For a successful hydrogen economy hydrogen storage is critical

COMMON FUTURES
ENERGY TRANSITION SPECIALISTS

Common Futures, energy transition specialists, sees three reasons why:

Meeting baseload industrial demand

By 2030, 42% of hydrogen used in industry will need to be renewable, rising to 60% by 2035. Industries need a steady supply of hydrogen, while its production uses variable wind and solar. Storage is critical to balance supply and demand.

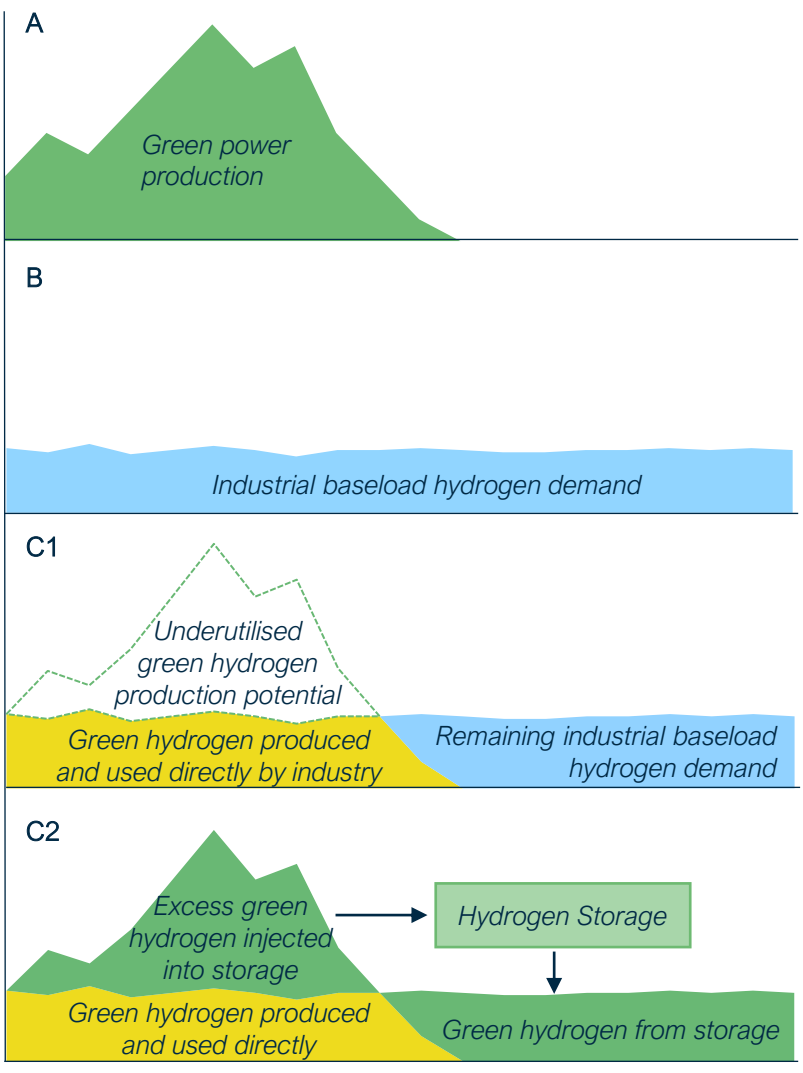
Ensuring power is always available at short notice

By 2040, storage will play a crucial role in ensuring electricity supply during windless winter weeks. Hydrogen can be extracted from storage and used to produce electricity.

Strengthening the business case for renewables

As solar and wind grow, so too do the peaks where we see negative power prices because supply far outstrips demand. Producers can use these moments to produce hydrogen and store it, to be used when prices are high. This reduces curtailment and creates a new revenue stream.

Example: how does storage serve industrial demand?



A: Green hydrogen production with an electrolyser follows the renewable electricity production profile. Cheap hydrogen is produced during high renewable electricity production hours (low electricity prices), and no hydrogen is produced in hours with limited renewable production (high electricity prices).

B: Industrial hydrogen demand is rather inflexible, following a baseload profile.

C1: No storage. The electrolyser follows the industrial demand, producing green hydrogen for direct use, while the excess green electricity is underutilised. When renewable electricity is scarcer, marginal electricity is used to produce hydrogen.

C2: With storage. The electrolyser fully utilises the cheap electricity and produces hydrogen, part of which is used directly, and excess is sent to storage. Stored hydrogen is used once renewable electricity production falls ensuring more green hydrogen use.

Large potential for salt caverns in parts of Europe

The most promising option in the short term is **salt caverns.**

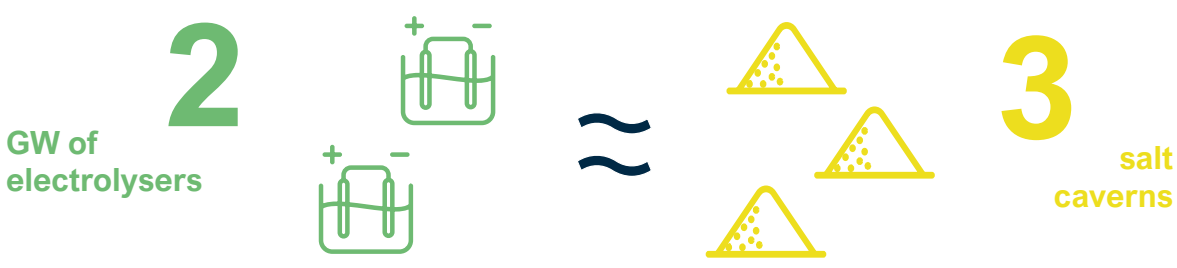
These offer fast injection and ejection of hydrogen, meaning they provide higher levels of flexibility to the energy system at short notice. Most salt structures in the EU are found in **Germany, Poland & the Netherlands, plus options in other countries too.**

For longer term storage, **depleted gas fields, rock caverns** and possibly aquifers could also play a role.

Darker shading indicates greater availability of salt layers where storage caverns could be created, adapted from Caglayan (2020)

How much is needed by when, and where?

Volumes and capacities of required storage are not yet clear. It appears that large numbers of salt caverns may already be needed by 2030. For every 2 GW of electrolysers, we may need 3 salt caverns, or even more. That means **well over 100 salt caverns across Europe to provide storage for 10 MT of hydrogen**. Storage in gas fields may also help to reduce the number of caverns needed.



Who should do what?

Hydrogen targets can only be achieved with the necessary infrastructure to support it. Development of the European Hydrogen Backbone is well underway. The storage needed for a functioning backbone requires the same level of attention. More analysis is needed on what the storage needs for Europe precisely are, including their type, the end-uses they can serve and their locations. This can lead to a **dedicated European Hydrogen Storage Strategy** that can offer clarity to investors.

About Common Futures
We translate scenarios into strategies

Energy transition scenarios show a need for hydrogen storage. Analysis is needed into how much of specific types of storage is required, considering their different characteristics and geologies. Common Futures supports clients in developing strategies for underground hydrogen storage. With our **hydrogen storage simulation model** and through our work in **hydrogen network planning,** we support the development of hydrogen storage strategies. Both company-specific and EU-wide strategies are needed **to move from modelling outcomes to tangible results.**

We focus on energy system optimisation. Looking forward to speaking with you.

daan.peters@commonfutures.com | kees.vanderleun@commonfutures.com

COMMON FUTURES
ENERGY TRANSITION SPECIALISTS