*Hornsdale Power Reserve At Sunset. Image Credit: Neoen*

# Which technologies can help meet the world's need for energy storage?

**22nd November 2022** 4 min read

Batteries ESS Hydrogen Fuel Cell New Energy

With the installation of renewable energy set to expand rapidly between now and 2050, new challenges will start to face the world's electricity and energy networks.

A major concern is that renewable energy is currently curtailed when generation outstrips demand.

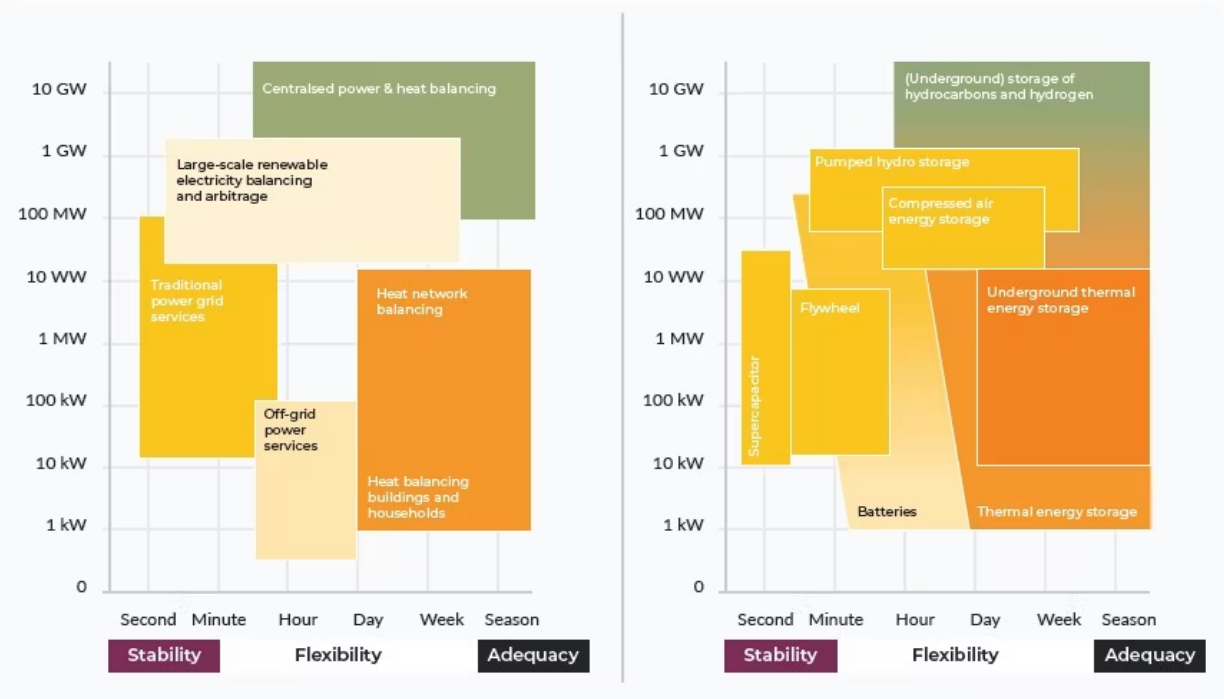
Energy storage is needed to capture this energy to later feedback into the grid when demand rises and generation falls. Storage can also provide a number of grid-level services, from frequency regulation to shifting energy from periods low demand to peak demand, helping electricity grids to function smoothly.

Each application has a distinct set of needs, requiring a wide range of technologies.

"We do not necessarily see winners and losers," Jacopo Tosoni, a policy officer at the European Association for Storage of Energy, told Benchmark. "We will see more and more technologies competing, but in different timeframes and for different services."

## The various applications (left) and technologies (right) for energy storage

Battery energy storage is useful for short time scales up to hours, but hydrogen and other technologies will be needed for longer storage durations.




SOURCE: TNO, LARGE-SCALE ENERGY STORAGE IN SALT CAVERNS AND DEPLETED FIELDS

BENCHMARK

### The role of batteries

Lithium ion batteries can economically store energy from seconds to hours. They can react within milliseconds of being called upon by the electricity grid, allowing them to be used for a variety of grid services.

Depending on the power and capacity of the battery system deployed, the stored energy can be used to regulate the frequency of electricity grids and smooth out the energy generated by renewables to help them better integrate into the network.

Battery demand for energy storage in 2030 is likely to be five times what it is today and account for just over 9% of all battery demand, according to Benchmark's Lithium ion Battery Database.

"Lithium ion is the fastest growing energy storage sector," Tosoni told Benchmark. "But they tend to provide a very specific service–very fast response, but also have only a few hours [of storage]."

Over 80% of lithium ion battery systems for energy storage have between two and five hours of storage, according to data from Rho Motion.

Tosoni said that lithium ion batteries also cover the vast majority of the market for behind-the-meter applications such as backup power for commercial and residential properties.

### Compressed air energy storage

For longer timescales than batteries can provide, compressed air energy storage is gaining interest. Surplus energy is used to compress air into underground salt caverns. When energy is required, the air expands through a turbine to generate electricity.

"It is naturally adapted to scale and duration," Mark Howitt, co-founder of compressed air energy storage developer Storelectric, told Benchmark.

The more mature form of compressed air energy storage, known as diabatic, requires burning natural gas to heat up the air as it expands. Howitt explained that Storelectric has developed a hydrogen-ready diabatic compressed air energy storage system that can burn hydrogen instead of natural gas, reducing the emissions.

A more efficient, but less mature form, is known as adiabatic. This form stores the heat generated during the air compression and uses this to then heat up the air on expansion.

Howitt said compressed air energy storage in salt caverns can provide 12 hours of storage, and that multi-week storage could be possible with new geologies.

### Hydrogen for seasonal storage

Hydropower currently accounts for the majority of the world's energy storage. Water is pumped up to a reservoir and then released downhill to generate energy when needed.

Beyond hydropower, there are limited commercially viable options for storing energy beyond a number of weeks and for seasons.

Hydrogen production and storage can fill this gap. Renewable electricity can electrolyse water to create green hydrogen which can be stored geologically in salt caverns.

"Hydrogen is one of the few technologies with pumped hydro [...] that is able to store significant amounts and for longer periods," Tosoni said. "And while doing that, it's also able to provide this kind of strategic or seasonal storage that is quite unique."

Tosoni said that as electrolysers need a "relatively stable influx" of energy to operate efficiently, hydrogen won't be able to provide the fast response services that batteries can.

Once generated the hydrogen can be fed through a fuel cell to generate electricity with only water as a byproduct. However, one advantage of hydrogen is that it does not necessarily need to be reconverted back into electricity: it can be used by industry as a chemical feedstock or as an alternative to natural gas for heating.

"Hydrogen is quite important because you're able to integrate the electricity and gas sectors, and you have so many industrial applications," Tosoni said. "That's why it is getting so much attention from policymakers."

Compressed air energy storage | Energy storage | European Association for Storage of Energy | Hydrogen | Storelectric

## Related content