>» Annual Merit Review Presentation Database</p>

# Desk Research Findings Summary

QI ELEMENT COVERED



ASPECT COVERED



➤ **63 standards** were identified as relevant to **hydrogen production, distribution, and storage**. 68% were developed by international bodies, with a majority prepared by the International Standard Organisation (ISO) and the European Committee on Standardization (CEN).

➤ **13 certification schemes** were identified being primarily developed by national or supranational bodies with jurisdiction subject to the states adopting them

➤ **7 accreditation schemes** were identified all developed by the ISO and IEC. These focus on asserting the competency of bodies involved in the assessment or conformity of a given product

➤ **14 testing and sampling standards** were identified in the desk research, 11 of which addressed testing in distribution, with production and storage having 3 and 2 such standards dedicated to them, respectively.

➤ No specific documentation found for inspection/monitoring and metrology



<https://www.surveymonkey.com/r/SRXGJ59> .

- **Key standards** (non exhaustive) to be considered:
  - **ISO 22734-1 and ISO TR 22734-2** Hydrogen generators using water electrolysis);
  - **IEC 60079-17** Inspection;
  - **IEC 60079-19** Repair and Overhaul of Equipment;
  - **ISO/TR 15916** Basic Safety considerations for safety of hydrogen systems;
  - **ISO 16110 series** Hydrogen generators
- **Key Certification** (non exhaustive) to be considered:
  - **ISO/AWI 19870** - Methodology for Determining the Greenhouse Gas Emissions Associated with the Production, Conditioning and Transport of Hydrogen to Consumption Gate;
  - **ISO 14687 Hydrogen fuel quality** — Product specification ;
  - **EN 16325 Guarantees of Origin related to energy** - Guarantees of Origin for Electricity, gaseous hydrocarbons, Hydrogen, and heating & cooling
  - **ISO 14067 - Greenhouse gases** — Carbon footprint of products
  - **IECEx Certification Scheme**



<https://www.surveymonkey.com/r/SRXGJ59> .

- **Key testing and inspection** protocols to be considered:
  - **ISO 16110-2:2010** Hydrogen generators using fuel processing technologies — Part 2: Test methods for performance
  - **ISO 22734-2**
  - **ISO/IEC 80069 series** – Explosive Atmospheres
  - **ISO/IEC 60079 series** - General requirements for construction, testing and marking of Ex Equipment and Ex Components intended for use in explosive atmospheres.
- **Key metrology** facets to be considered:

Respondents highlighted the importance of making available metrological services (currently only found in developing economies) for the following aspects in relation of H2 production:

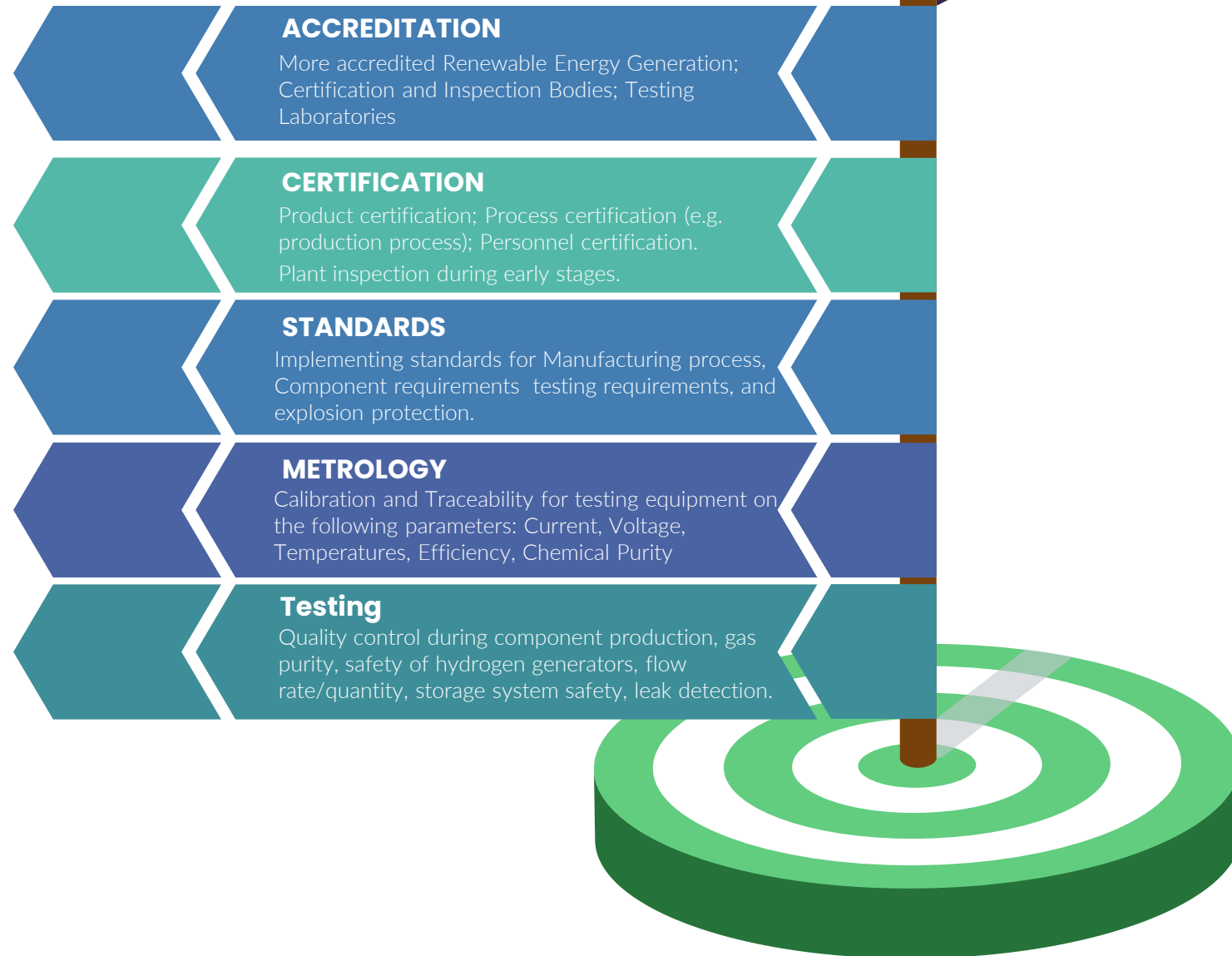
  - **Pressure readings**
  - **Process parameters H2 production**
  - **H2 purity and chemical composition**
  - **Temperature**

Consult UNECE publication "A Common Regulatory Framework for Equipment Used in Environments with an Explosive Atmosphere: ECE/TRADE/391" available from <https://unece.org/publications/>



- **On certification:**
  - Most appropriate certification schemes of hydrogen equipment are being developed by IECEx conformity assessment services that now include both electrical and mechanical (pressure gas) components. **A hydrogen certification system as a product still needs to be developed.**
  - Major work is required to **govern downstream emissions related to green hydrogen**. Similar downstream challenges **regarding tracking and allocating emissions** is also needed.
- **On metrology:**
  - Most of the gaps identified in the survey apply specifically to hydrogen under high pressure, to high flow rates, and especially to adaptations for gas mixtures and other gases such as ammonia. The key metrological objectives to be fulfilled are **measurement accuracy and billing issues, but focus also needs to be placed on metrological hydrogen origin analysis and verification** to order to enable global trade.
- **On testing:**
  - More focus is required on developing testing methods as well as standards for the effective storage of hydrogen – given the flammable and light weight characteristics of this element.

# Essential QI Services for GH2



# Thank you!

**IRENA Innovation and Technology Center**

Jaidev Dhavle [JDhavle@irena.org](mailto:JDhavle@irena.org)