IGES-WRI Webinar: Advancing the Net-Zero Agenda through Regional Cooperation in Green Hydrogen in Asia, August 23, 2023

Stocktaking the national hydrogen strategies: *Preliminary results of a systematic review*

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IGES

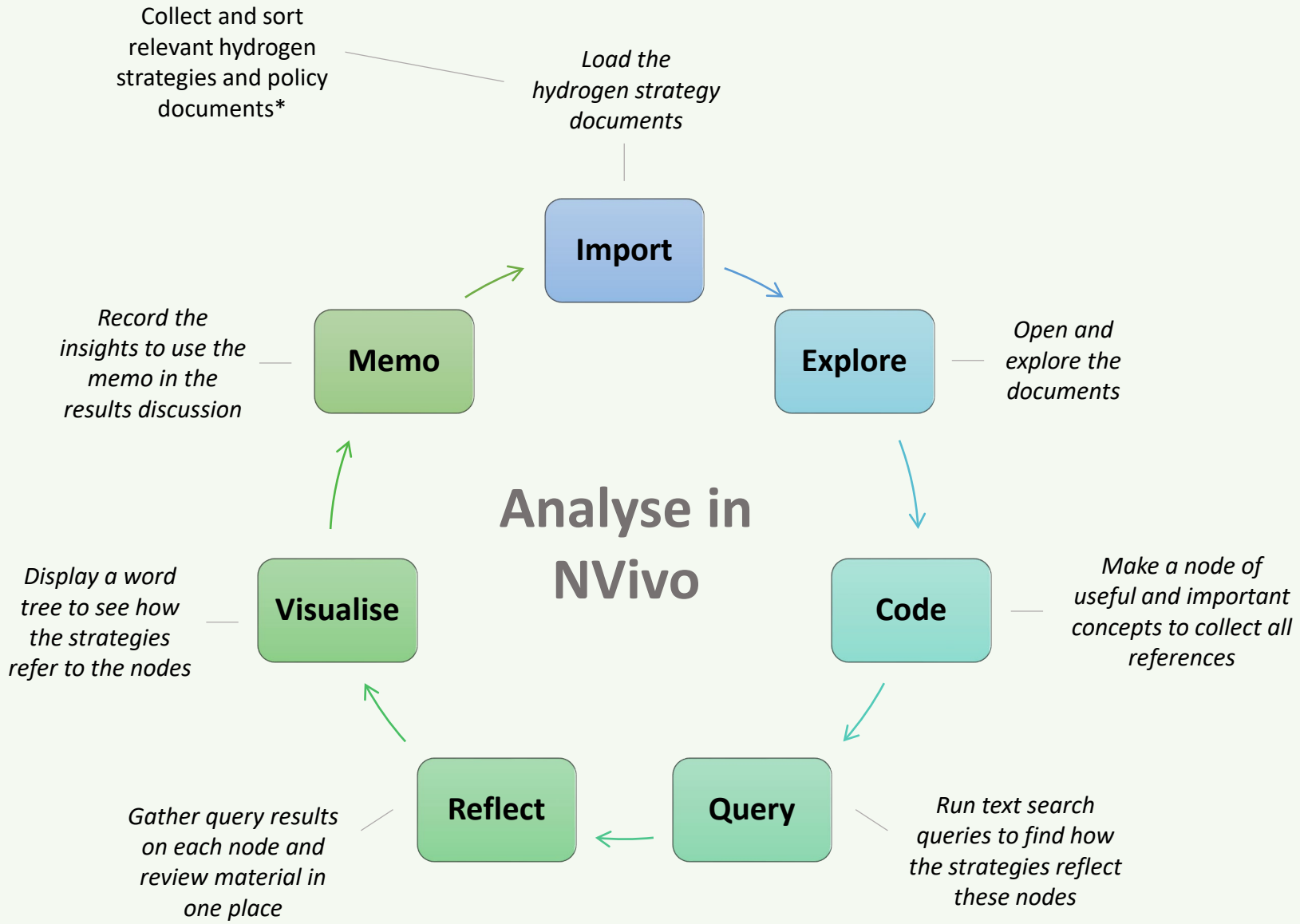
Introduction: Hydrogen's momentum

- Growing number of countries adopting hydrogen strategies
- Commercial production and use of hydrogen is nothing new
  - So why this renewed interest?
- Purpose of the systematic review of national hydrogen strategies
  - To stocktake where the strategies are at present
  - To understand the common objectives and issues across national hydrogen strategies
  - To point out the key features and priorities of these strategies
  - To see if the strategies cater to the net-zero agenda
    - Green hydrogen in focus

- Publicly-available national and regional hydrogen strategies and policies from around the world included in the review

Algeria	Australia	Austria	Belgium	Canada	Chile	China	Colombia	Croatia
Czech Rep.	Denmark	EC	Finland	France	Germany	Greece	Hungary	India
Italy	Japan	Luxembourg	Morocco	Namibia	Netherlands	New Zealand	Norway	Oman
Paraguay	Poland	Portugal	Korea, Rep.	Russia	Scotland	Singapore	Slovakia	South Africa
Spain	Sweden	Switzerland	Turkiye	Ukraine	UAE	UK	USA	Uruguay

Methodology



Adapted from Nvivo user guides

* Documents collected from publicly available sources online

Queries and questions

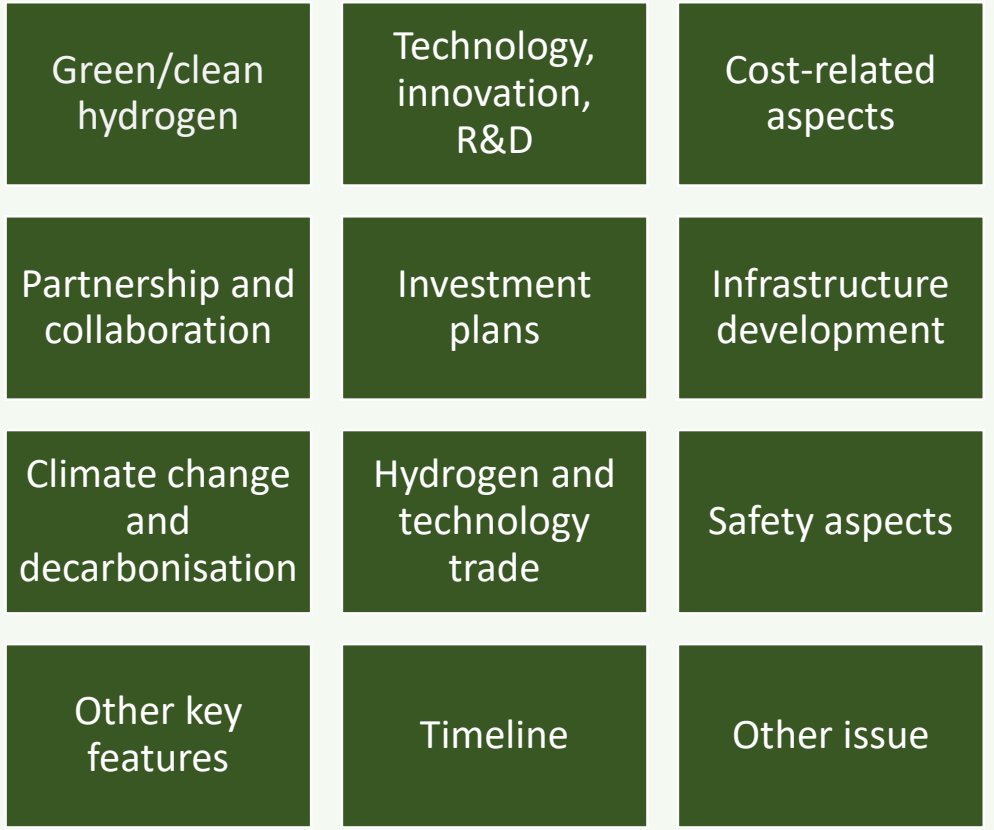
Examples

"Do these strategies talk about investment and cooperation in technology development?"

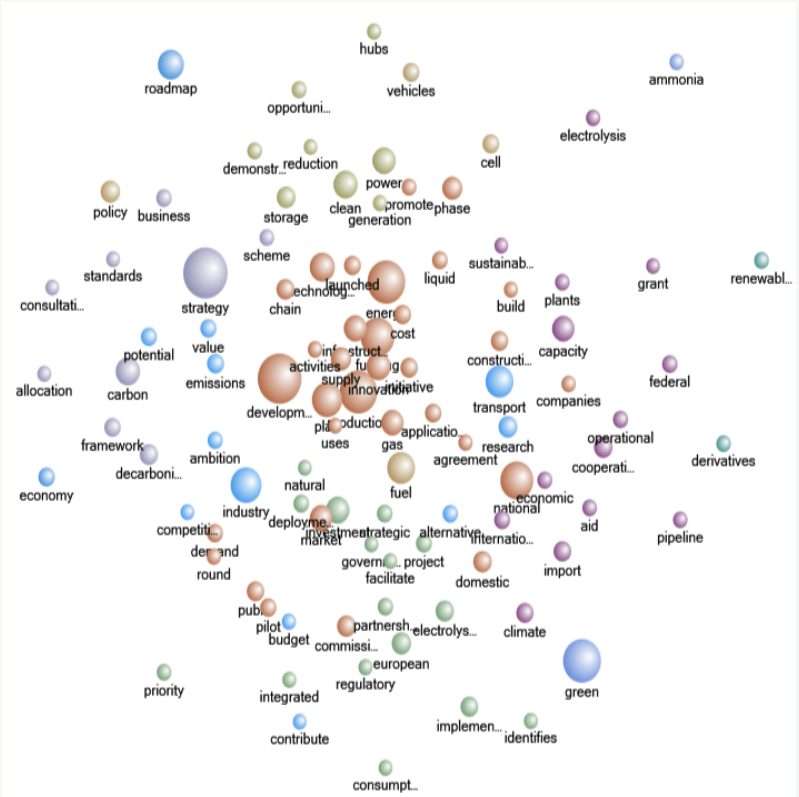
"What are the major priorities in hydrogen development?"

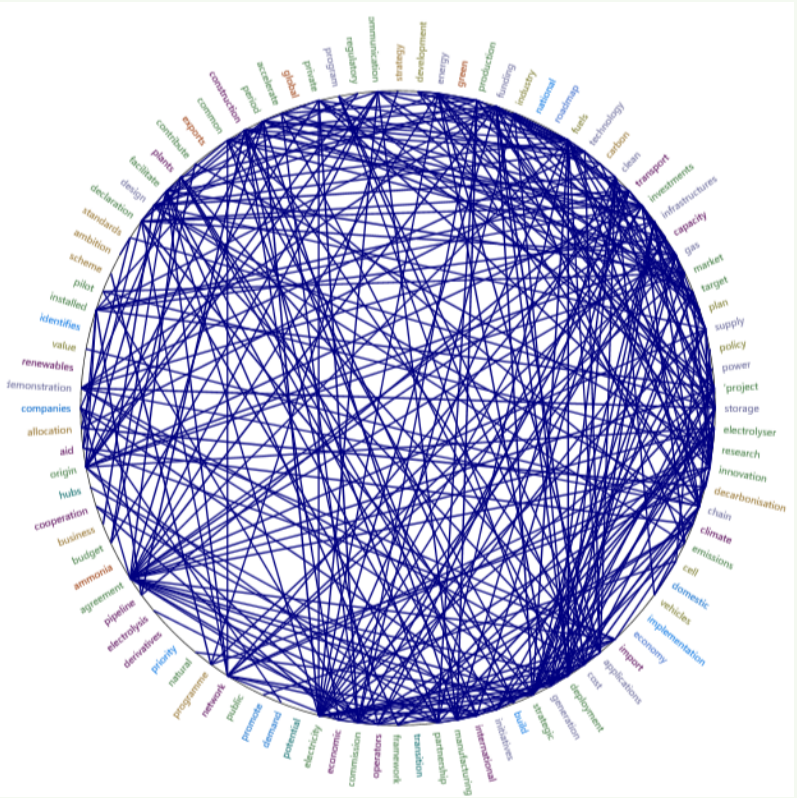
"To what extent to they focus on green hydrogen?"

"Is there any discussion about cost-effectiveness?"



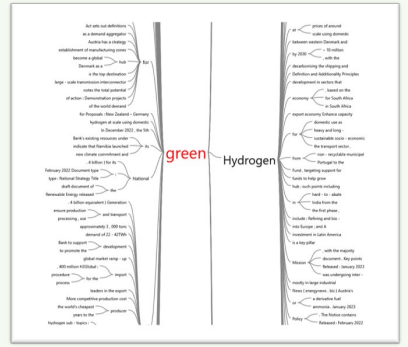
Key features: Frequency and association

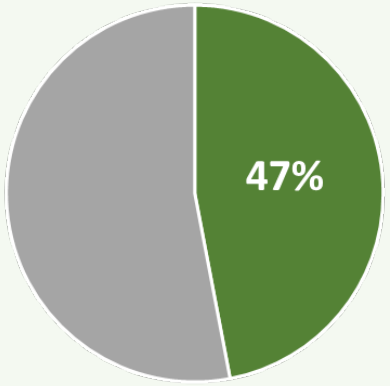




Source: Generated by author using Nvivo 12 Plus

Green/clean hydrogen: Important aspects reflected



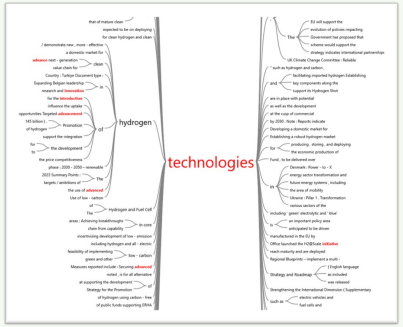


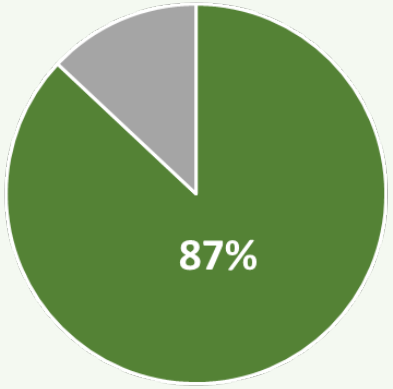
Strong reference
(% of strategies)

Key players

- Establish green hydrogen as an alternative energy source
- Produce green hydrogen and green ammonia using renewable resources
- Export/import green hydrogen
- Targets for green hydrogen production, export and import
- Develop green hydrogen funds
- Green hydrogen for transport sector
- Using non-recyclable municipal waste to produce green hydrogen
- Infrastructure for green hydrogen, including for hydrogen transportation
- Supply Chain (e.g. green hydrogen, fossil fuel-based with CCS)
- **Observation:** Ambitions and details are uneven across the covered strategies, and lack the urgency of accelerating the transition.

Technology, innovation, R&D



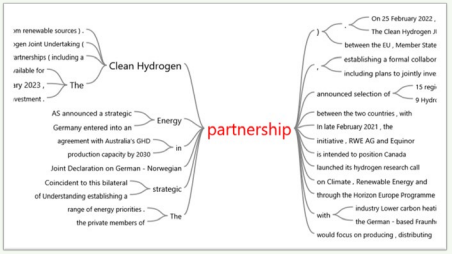


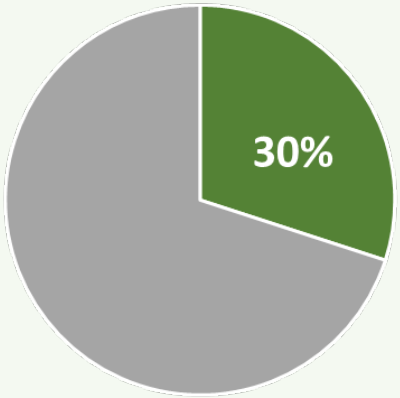
Strong reference
(% of strategies)

Key players

- Integration of hydrogen technologies in future energy systems
- Research and innovation in hydrogen technologies
- Clean hydrogen production technologies
- Hydrogen energy storage, distribution and utilisation technologies
- Technological and financial viability
- Price competitiveness of hydrogen technologies
- Market for hydrogen technologies
- Value chain for clean hydrogen technologies
- Net-zero technologies
- R&D to unlock key technological bottlenecks
- Improve the technical and economic feasibility
- Hydrogen infrastructure and technologies
- Scale hydrogen projects in industrial applications
- **Observation**: Price competitiveness of hydrogen technologies will be the key.

Partnership and collaboration





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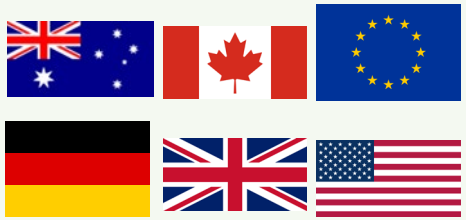
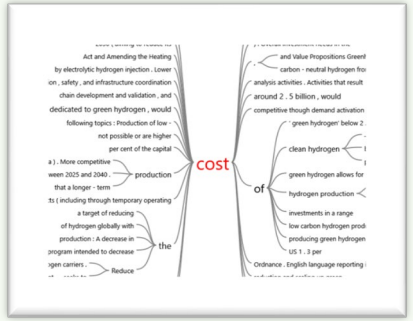
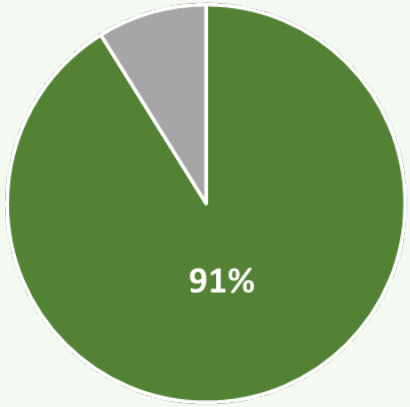


Key players

- Regional and global partnerships
- Strategic partnerships
- Government to government collaborations
- Public-private partnerships
- Market-based business models
- Collaboration in research and development
- Long-term value chain creation
- Observation: Compared to other countries and regions, European approaches appear to be stronger.

Cost-related aspects





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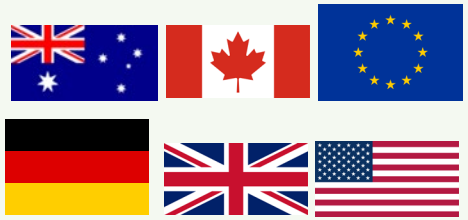
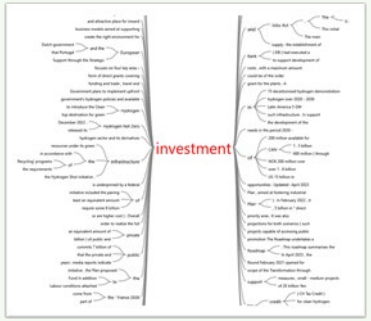
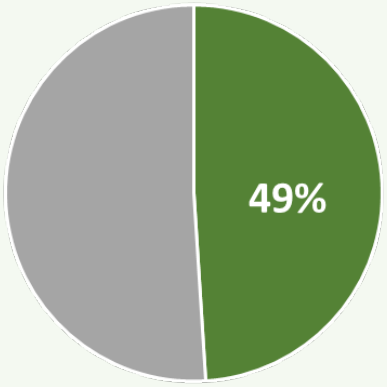


Key players

- Major focus on improve price competitiveness of hydrogen technologies and hydrogen production compared to fossil fuels
- Production of low-cost, carbon-neutral hydrogen
- Demand activation policies to gradually reduce costs of hydrogen
- Cost reduction and scaling up
- **Observation:** Along with technological advances, creating a market and increasing the social acceptance of hydrogen will be quite important.

Investment plans and strategies





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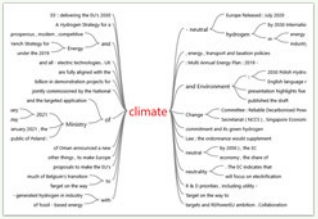
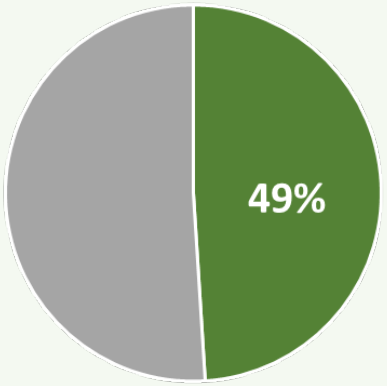
(% of strategies)

Key players

- Establish an investment tax credit to support investments
- Investing in promoting cooperation and collaboration
- Large-scale governmental investment
- Investment in hydrogen transport, distribution, storage and deployment
- Green infrastructure investment
- Investment needs analysis
- Hydrogen-related joint investments among countries
- Attracting private investment and public-private partnership
- Enabling environment for investment
- Subsidising cyclical investments
- Investing in R&D
- Observation: More focus on green infrastructure, and cooperation on green hydrogen production and technologies needed

Climate change and decarbonisation





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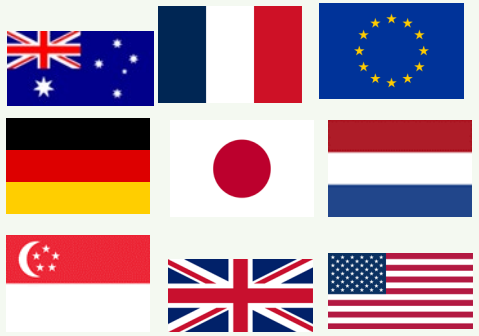
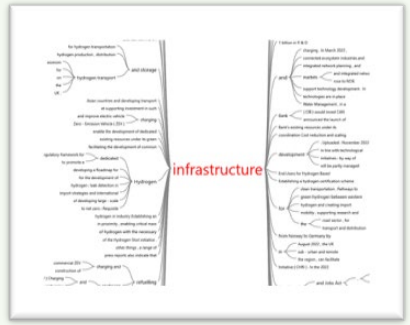
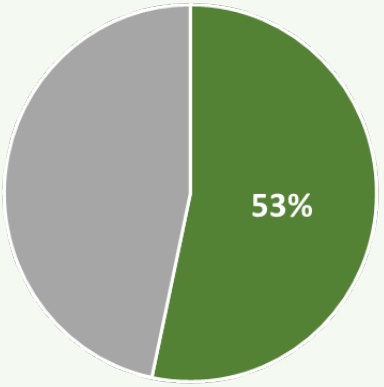


Key players

- Climate-neutral hydrogen
- Climate change mitigation using hydrogen
- Industrial decarbonisation
- Green hydrogen projects with 2030 targets
- Use of hydrogen in the hard-to-abate sectors
- Decarbonisation of the gas sector
- Decarbonised transportation, particularly heavy-duty ones
- **Observation**: The role of hydrogen in climate change mitigation is discussed sometimes without explicitly referring to “green hydrogen” from renewables. If not green, it may not be feasible for net-zero transition.

Infrastructure for hydrogen





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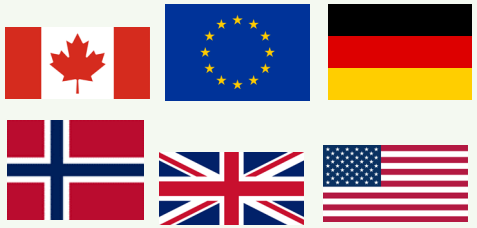
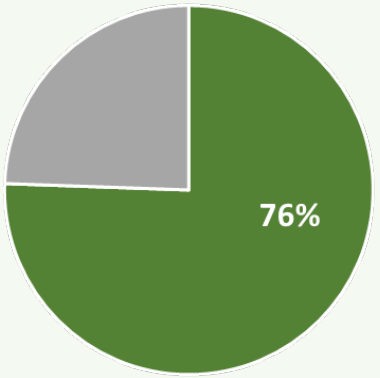


Key players

- Development of the roadmap for hydrogen infrastructure
- Infrastructure for global hydrogen market
- Hydrogen transport and storage infrastructure
- Investment requirements in infrastructure and technology
- Regulatory infrastructure
- Infrastructure supply chain and regional hydrogen hub
- Hydrogen refuelling infrastructure for road transport
- Observation: Both hard and soft (regulatory) infrastructure will be important for transitioning to a green hydrogen economy

Hydrogen trade

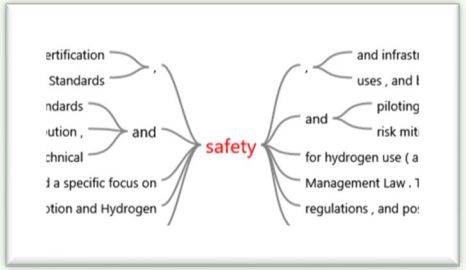


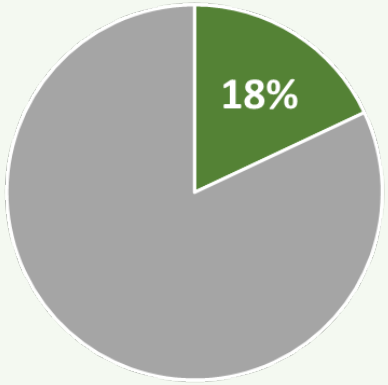
Strong reference
(% of strategies)

Key players

- Development of a hydrogen market
- Hydrogen import and transit hub
- Clean hydrogen trade initiative
- Market platform for hydrogen
- Working with partners to in the international market
- Promotion of domestic and export markets
- Dedicated infrastructure for trade
- **Observation**: Trade in various hydrogen-related technologies (production, distribution, transportation, storage, deployment etc.) not that prominently featured

Safety aspects





Strong reference
(% of strategies)

Key players

- Hydrogen safety management law
- Production safety
- Safety regulations
- Improvement of standards and safety for hydrogen use
- **Observation**: Safety aspects received negligible attention in the strategies

Examples of plans and timelines for green hydrogen rollout

- 100,000 - 200,000 tonnes of green hydrogen a year by 2025
- 50,000 hydrogen-fuelled vehicles on roads by 2025.

- 2020-2024: 6 GW of renewable hydrogen electrolysers in the EU
- 2025-2030: Integrate hydrogen in EU's energy system (40 GW of RE hydrogen electrolysers)
- 2030-2050 – RE hydrogen technologies deployed across all hard-to-decarbonise sectors

- Increase hydrogen supply from present levels of around 2 million tonnes to 12 million tonnes by 2040, 20 million tonnes by 2050

- Around 5 GW of hydrogen-generation capacity is planned to be established domestically by 2030; market ramp-up starting 2023

- 2030: 10 million metric tonnes (MMT) of clean hydrogen annually
- 2040: 20 MMT annually by 2040,
- 2050: 50 MMT annually by 2050

Some important observations and insights

- Reduce grey hydrogen demand and provide low-carbon or zero-carbon alternatives particularly to hard-to-decarbonise sectors
- Identify areas for policy actions. These include:
  - Investment (especially private),
  - Production and demand sectors
  - Market and infrastructure development
  - R&D and cooperation
  - International cooperation.
- Develop regulatory frameworks for (green) hydrogen
- Set up green hydrogen targets
- Develop international supply chains
- Development and deployment of green hydrogen technologies
- Enhance social acceptance of hydrogen
- Hydrogen for seasonal power generation

Limitations

- Work in progress; results are preliminary
- Coverage of strategies and policies:
  - Not all strategies are available online
  - Sometimes in native languages
  - Other policy documents, including subnational ones may be relevant
- Enhance the coverage and methodology, particularly for gaps

Thank you

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