

# CARES PCI Information Leaflet

In the CARES (Compressed Air Renewable Energy Storage) PCI (Project of Common Interest), Storelectric offers safe, clean and cost effective energy storage at grid scale (Gigawatts and Gigawatt-hours).

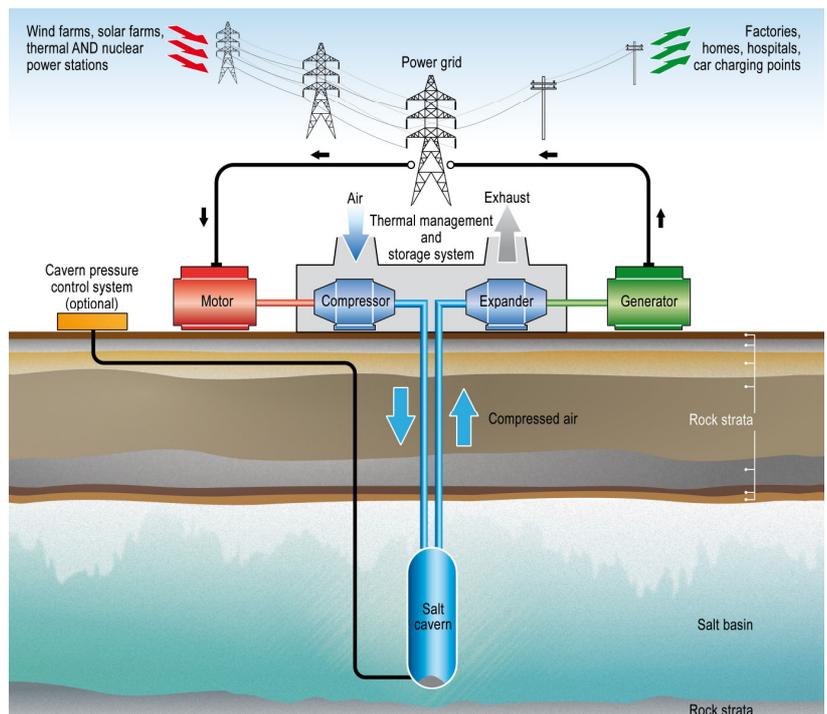
## Why Energy Storage is Needed

Natural resources such as wind and solar are unpredictable, only generating electricity when nature's conditions allow. This makes them unreliable and unsuitable for satisfying either baseload or variable demand, and costly as other forms of generation must be kept available to back up times when it is not available. If renewable energy could be stored and used when needed, this would make them a cost effective and viable (i.e. without subsidies) alternative to fossil fuels.

The main thing that eludes the energy industry is how to store energy in large quantities, cost effectively and safely. Battery technology has not yet advanced far enough and are one thousandth or less of the scale required, and other forms of energy storage currently being used are limited in capacity and high cost.

## Compressed Air Energy Storage (CAES)

Surplus (usually off-peak) electricity is used to pressurise air, which is stored underground in very high capacity salt caverns, as most natural gas is currently stored worldwide. During peak demand, when prices are high, this air is released to regenerate electricity. It draws off and feeds into the grid, so supporting all generation technologies. It is safe, far underground, and salt caverns are naturally hermetic and self-sealing. This is not a new idea: the application has been proven in Huntorf in Germany (from 1978) and in McIntosh, Alabama, USA (1991). These facilities have proven successful and safe, but only achieve 42-50% efficiency.



Storelectric's plants will achieve close to 70% efficiency and up to 100% renewable.

CAES can satisfy global energy storage needs as there are many suitable geologies globally.

## Why is TES CAES different?

- TES CAES (Compressed Air Energy Storage with Thermal Energy Storage) is up to 100% renewable, whereas all previous CAES uses large amounts of fossil fuels.
- Efficiencies are considerably better at up to 70% vs 42-50% for traditional CAES.
- Power capex (€/GW) is roughly equivalent to that of gas-fired power stations.



- Storage capex (per GWh) is 1/50 of pumped hydro and 1/200 of chemical batteries.
- Profitable: IRR >12% for first-off in today's (consistently improving) markets, rising as costs reduce.
- Uses off-the-shelf equipment, well proven in other industries, which reduces risk considerably.
- Storelectric has a developing consortium of blue-chip multinational partners, with salt caverns ready to go.
- Plants can be built throughout the world: suitable geologies are widespread, and others available in future.
- There is great interest in financing full-scale plants, following a successful first-off.
- Technology pipeline for an integrated range of solutions optimised to the most locations and load cases.
- TES CAES uniquely has the potential to make both existing and renewable generation profitable without subsidy, dramatically cut emissions and provide complete energy security to countries and regions.

The European ENTSO-E organisation has approved a Cheshire 40+500MW TES project as a Project of Common Interest, meaning that it is important infrastructure at a continental scale, giving access to €9.12bn Connecting Europe Facility and €5.12bn ECB funding for energy, and assistance with permits in all 35 member countries.

### CARES PCI

The CARES PCI project is one distribution connected plant rated at 40MW, 200MWh and a second transmission connected plant rated at 500MW, 2.5GWh. The smaller plant will prove the technology while generating a double-digit Internal Rate of Return (IRR) and enable swift re-financing of this plant with project financing.

### Preliminary Project Schedule

The project schedule (right) shows how the two plants will be developed concurrently, with just sufficient delay for the larger plant to be developed in consideration of the lessons learned from the smaller plant. The longer timescales for the large plant are largely due to the different planning process (Nationally Significant Infrastructure Project for the large one, local authority planning for the small) and different grid connections (transmission grid for the large one, distribution grid for the small). There will also be a smaller difference in the construction times of the two plants.

### Investment opportunity

The 40MW plant is in development. We have applied for funds to pay for pre-construction work on both plants: pre-planning, planning, FEED, grid connection application, some detailed design; the funding would also support the further development of our European pipeline of future projects. We seek match funding for this.

	40MW, 200MWh	500MW, 2.5GWh
2019 Q3	Pre-	
Q4	planning	
2020 Q1		Pre-
Q2	Planning,	planning
Q3	detailed	Planning,
Q4	design	detailed
2021 Q1		design
Q2	Construction	
Q3		
Q4		
2022 Q1		
Q2		
Q3		
Q4		
2023 Q1		
Q2		
Q3	Commission	
Q4		
2024 Q1		Construction
Q2		
Q3		
Q4		
2025 Q1		
Q2		
Q3		
Q4		
2026 Q1		
Q2		
Q3		
Q4		
2027 Q1		Commission



Assuming that we are awarded this pre-construction funding, we will be in a position to apply for construction funding for the 40MW plant, at a potential funding level of 50% or 75%. Current information available to us suggests that this will be available regardless of Brexit.

### **National Grid Development Plan and Alternative Routes Considered**

Evidently this will be developed during the FEED phase of each plant, in discussion with the relevant system operator.

### **Expected Impacts**

The north of England is in the middle of a period in which 13GW of fossil fuelled power stations are closing, and over 11GW of major wind farms are being built – not to mention the distributed renewable generation (both wind and solar) being installed. This is an enormous shift from dispatchable to intermittent generation. However well one can forecast the intermittent generation, it cannot be relied upon to be generating when it is required. This yields a need for many gigawatts of storage to enable renewables to deliver the dispatchable energy that is needed.

The closure of all these power stations also greatly reduces the inertia and natural reactive power available to the grid. This in turn reduces the black start capability within the region. In all these ways the grid in the north of England is becoming exceedingly vulnerable; National Grid is spending millions in building synchronous condensers to alleviate these issues to a small degree. Storelectric's CARES project will provide natural inertia and natural reactive power 24 hours a day; and if designed to do so, it can provide 540MW of black start capability with sufficient inertia to magnify the impact of this capability.

National Grid has recognised these needs in launching its Stability Services Pathfinder project which may provide revenues for the plants that are largely additional to the revenue streams previously identified for them.

### **Cross-Border Impacts**

Interconnectors cannot plug this gap as the region is too far from most, the opposite side of highly congested parts of the transmission grid in London and the South East. Therefore these balancing services must be provided locally, to avoid grid reinforcement costing tens of billions. Moreover, our neighbouring countries cannot always provide the energy Britain needs at peak times because most of them have similar dispatchable generation closures to us, and similar times of peak consumption, so they need the energy just when Britain needs it.

However this storage can work in conjunction with interconnectors when it is not filled with more local renewable energy. That is because it enables continental electricity to be imported and moved to the north of England during periods of low demand (e.g. overnight), when the grid in London and the South East is not congested, for use during periods of high demand.

### **Note on the Project**

This project is advancing fast in its design and engineering, having been delayed while seeking funding. Therefore this document is in its early stages of development, and will be amplified as the project progresses.

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