

Unlocking Underground Hydrogen Storage: Securing Europe's Future Energy System

A position paper by H2eart for Europe

22 September 2026

Europe's evolving energy system is changing the way security of supply must be understood. An energy system with a growing share of intermittent renewables needs **flexibility across different timescales** – from short-term balancing to managing prolonged periods of low supply and seasonal mismatches between energy production and demand.

Underground hydrogen storage (UHS) can provide the necessary **long-duration, large-scale flexibility** and thereby strengthen the resilience, affordability and security of Europe's future energy system.

At the same time, UHS projects require **significant investment years** before future hydrogen demand and utilisation are fully visible. Delaying action until the hydrogen market has matured would risk a storage bottleneck just as Europe needs flexibility infrastructure most.

H2eart for Europe therefore calls for the following priorities.

1. Recognise UHS as core element of European energy infrastructure

UHS should be treated as an integral part of Europe's future energy infrastructure – alongside hydrogen transport networks, production and demand. Storage is not an ancillary service: it links energy supply and demand across time, enables more efficient use of hydrogen production and transport assets, and supports market integration, flexibility and security of supply. Infrastructure policy should therefore **assess the hydrogen system as a whole** rather than considering individual assets in isolation. This includes an appropriate representation of hydrogen storage in key European frameworks, such as the TYNDP or the PCI process.

2. Put long-duration storage at the heart of energy security and resilience policy

European security-of-supply frameworks should **explicitly recognise the contribution of UHS** to adequacy, resilience and preparedness. UHS can store energy over weeks or even

seasons and provide structural back-up during prolonged periods of system stress (Dunkelflaute, cold snaps, harsh winters, heat waves, prolonged droughts etc.) – a role that short-duration flexibility solutions cannot perform at comparable scale. UHS should therefore be incorporated into the forthcoming EU Energy Security Framework as well as any further adequacy assessments, resilience planning, stress testing and crisis preparedness.

3. Assess Europe's future storage adequacy needs now

The H2eart for Europe members believe in the long-term role of hydrogen storage and are ready to invest. However, uncertainty around the future development and needs of the wider energy system can materially increase project risk and, in turn, the cost of storage for promoters and finally future users. Greater clarity and support at European level can help reduce these system-level risks and create better conditions for investment.

The European Union therefore needs to **develop a clear view of how much long-duration hydrogen storage will be required, where it will be needed and by when**. Such an assessment should consider prolonged low-renewable periods, hydrogen import disruptions, industrial demand profiles and interactions between the electricity and hydrogen systems. It should inform European and national infrastructure development and could provide a credible investment signal for projects with long development timelines.

Waiting for market demand alone to reveal storage needs risks systematic underinvestment: the system value and required scale of storage only become fully apparent when supply and demand needs are considered together.

4. Provide appropriate de-risking to enable anticipatory investment

UHS must be developed ahead of fully mature hydrogen demand. **Policy frameworks should therefore protect storage operators from risks they cannot manage** – in particular early-stage utilisation, volume and revenue risks – while maintaining incentives for efficient investment and operation.

Action is needed at both EU and Member State level. EU-level mechanisms should address risks arising from cross-border utilisation which cannot be efficiently allocated nationally, while Member States and national regulators need to provide predictable regulatory, access and support frameworks for projects.

Support should evolve with the market. Early projects need development support, faster permitting and greater regulatory certainty. During market ramp-up, revenue stabilisation, long-term booking arrangements, intertemporal cost allocation and public guarantees can help make strategically important projects bankable. As the market matures, support can gradually transition towards stable tariffs and commercially sustainable operation. Ultimately, projects will only progress to FID if investors have sufficient confidence in future revenues.

5. Reflect the cross-border value of storage

The benefits of UHS often extend well beyond the Member State in which a storage facility is located. Geological conditions determine where large-scale storage can be developed, while its benefits can accrue across interconnected European markets. National frameworks alone may therefore fail to recognise and remunerate the full value of strategically located storage.

EU-level de-risking instruments should address this gap and ensure that projects with wider European system value can proceed. Cross-border participation in capacity allocation and consistent market rules should also enable users to access storage irrespective of national borders.

6. Accelerate permitting, standards and regulatory implementation

Investment certainty is not only a question of financial support. Fragmented permitting, unresolved technical standards and uncertainty over future tariff and access arrangements can materially delay projects and increase costs. The EU and Member States should **accelerate and simplify permitting, establish harmonised technical requirements** – including hydrogen quality, connection and safety standards – **and provide timely clarity on the implementation of the regulatory framework for UHS.**

7. Move from recognition to implementation through a coordinated UHS agenda

Following recognition of the strategic role of UHS, the next priority is to ensure its coordinated and effective delivery. EU institutions and Member States should bring together storage adequacy assessment, permitting, technical harmonisation and investment support in a **coordinated implementation agenda for UHS.** The forthcoming revision of the EU Energy Security Framework provides an immediate opportunity to turn this into action.

The objective should be to ensure that sufficient UHS is available when Europe's hydrogen and wider energy system needs it – rather than discovering too late that essential flexibility infrastructure has not been built. With development timelines measured in years, the decisions that secure Europe's future energy system must be taken today.

About H2eart for Europe

H2eart for Europe is an EU-wide, CEO-led alliance committed to accelerating the decarbonisation of the European energy system at lowest cost to society by scaling up underground hydrogen storage (UHS). Launched in Brussels on 23 January 2024, the alliance provides fact-based analysis to support policymakers and draws on the expertise of its members, leading companies shaping the future of hydrogen storage across Europe. We are committed to investing in UHS infrastructure to meet the flexibility needs of a decarbonised energy system.

The organisations listed below are the members of H2eart for Europe.



For media inquiries, please contact info@h2eart.eu.