

**Meetings of IECEx System
Industry Symposium
Edinburgh, September 20, 2023**

Evolution of the **Hydrogen Ecosystem:
Update on Global Trends**

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Chair, ISO/TC 197/SC 1* 

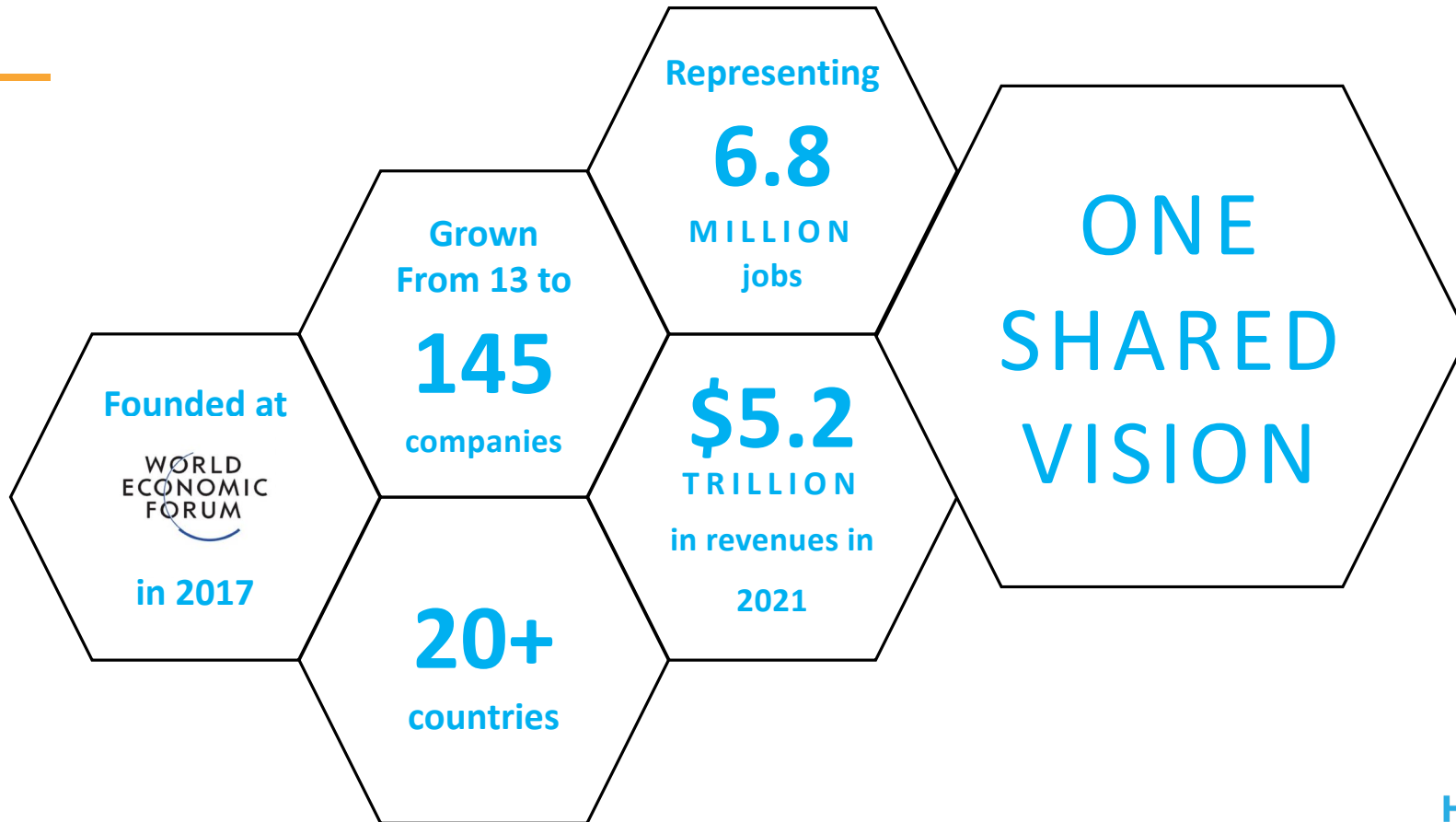
Hydrogen
Council 

The image features a central graphic of a glowing blue and white digital globe, composed of interconnected nodes and lines, held gently in two hands. This central element is framed by a large, semi-transparent hexagonal border. The background is a blurred image of people in a meeting setting.

Introduction to the
Hydrogen Council

September 2023

A global CEO-led initiative



145 members and counting...

Steering Members



Supporting Members



Investors



Unlocking social value of the hydrogen economy

Public-private cooperation will play a key role in unlocking the positive contribution that hydrogen can bring to several UN Sustainable Development Goals, including:



Good health and well being ⇒ Reducing air pollution



Diversity, equity and inclusion ⇒ Helping unlock diverse talent pool



Affordable and clean energy ⇒ A clean and versatile energy vector



Decent work and economic growth ⇒ Fuelling green growth & deliver sustainable jobs
⇒ Creating opportunities for indigenous communities through employment and new business creation



Industry, innovation and infrastructure ⇒ Fostering decarbonization of the industry, innovation and deployment of clean infrastructure



Sustainable cities and communities ⇒ Clean transportation and heating
⇒ Sustainable jobs for local communities



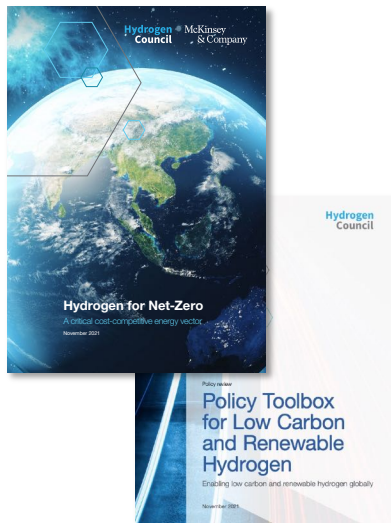
Climate action ⇒ Key solution to decarbonizing economies



Hydrogen Council

Thought Leader & Trusted Partner

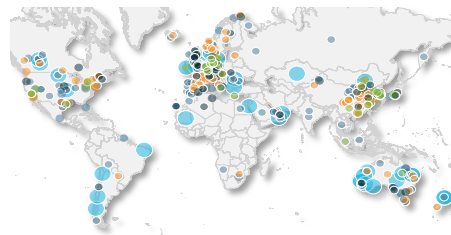
Thought Leader



Unique Source of Global Industry Data

Hydrogen Insights 2023

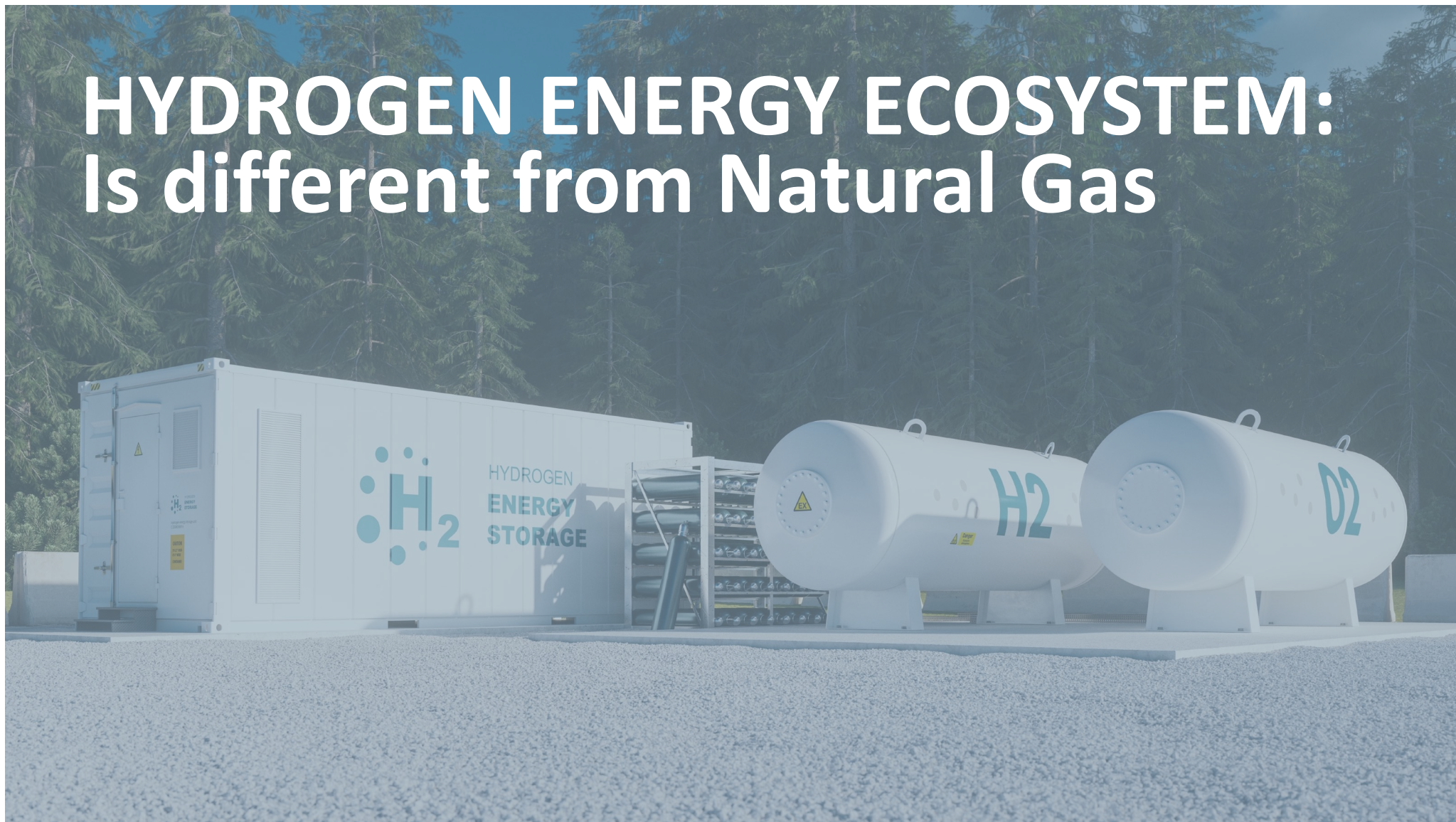
An update on the state of the global hydrogen economy, with a deep dive into North America
May 2023



Trusted Partner to Global Organisations



HYDROGEN ENERGY ECOSYSTEM: Is different from Natural Gas



Hydrogen Insights 2023

State of the Union: global clean hydrogen deployment

H₂ production

0.8 MT total clean H₂ production
of which 0.7 MT low-carbon H₂

700 MW (+30% YoY)
electrolysis capacity installed

Manufacturing capacity

8.8 GW (+150% YoY)
installed electrolysis mfg. capacity

12 GW (+10% YoY)
installed FC mfg. capacity



H₂ end-use

80.000
FCEVs on the road (+30% YoY)

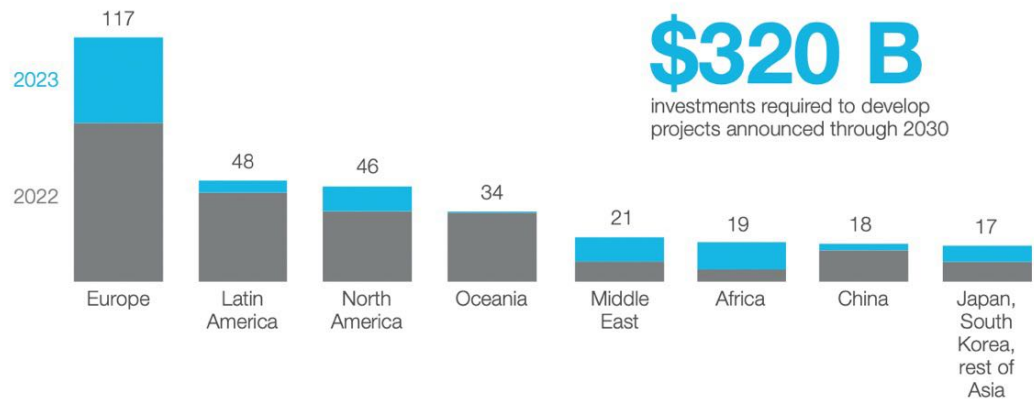
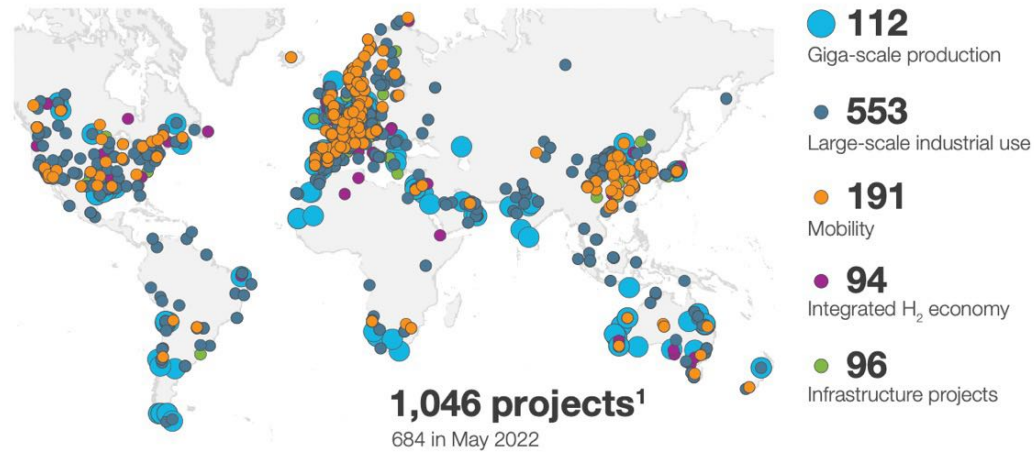
130 (+60% YoY)
vehicle models launched by OEMs

H₂ infrastructure

1.070 (+55% YoY)
HRS installed globally

120 ammonia terminals available
38 export and 88 import globally

Renewable and low carbon hydrogen projects worldwide



Hydrogen Energy Ecosystem Key Differentiators:

- ❑ Electrification
- ❑ Energy grid integrator
- ❑ Deep decarbonisation
- ❑ Diversity of transport
- ❑ Manufactured energy carrier



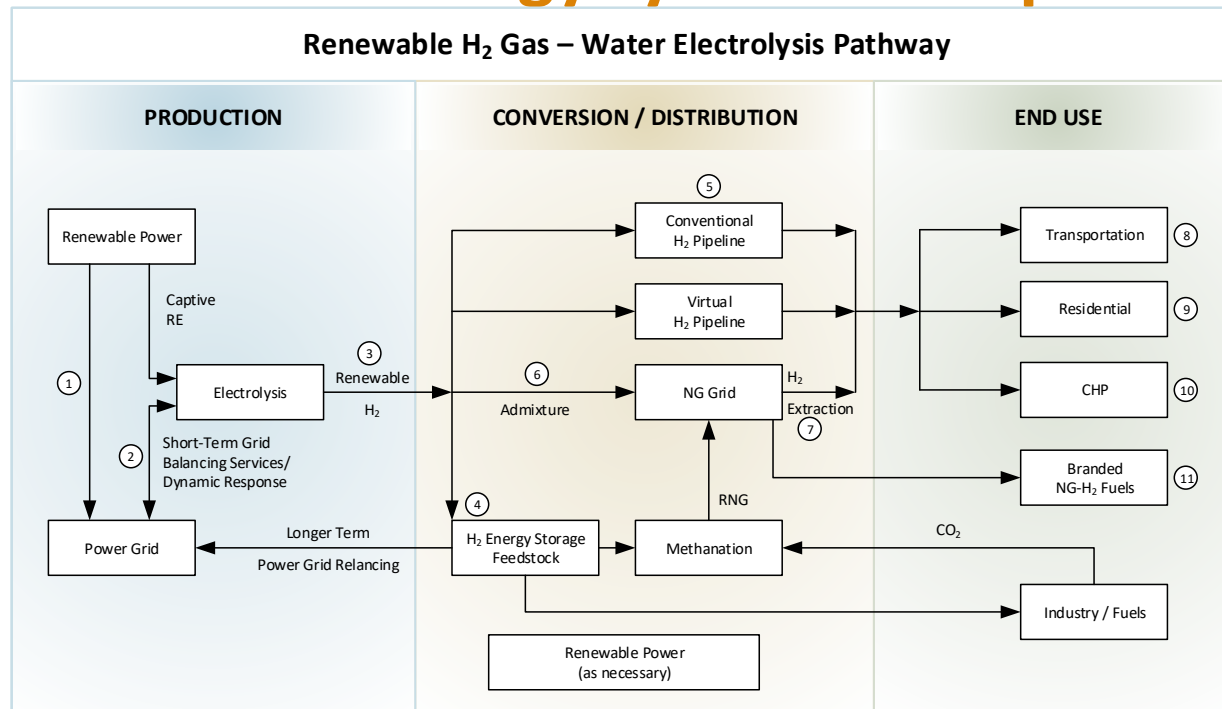
- ✓ Deep bi-directional linkages to the electrical grid and electrification (via grid balancing and FCs)
- ✓ Integration of RES with electrical and gas grids via energy storage
- ✓ Wide spectrum of derivatives and carriers such as ammonia, LOHC, Direct Reduced Iron, others
- ✓ Will be moved in all forms in pipelines and on the seas
- ✓ Not recovered from the earth as a product – it is a manufactured carrier of energy



HYDROGEN ENERGY ECOSYSTEM

Connecting and Integrating Sectors of
Economy in a Horizontal Energy Chain

Renewable Hydrogen Energy Economy: Integrated horizontal energy system example



Areas for Standardization

- | | |
|--|---|
| ① Certification of renewable power | ⑦ H ₂ extraction |
| ② Dynamic power grid service | ⑧ Road and off-road transportation – all applications |
| ③ Certification of renewable hydrogen | ⑨ H ₂ for residential appliances and cooking |
| ④ H ₂ energy storage | ⑩ Combined heat & power / stationary FC |
| ⑤ H ₂ pipelines | ⑪ Use of NG-H ₂ blended fuels / fuel quality |
| ⑥ Addition of H ₂ to NG pipelines
- Mixing and concentration control | |

Same Hydrogen Different Place **New Challenges**

Industrial Gas

- Captive markets
- Behind the fence
- Private ownership
- Industrial Customer
- Traditional Markets
- High user competence
- Long history of practice
- Mostly fossil origin
- Traditional built environment fire & building codes; installation codes, pressure vessel codes

Hydrogen Energy

- Public domain
- Outside the fence
- Public project proponent
- Public Customer
- Residential sector
- Public risk profile
- New users / markets
- Energy markets / utility integration / multifuel
- Environmental / Sustainability attributes

Implications:

- Mega growth
- International Standards
- Maturing Standards
- Global Tech Regulations
- Public authorities oversight
- New regulations
- Sustainability agenda

An aerial photograph of a dense, vibrant green forest. A winding river or stream flows through the center of the forest, reflecting the surrounding greenery. The atmosphere is misty and ethereal, with soft white clouds or fog drifting through the trees. The overall scene conveys a sense of natural beauty and environmental health.

H₂ ENERGY ECOSYSTEM

**Sustainability: Assessment of Attributes
and Certification**

Hydrogen integration – paving the way for a resilient, cost-effective net zero energy system

Goes hand in hand with electrification

- Enabling greater and faster integration of renewable energy capacity in the energy system, including through efficient long distance transport of renewable electrons through molecules

Maximises climate and cost-efficiency benefits of RES-E uptake

- Helping make sure renewable electricity does not go to waste with curtailment

Fosters greater resilience, cost-efficiency & optimization of the energy system

- Enabling both short term flexibility of the energy system thanks to power grid balancing and long-term flexibility thanks to synergies with repurposed gas infrastructure and hydrogen storage to help serving seasonal demand

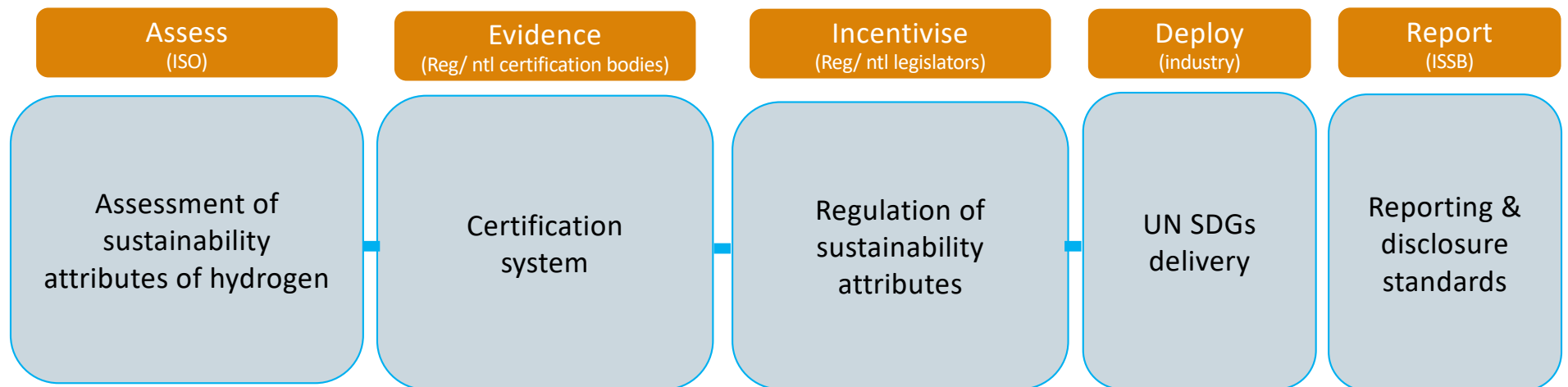
Support healthy competition of net zero solutions

- Uptake of such solutions as FCEVs in transport can not only have a material impact on system efficiency but also help spur competition

HYDROGEN SUSTAINABILITY PROGRAM

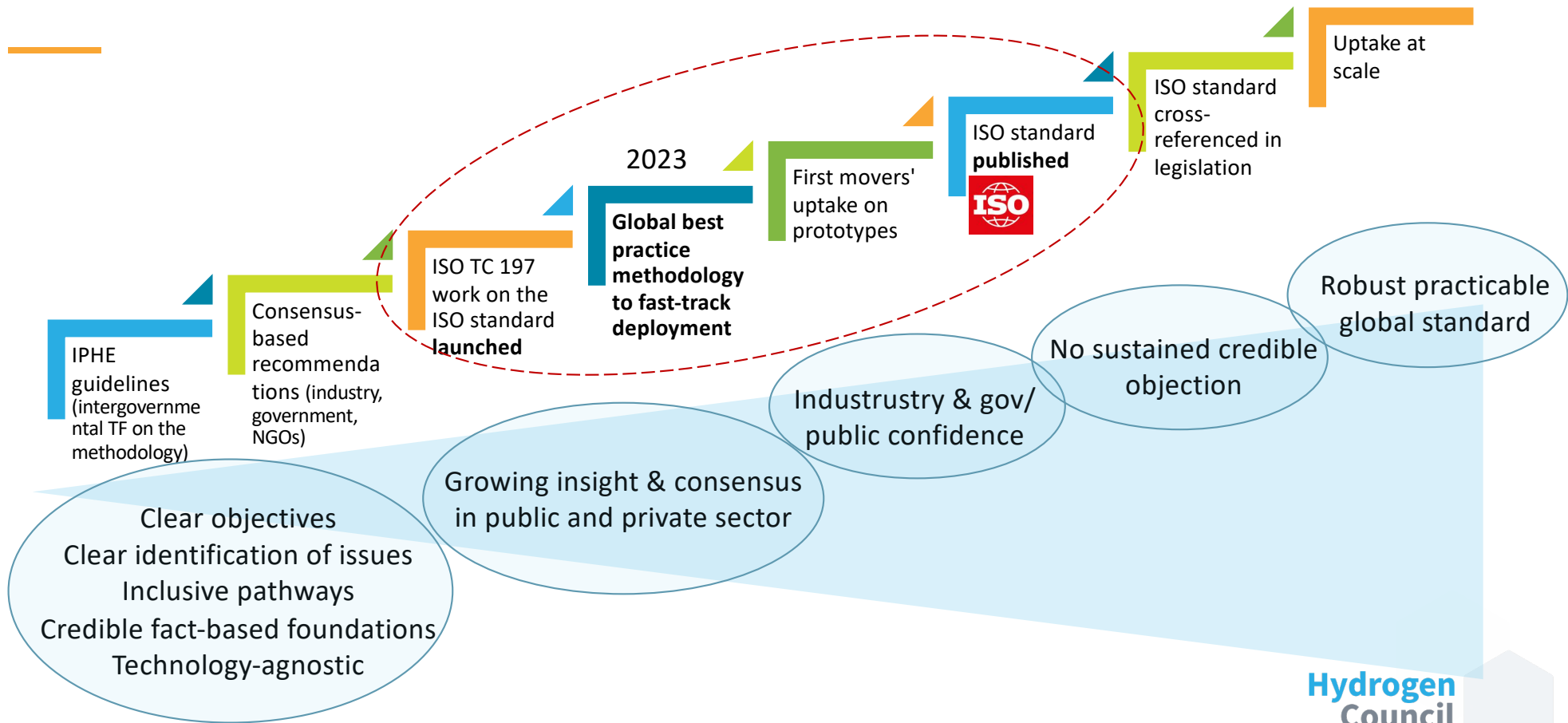
Joining forces with International Partners for global consensus-based standards, robust tradable certification systems and reporting and disclosure standards

HYDROGEN SUSTAINABILITY PROGRAM

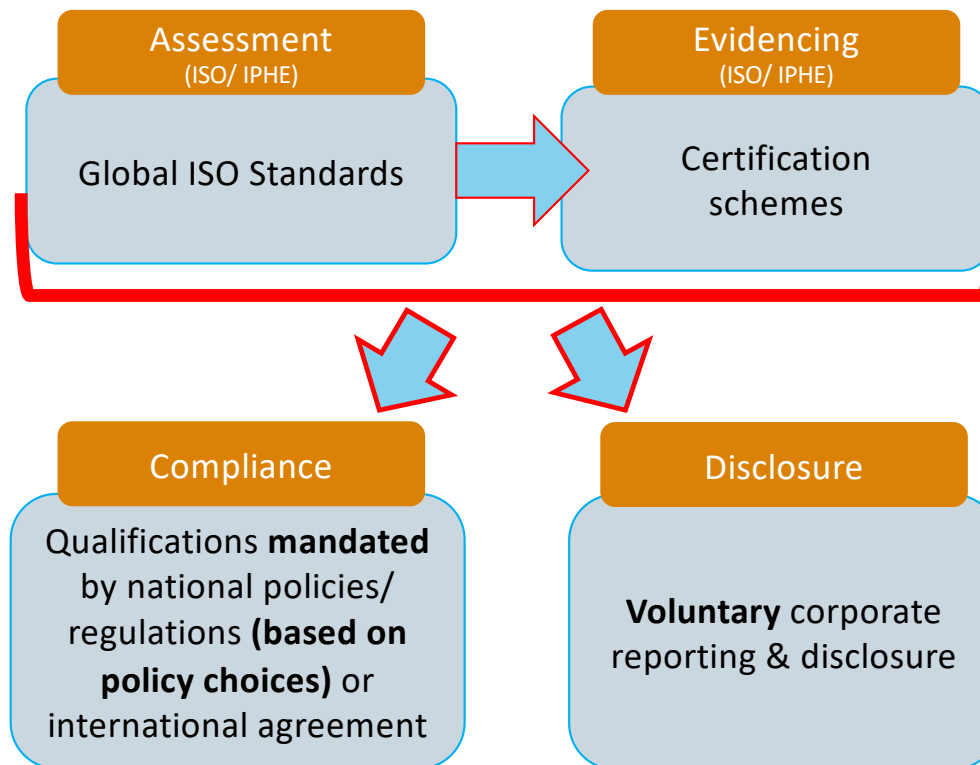


Cross-cutting topics include guidelines for qualifying hydrogen as low carbon/renewable - e.g. creating a repository of the emerging thresholds, hydrogen definitions and potential 'corridors'

ISO standard methodology for GHG assessment of all H2 production, conditioning and transportation pathways is underway



Standards, Certification Schemes and Policies/Regulations: distinct instruments with distinct purposes





Hydrogen Council

Thanks for your attention