CARES PCI Information Leaflet

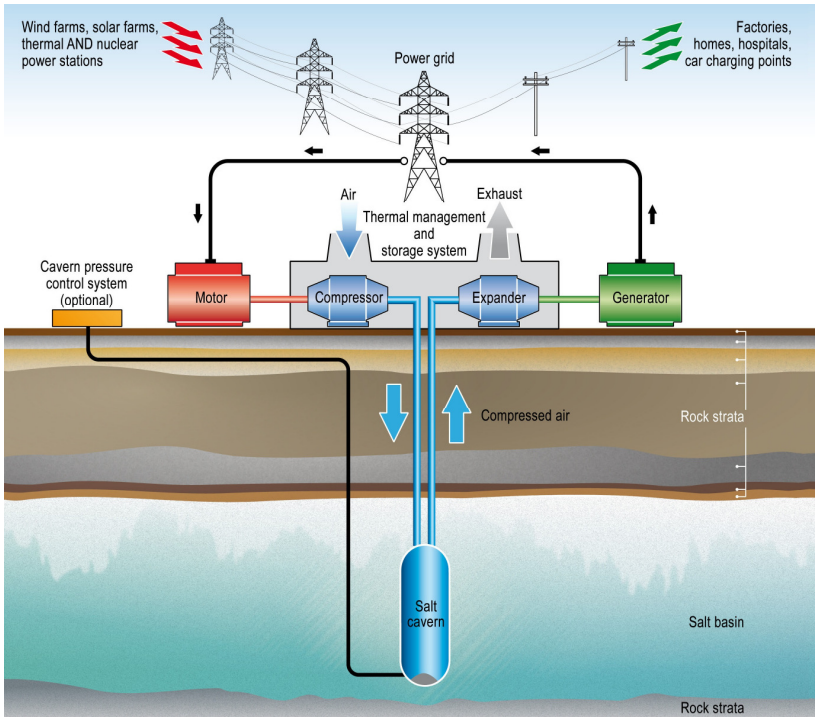
In the CARES (Compressed Air Renewable Energy Storage) PCI (Project of Common Interest), Storelectric offers safe, clean and cost effective energy storage at grid scale (Gigawatts and Gigawatt-hours).

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 world-wide. 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 20+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.

		40MW, 200MWh	500MW, 2.5GWh
2018	Q1	Technical feasibility	
	Q2	FEED + planning + grid offer	Technical feasibility
	Q3		
	Q4		FEED + planning + grid offer
2019	Q1	Construct	
	Q2		
	Q3		
	Q4		
2020	Q1		
	Q2		
	Q3		
	Q4	Commission	
2021	Q1		Construct
	Q2		
	Q3		
	Q4		
2022	Q1		
	Q2		
	Q3		
	Q4		Commission

Investment opportunity

The 40MW plant is in development and will be seeking funds by the end of 2018 in order to build the plant. We will also be seeking funding during 2018 in order to develop the 500MW plant to shovel ready. Any PCI awards will reduce the funds needed.

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.

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.

Competent Authorities and Stakeholders

The competent authorities and stakeholders include:

Organisation	Website	Role	Concerns
Department of Business, Energy and Industrial Strategy (BEIS)	www.gov.uk/.../department-for-business-energy-and-industrial-strategy	Government department	Energy, business, industrial and environmental impacts; UK climate commitments
Her Majesty's Treasury	www.gov.uk/government/organisations/hm-treasury	Government finance department	Economic impact
National Grid	www.nationalgrid.com/uk	Transmission Services Operator (TSO)	Transmission grid connection, balancing and ancillary services
Scottish Power Energy Networks (SPEN)	www.spenergynetworks.co.uk	Distribution Network Operator (DNO)	Distribution grid connection, soon acquiring system operator responsibilities
Planning Inspectorate	www.gov.uk/government/organisations/planning-inspectorate	Nationally Significant Infrastructure Planning (NSIP)	Visual and environmental impact; national priorities
Cheshire East Council	www.cheshireeast.gov.uk	Local planning	Visual and environmental impact; jobs; local priorities
Natural England	www.gov.uk/government/organisations/natural-england	Environmental gatekeepers	Environmental impact
The local population	n/a	Consultees	Visual and environmental impact; jobs; local priorities