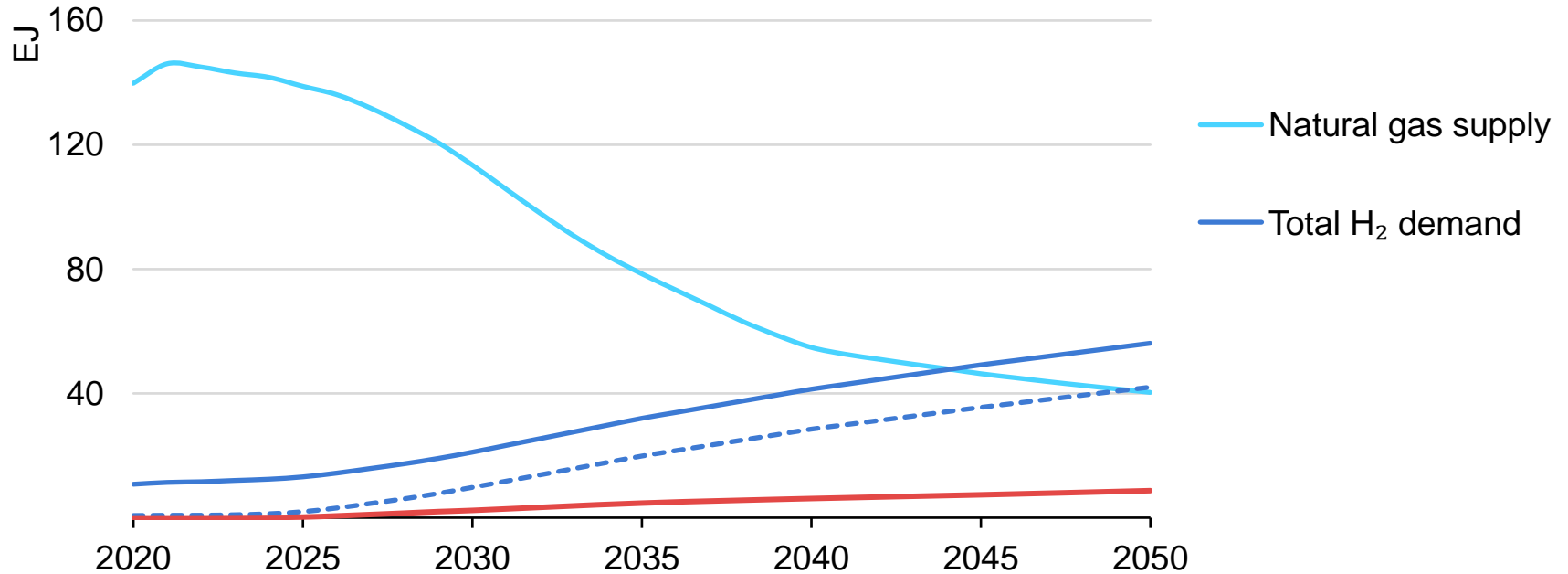International
Energy Agency

IEA

The role of hydrogen storage in the Net Zero Emissions by 2050 Scenario

Amalia Pizarro – Hydrogen and Alternative Fuels Unit

26 May 2023
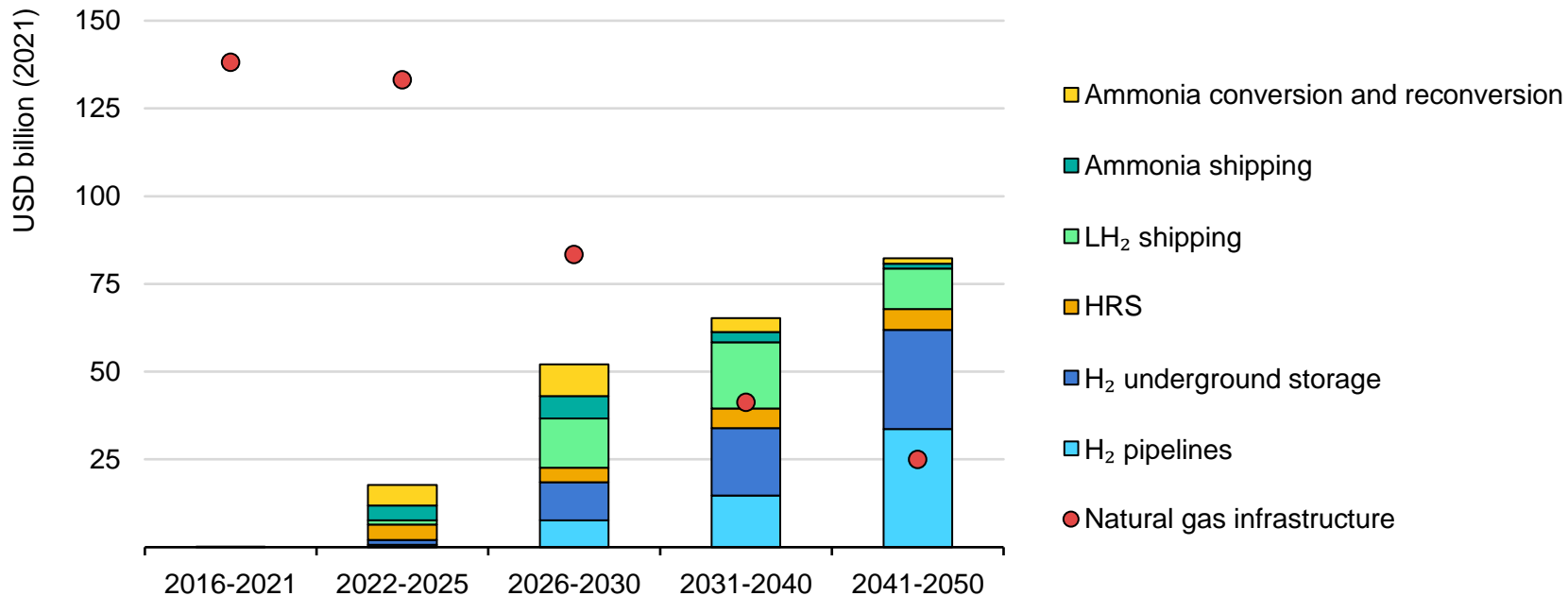
Hydrogen infrastructure needs

Global natural gas and hydrogen supplies in the NZE Scenario, 2020-2050

Hydrogen supply in the NZE Scenario surpasses that of natural gas in 2045 and by 2050 is equivalent to 40% of the current natural gas supply, 75% of it from merchant producers

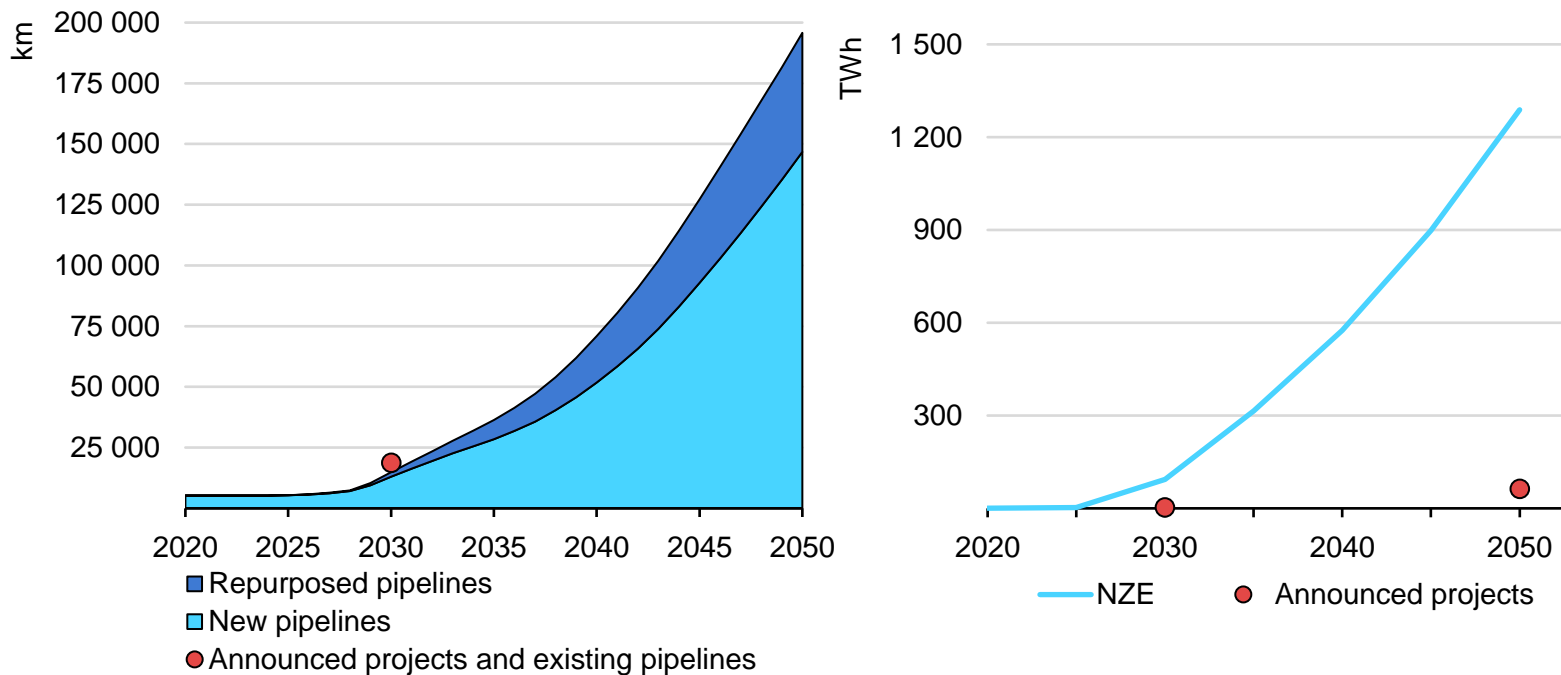# Hydrogen infrastructure – an opportunity for investment

iea

Average annual global investment in hydrogen and natural gas infrastructure in the NZE Scenario, 2016-2050

Legend:
- Ammonia conversion and reconversion (yellow)
- Ammonia shipping (teal)
- LH_2 shipping (green)
- HRS (orange)
- H_2 underground storage (dark blue)
- H_2 pipelines (light blue)
- Natural gas infrastructure (red dot)

Y-axis: USD billion (2021), 0 to 150
X-axis: 2016-2021, 2022-2025, 2026-2030, 2031-2040, 2041-2050

The NZE Scenario requires major investments in hydrogen infrastructure, mostly for pipelines and storage

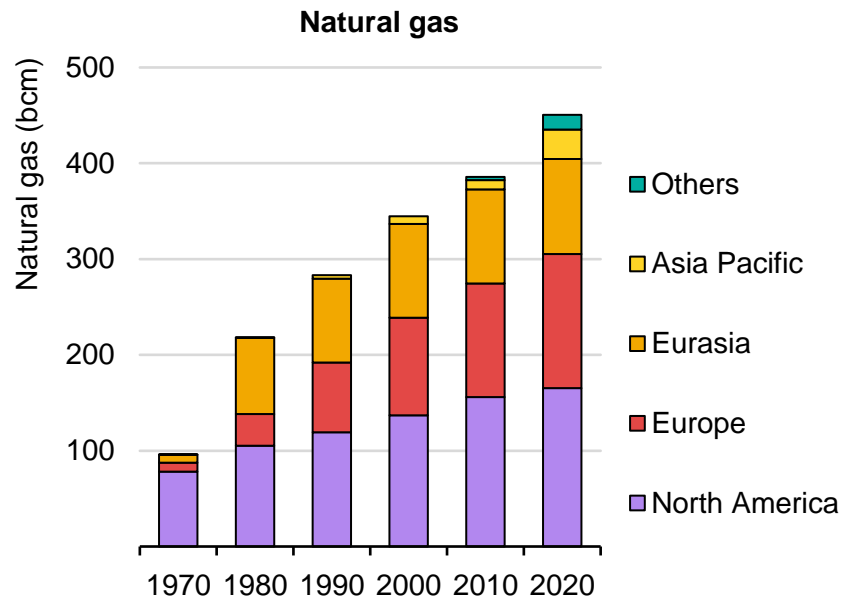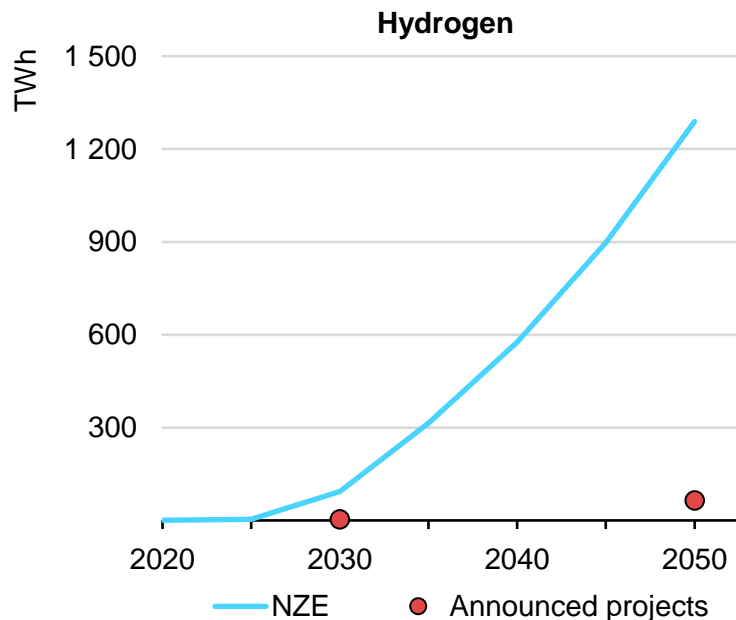# Historical growth in natural gas storage by region

Global hydrogen transmission pipeline length and underground storage capacity in the NZE Scenario, 2020-2050

Legend (left chart):
- Repurposed pipelines
- New pipelines
- Announced projects and existing pipelines

Legend (right chart):
- NZE
- Announced projects

Hydrogen transmission infrastructure expands rapidly in the NZE Scenario, evolving from a few small networks to interregional trunklines, along with the conditioning of underground gas storage facilities

The rise of the network for the transport and storage of hydrogen

Global hydrogen transmission pipeline length and underground storage capacity in the NZE Scenario, 2020-2050

Hydrogen

TWh

— NZE   ● Announced projects

Natural gas

Natural gas (bcm)

■ Others
■ Asia Pacific
■ Eurasia
■ Europe
■ North America

Rapid hydrogen supply growth in the NZE Scenario will require and increase in bulk underground storage, equal to more tan twice that of natural gas over the last 30 years
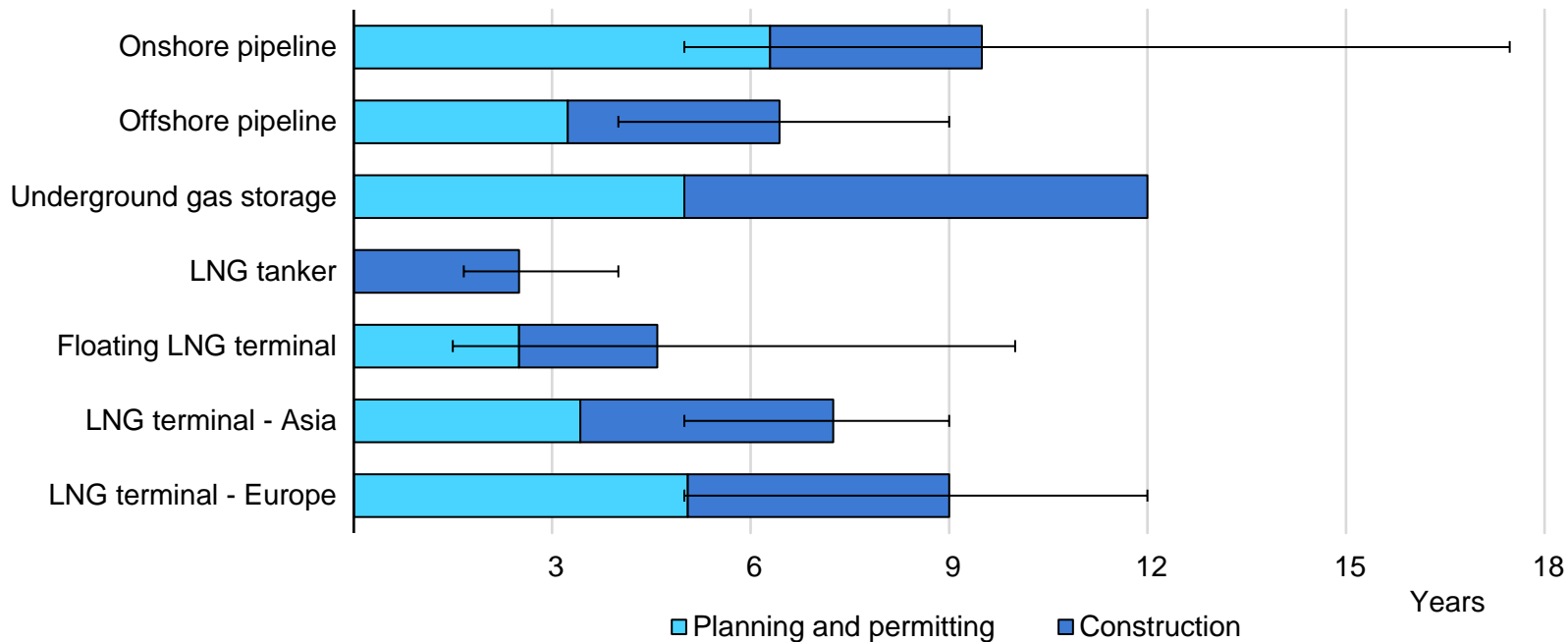
Porous reservoirs for hydrogen or CO_2 storage

Hydrogen and CO_2 storage needs in the NZE Scenario

	Hydrogen	CO_2
By 2050	450 bcm	3 250 bcm
Cumulative to 2050	450 bcm	48 000 bcm

bcm: at normal conditions

Shortening lead times

Lead times of selected natural gas infrastructure projects

Legend: Planning and permitting | Construction

Categories (top to bottom): Onshore pipeline, Offshore pipeline, Underground gas storage, LNG tanker, Floating LNG terminal, LNG terminal - Asia, LNG terminal - Europe

X-axis: Years (3, 6, 9, 12, 15, 18)

Developing new gas infrastructure takes considerable time, so planning must start well in advance and strategies to shorten lead times should be explored

Innovation will be key to the success of low-emission hydrogen

Technology readiness levels of low-emission hydrogen and synthetic fuels, and infrastructure
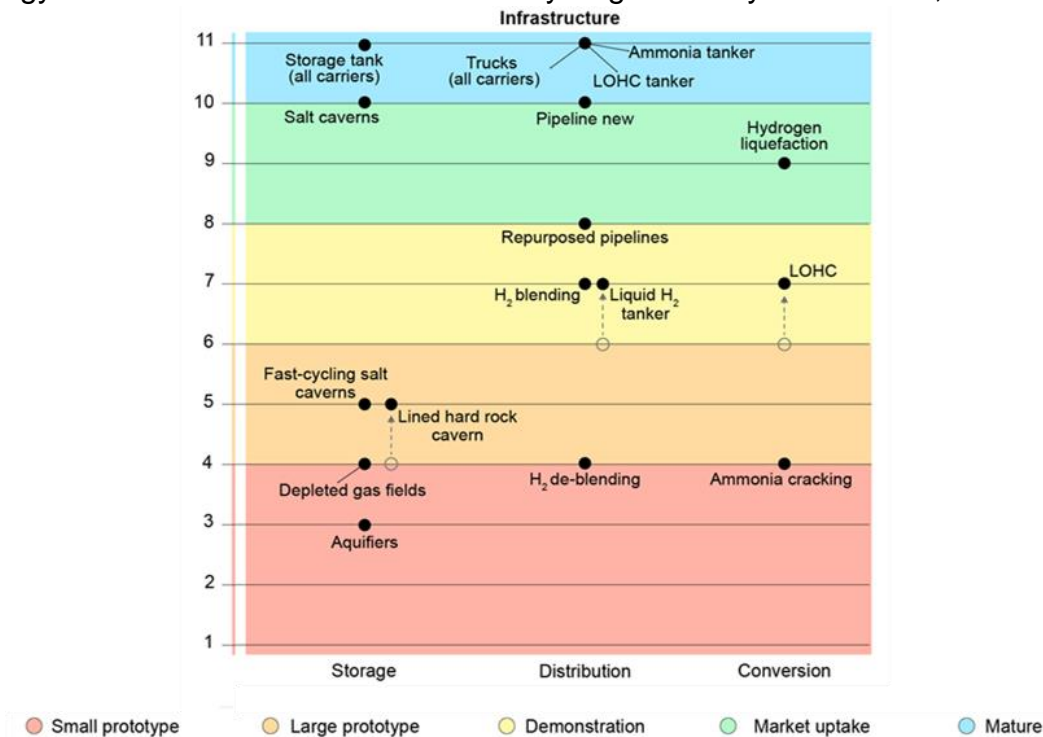
Several technologies related to hydrogen infrastructure are not yet commercially available on a large scale

Conclusions

- Announcements on underground gas storage for hydrogen are still limited compared to transmission pipelines.

- A turbo-charged innovation is needed to ensure that knowledge on underground hydrogen storage technologies is demonstrated on a large scale within this decade.

- Adequate planning should be undertaken well in advance, considering an integrated approach to storage needs for natural gas, hydrogen and CO_2, and taking into account flexibility and energy security concerns.

- Certainty is needed to move from announcements and intentions to actual deployment.