

Grid-scale electricity storage
enabling renewables to power grids
affordably, reliably and resiliently



Synergies for Hydrocarbon Companies



Storelectric is in electricity storage at large scales and long durations, the essential missing link in the renewable energy transition. While there may not appear superficially to be many synergies with hydrocarbon companies, in fact Storelectric's storage is the perfect match and diversification, supporting the evolution of hydrocarbon businesses into an increasingly Net Zero world.

Geology

Currently, Storelectric's advanced Compressed Air Energy Storage stores its air in salt caverns. In future, we will develop the use of other geologies such as aquifers, depleted hydrocarbon wells and some mines.

Salt basins have mostly been found by petrochemical companies' exploration, and so tend to be at or near locations where they are operating long-term. Salt caverns are well-known technologies to the petrochemical industry:

- ◆ Widely used for bunkering oil and various gases;
- ◆ About 1/3 of Western Europe's natural gas stocks are in them;
- ◆ Also used for permanent disposal of special waste.

Plant and Equipment, Supply Chains

Storelectric's CAES plants all use equipment well-known to the petrochemical industry, at similar scales, which therefore have similar supply chains. This equipment includes:

- ◆ Compression;
- ◆ Expansion / generation (turbines);
- ◆ Heat exchange;
- ◆ Fluid flow;
- ◆ Thermal storage plant and equipment;
- ◆ Salt caverns.

Grid-scale electricity storage enabling renewables to power grids affordably, reliably and resiliently



Project Sizes

Storelectric's plants will be at a similar scale as power stations, 40MW to multi-GW and with an above-ground footprint slightly greater than that of a gas-fired power station. Therefore project management skills, methods and financing are all very transferrable.

Energy Trading

Petrochemical businesses frequently trade electricity; almost all buy it wholesale, optimising their purchases and consumption to minimise costs. Increasing numbers of such businesses generate and sell electricity and related services. Electricity is probably the world's most traded commodity that is almost un-stockable. The ability to stock it would transform the business.

Storelectric's plants have a broader range of capabilities than any others in the business: just as many petrochemical companies seek to sell value-added products, so the majority of revenues from Storelectric's plants would be for value-added services provided to grids, customers and even suppliers.

Synergies with Renewables

Increasing numbers of petrochemical companies, seeking to remain in the energy industry after the demise of oil and gas, are investing in renewable generation – both on-site and in dedicated renewable farms. Storelectric's CAES technologies have many [synergies with renewable generation](#) at suitable scales, including enabling such farms to be built where otherwise grid reinforcement would be prohibitive.

Hydrogen

Storelectric's technologies are hydrogen compatible, in making, consuming and complementing it.



Making hydrogen is much more expensive opex and (especially) capex if powered intermittently. Storelectric's CAES can turn intermittent renewable energy into baseload or (substantially cheaper) near-baseload in-feed energy, whether the hydrogen is made by electrolysis, Steam Methane Reformation (SMR) or almost any other process, and whether powered by offshore or onshore wind, solar or a combination of these.

Consuming hydrogen: Storelectric's technologies include Hydrogen CAES™, hybrid plants and a high temperature electrolysis patent.

- ◆ Hydrogen CAES is a more-efficient and much cheaper form of traditional CAES which can consume methane, hydrogen or any mix of the two in the expansion /

Grid-scale electricity storage enabling renewables to power grids affordably, reliably and resiliently



discharge part of the cycle, in a plant that can deliver more flexible outputs than almost any plant on the grid, of any technology.

- ◆ Hybrids (between Hydrogen CAES and Green CAES™) offer increased efficiency and flexibility.
- ◆ The high temperature electrolysis patent¹ uses the heat of compression to catalyse electrolysis, greatly reducing or even eliminating the electricity input. It is a developmental technology.

Complementing Hydrogen: hydrogen can validly and efficiently target many enormous industries such as gas grids, transportation, heating and some industrial processes. However, for balancing grids, the round-trip efficiency can never exceed the mid-40s % (measured from intermittent input to hydrogen-fuelled power station output, grid-to-grid) while Storelectric's CAES can achieve ~70% with much cheaper plant. The two technologies together can offer the whole solution.

Reducing / Eliminating Self-Consumption

Many petrochemical plants and their related site developments consume a large proportion of the hydrocarbons entering them, thereby greatly reducing their potential sales. Storelectric's CAES enables much or all of this to be replaced by locally generated and stored renewable electricity.

Business Size and Scope

The need for large-scale long-duration electricity storage is global, its market (for construction alone) estimated at \$1trn capex in the first (and smallest) of its 3 phases, 3-6 times that for the second, and 3-10 times the second for the third. Operational cash-flows are 10 times those numbers, annually. This is a market in which a substantial number of multinational trillion-dollar businesses can compete, just as they do in the petrochemical industry.

Skills and Personnel

Because of all these commonalities above, personnel can be re-trained for the renewable energy industry very quickly and cheaply; the conversion of their skills will be easier than most other transitions. This applies across a vast range of skills and capabilities, and right up the hierarchy.

Below:

- ◆ About Storelectric
- ◆ About the Author

¹ WO 2019 GB 52168 20190801

Grid-scale electricity storage

enabling renewables to power grids affordably, reliably and resiliently

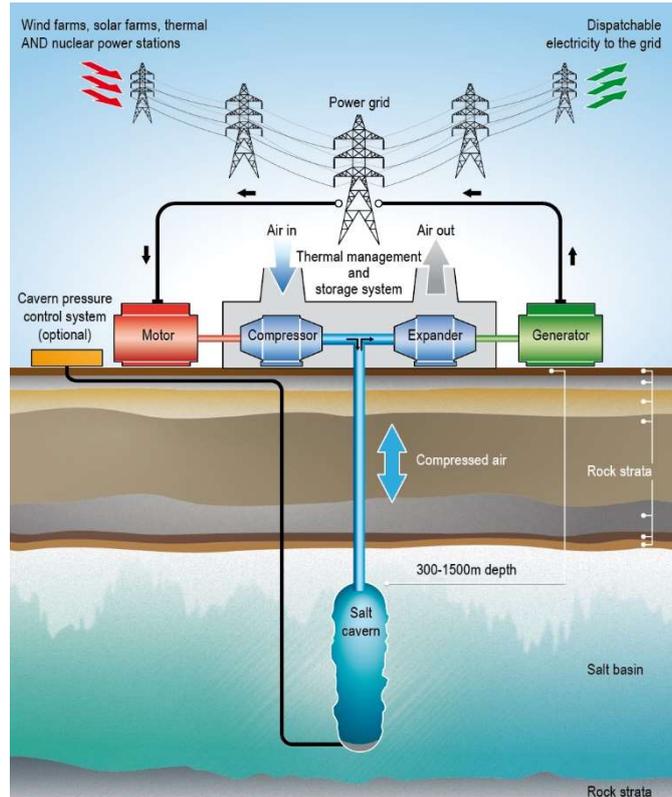


About Storelectric

Storelectric (www.storelectric.com) is developing transmission and distribution grid-scale energy storage to enable renewables to power grids reliably and cost-effectively: the world's most cost-effective and widely implementable large-scale energy storage technology, turning locally generated renewable energy into dispatchable electricity, so... **enabling renewables to power grids cheaply, efficiently, reliably and resiliently.**

- ◆ Innovative adiabatic Compressed Air Energy Storage (Green CAES) will have zero / low emissions, operate at 68-70% round trip efficiency, levelised cost significantly below that of gas-fired peaking plants, and use existing, off-the-shelf equipment.
- ◆ Hydrogen CAES technology converts & gives new economic life to gas-fired power stations, reducing emissions and adding storage revenues; hydrogen compatible.

Both technologies will operate at scales of 20MW to multi-GW and durations from 4 hours to multi-day. With the potential to store the entire continent's energy requirements for over a week, global potential is greater still. In the future, Storelectric will further develop both these and hybrid technologies, and other geologies for CAES, all of which will greatly improve storage cost, duration, efficiency and global potential.



About the Author



Mark Howitt is Chief Technical Officer, a founding director of Storelectric. He is also a United Nations expert advisor in energy transition technologies, economics, regulation and politics – [invitation here](#).

A graduate in Physics with Electronics, he has 12 years' management and innovation consultancy experience world-wide. In a rail multinational, Mark transformed processes and developed 3 profitable and successful businesses: in commercialising a non-destructive technology he had innovated, in logistics (innovating services) and in equipment overhaul. In electronics manufacturing, he developed and introduced to the markets 5 product ranges and helped 2 businesses expand into new markets.

Disclaimer. This document represents the intentions of Storelectric Ltd at the time of writing, which may change for various reasons including (but not limited to) technical, strategic, political, financial and the wishes of partners or investors. Any person or organisation considering investing in Storelectric does so at their own risk and is responsible for undertaking their own due diligence.