HIGHVIEW
POWER STORAGE

Liquid Air Energy Storage

Pumped Hydro Capability
No Geographical Constraints

2017

www.highview-power.com

In Operation: The Pilot Plant ran from 2011—2014 connected to SSE's biomass facility near London. Relocated to the Centre for Cryogenic Energy Storage at the University of Birmingham.

In Build: A new 5MW pre-commercial LAES technology demonstrator with project partners, Viridor at their landfill gas site at Pilsworth in Greater Manchester, UK.

In the Future: The LAES GigaPlant. 200MW/1.2GWh. Tomorrow's storage using today's technology.

Contents

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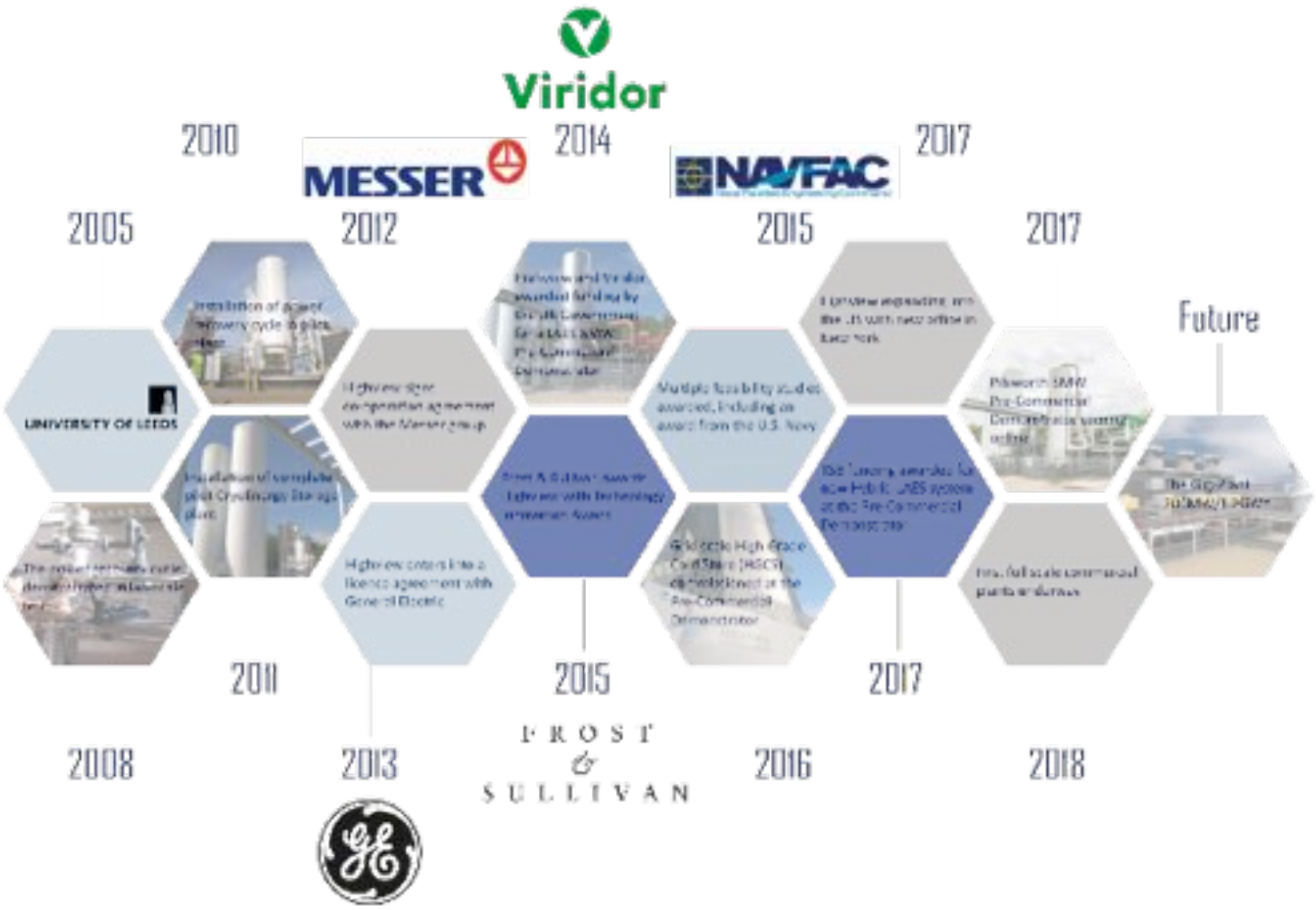

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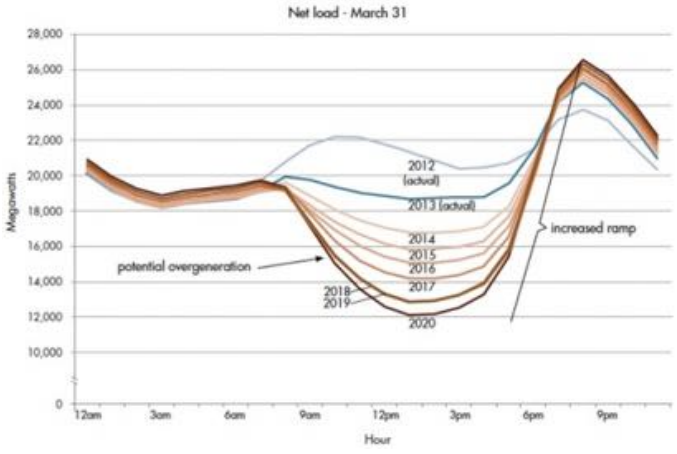
The need for large scale, long duration energy storage

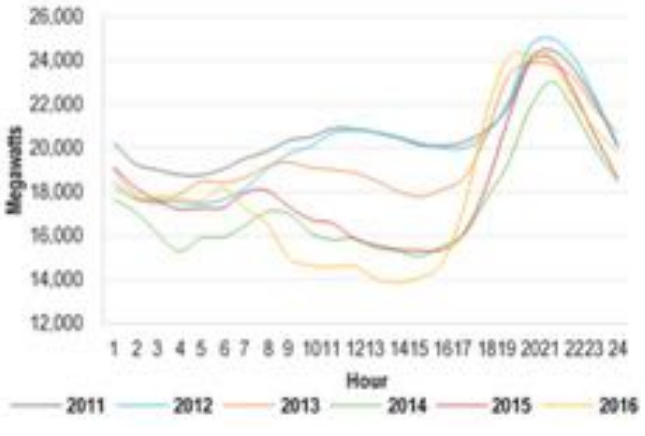
'The electric grid and the requirements to manage it are changing. Renewable resources increasingly satisfy the state's electricity demand. Existing and emerging technology enables consumer control of electricity consumption. These factors lead to different operating conditions that require flexible resource capabilities to ensure green grid reliability. The ISO created future scenarios of net load curves to illustrate these changing conditions. Net load is the difference between forecasted load and expected electricity production from variable generation resources. In certain times of the year, these curves produce a "belly" appearance in the mid-afternoon that quickly ramps up to produce an "arch" similar to the neck of a duck—hence the industry moniker of "The Duck Chart".' California ISO CommPR/HS/10.2013

The Duck Curve



Graph courtesy of CAISO

CAISO's analysis of actual and projected electric load from 2012-2020 to understand how increasing penetrations of renewables will impact grid conditions.



Graph courtesy of ScottMadden Inc.

Actual average hourly production data from CAISO from January 2011 to June 2016 - the duck curve is real and growing faster than expected.

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Key Benefits

30+ years lifetime
with mature components

Lowest cost
at utility scale

60% efficiency
in standalone configuration

70%+ efficiency
by utilising **waste heat or cold**

Ready to deploy
with an established supply chain

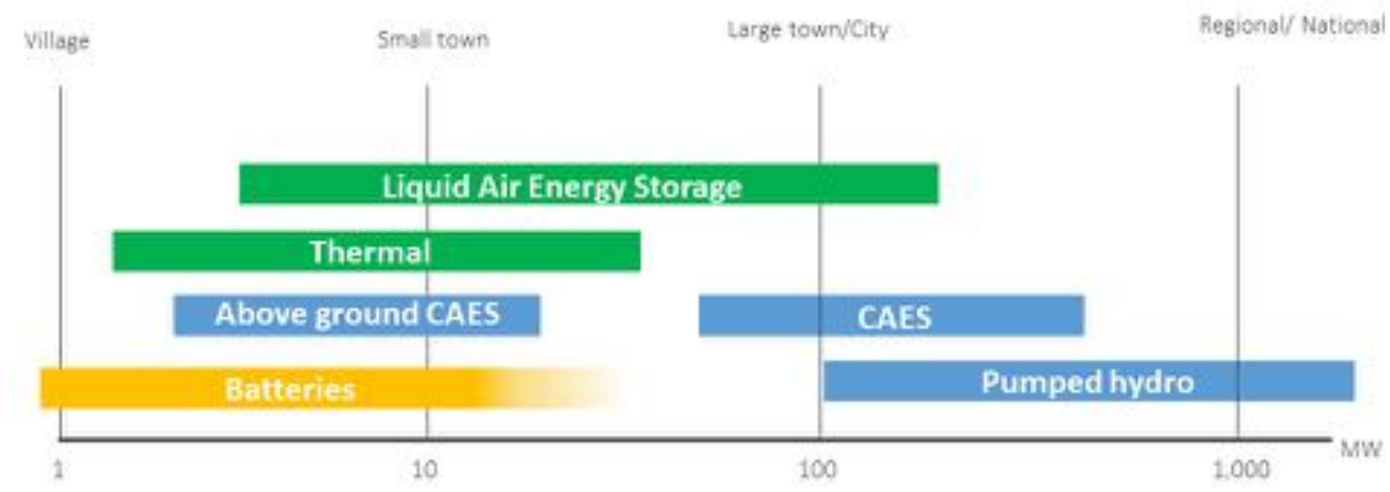
Zero emissions
and benign materials

Can be **built**
anywhere

Large-scale
GW and GWh

Alternative Energy Storage Technologies

Different storage technologies cover different needs. LAES sits comfortably in the middle offering medium to large scale storage solutions that can be located at the point of demand. Below is a comparison chart showing the different energy storage technologies and the size ranges they can offer.



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LAES: Helping to balance the grid

1. Power Generation

- Managing intermittent renewable generation
- Energy Arbitrage
- Peak shaving

2. Transmission

- Ancillary services
- Transmission constraints
- Inertia services
- Responsive flexibility services

3. Distribution

- Reactive power
- Voltage support
- Local security
- Distribution losses

4. End Users

LAES can provide power reliability and energy management to commercial and industrial end users. In particular, LAES is well suited for energy intensive industries that have low-grade heat or waste cold available, for example thermal generation and LNG terminals.

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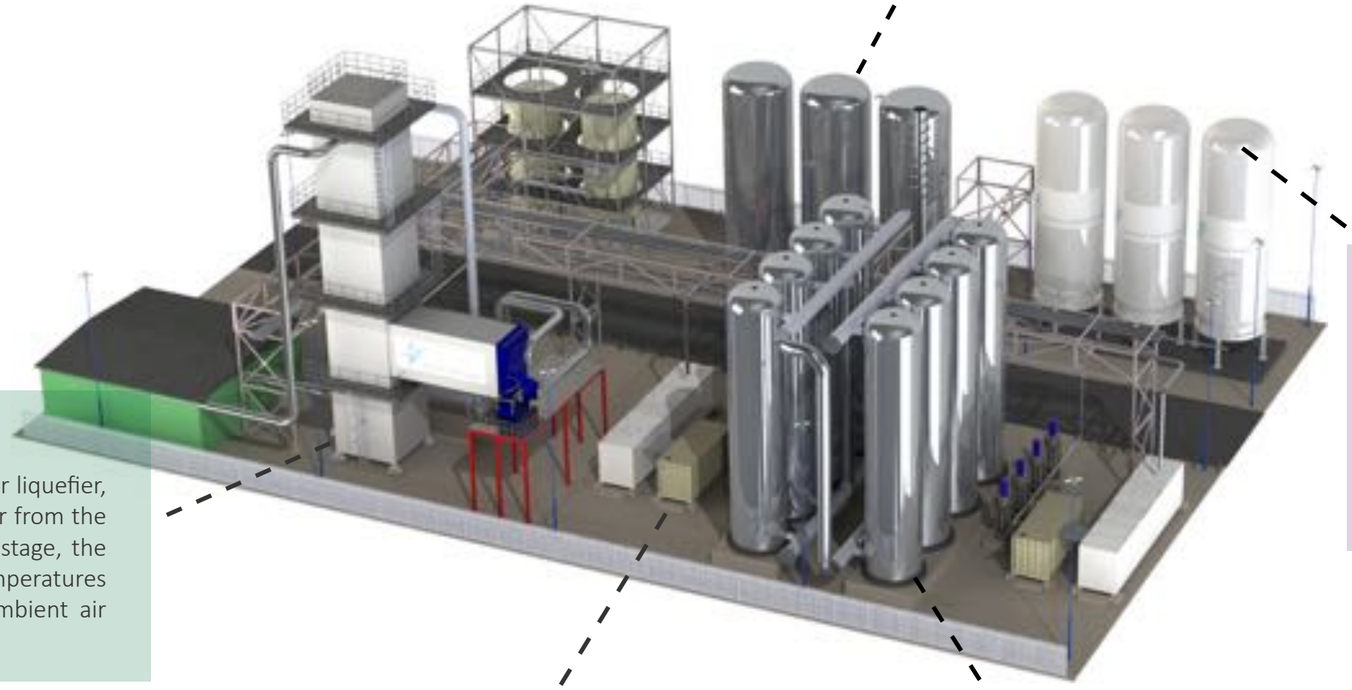
Liquid Air Energy Storage (LAES): Our Process

Highview's LAES system comprises of three primary processes:

1.) Charging System **2.) Energy Store** **3.) Power Recovery**



Stage 1. Charging the system

The charging system comprises of an air liquefier, which uses electrical energy to draw air from the surrounding environment. During this stage, the air is cleaned and cooled to subzero temperatures until the air liquefies. 700 litres of ambient air become 1 litre of liquid air.

Thermal store

The low boiling point of liquefied air means the round trip efficiency of the system can be improved with the introduction of above ambient heat. Highview's standard LAES system captures and stores heat produced during the liquefaction process (stage 1)and integrates this heat to the power recovery process (stage 3). The system can also integrate waste heat from industrial processes such as thermal power generation or steel mills.

Stage 2. Energy store

The liquid air is stored in an insulated tank at low pressure, which functions as the energy store. This equipment is already globally deployed for bulk storage of liquid nitrogen, oxygen and LNG. The tanks used within industry have the potential to hold GWh of stored energy.

Stage 3. Power recovery

When power is required, liquid air is drawn from the tank(s) and pumped to high pressure. Stored heat from the air liquefier is applied to the liquid air via heat exchangers and an intermediate heat transfer fluid. This produces a high pressure gas, which is then used to drive a turbine.

Cold recycle

During stage 3, very cold air is exhausted and captured by our proprietary high-grade cold store. This is used at a later time to enhance the efficiency of the liquefaction process. Alternatively, the system can integrate waste cold from industrial processes such as LNG terminals.

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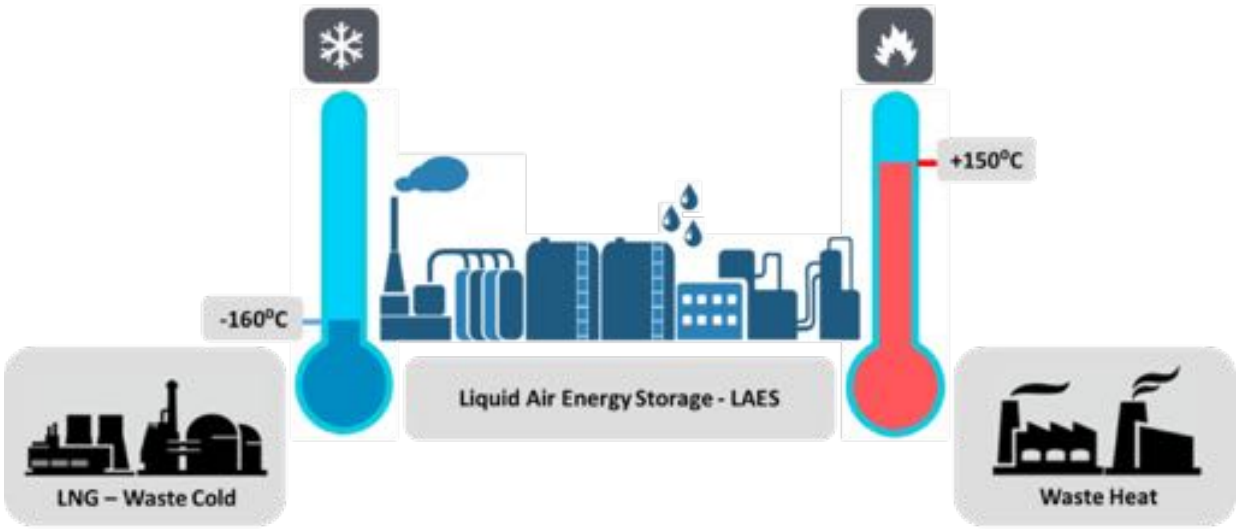
Waste Heat and Waste Cold

Waste Cold

Waste cold is produced primarily during the regasification of Liquefied Natural Gas, or LNG. During this regasification process, vast amounts of cold is wasted and as such operators are looking at smarter and more efficient ways of harnessing this cold. As Highview's LAES technology is a thermodynamic process we can harvest this waste stream and make use of it during our re-charging phase.

During the re-charge of the Liquid Air tanks, the waste cold is used to reduce the amount of work the refrigerators have to do. The effect of this is a reduced amount of power consumption during re-charge and a higher overall round trip efficiency.



Waste Heat

If there is a waste heat stream available, the LAES system can utilise this during the discharge of the system. The effect of injecting this waste heat into the expanding air makes more work available to the generators, thus creating more power from the same amount of Liquid Air. This improves the round trip efficiency considerably, and potentially reduces the CAPEX of the LAES plant by not having to harvest our own waste heat from compression during the re-charge of the system.

The higher the grade of heat available, the better the performance of the LAES system. This provides a flexible Energy Storage plant that can be operated as a stand-alone plant, co-located near industrial waste heat applications or integrated into power plants, such as the GE Peaking Plant application.

~ 60%	70%	>100%
Stand-alone	Peaking Plant	LNG + Waste Heat

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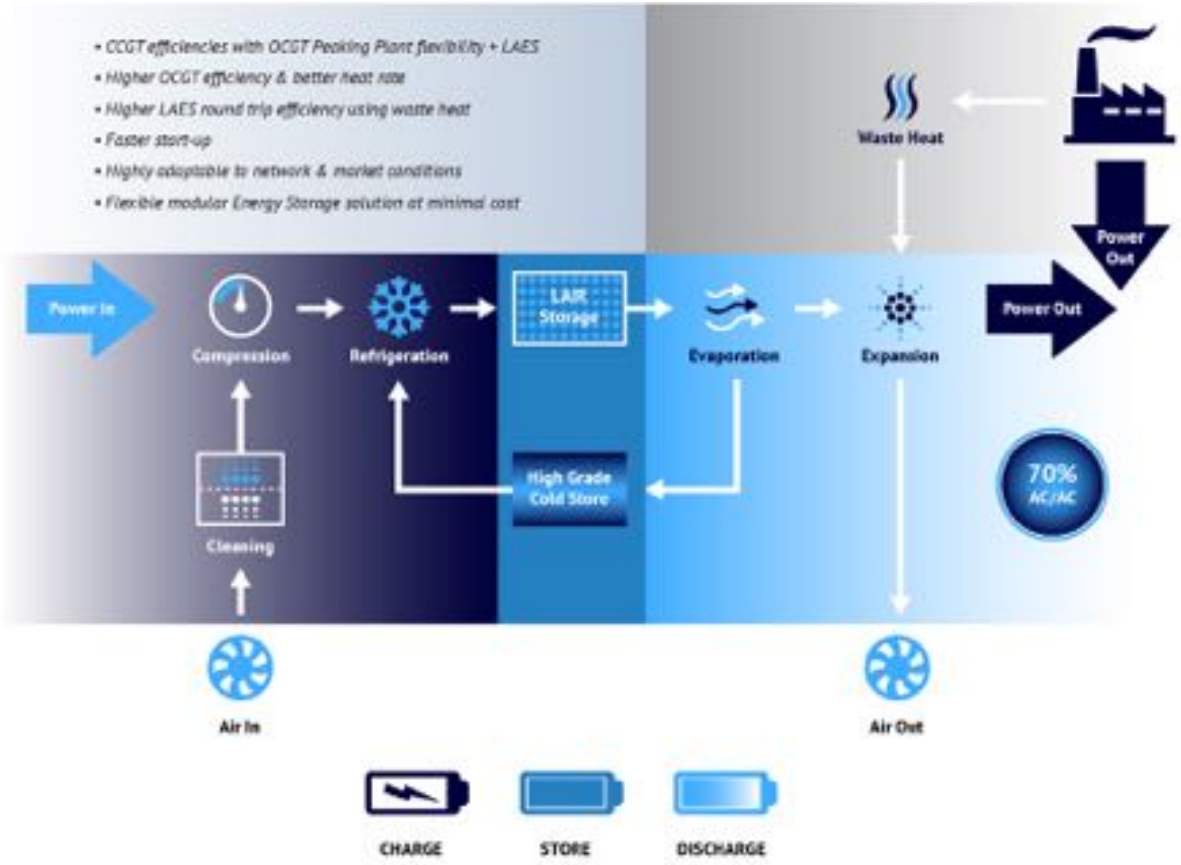
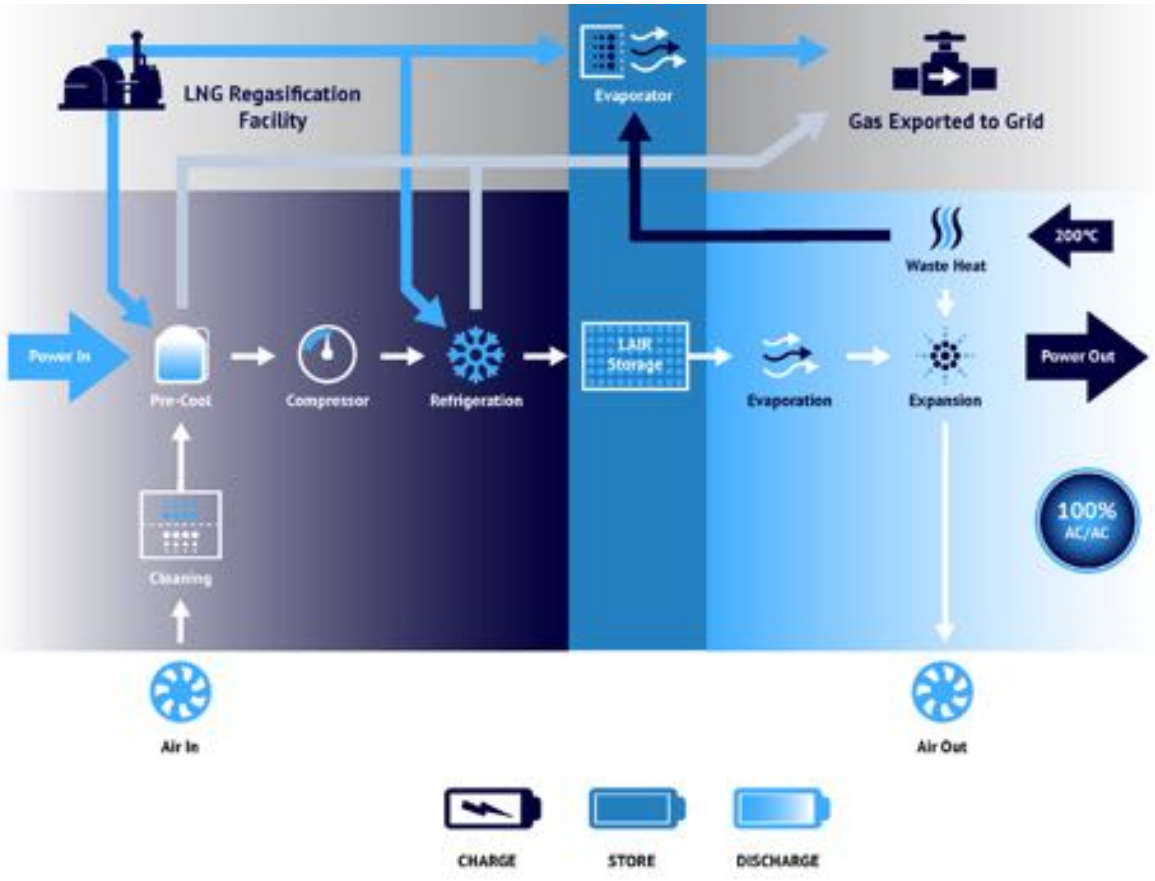
Peaking Plant Application



LNG Application



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Pilot Plant

Highview successfully tested and demonstrated its fully operational LAES pilot plant (350kW/2.5MWh) at SSE's 80MW biomass plant at Slough Heat and Power in Greater London from 2011-2014. The plant was built to prove the technology, was connected to the UK grid and complied with all the necessary regulations and inspections. It successfully underwent a full testing regime, including automated performance testing for the US PJM electricity market. It has operated for the hours equivalent to three years of UK Short Term Operating Reserve service and seasonal TRIAD management in the winter months. Heat from SSE's 80MW biomass plant was used to improve the efficiency of the system.

The pilot plant has now been relocated to the University of Birmingham's new Birmingham Centre for Cryogenic Energy Storage where it will support further testing and academic research.

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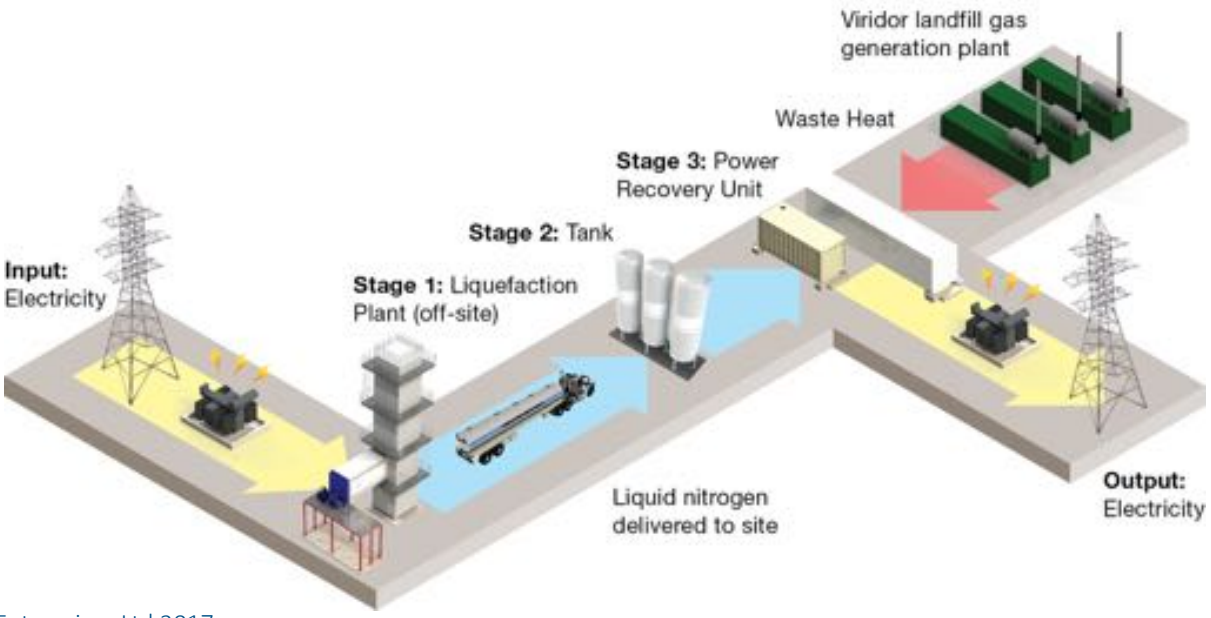
Pre-Commercial Demonstrator

In February 2014, Highview and project partners, recycling and renewable energy company Viridor, were awarded more than £8 million ($13.5m) of funding from the UK Government to build a 5MW pre-commercial LAES technology system. The funding is supporting the design, build and testing of the LAES Pre-Commercial Demonstrator alongside Viridor's landfill gas generation plant at Pilsworth Landfill facility in Greater Manchester, UK. In addition to providing energy storage, the liquid air plant will harvest low-grade waste heat from the landfill gas engines and convert it to power.

The project will operate for at least 1 year and will demonstrate LAES servicing a number of balancing services, including Short Term Operating Reserve (STOR), Triad avoidance (supporting the grid during the winter peaks) and testing for US regional regulation markets. Work on the project began in February 2015 and with commissioning currently underway it is expected to be online in early 2018.

In August 2017, Innovate UK, the UK's innovation agency, awarded Highview £1.5 million to develop a new hybrid LAES system using supercapacitors and flywheels at the Pre-Commercial Demonstrator. This will help demonstrate LAES's ability to compete with battery systems in terms of response time and broadens the range of services which LAES can supply, such as National Grid's frequency response services. The aim of the project is to test performance and economics and it will be operational by Summer 2018.



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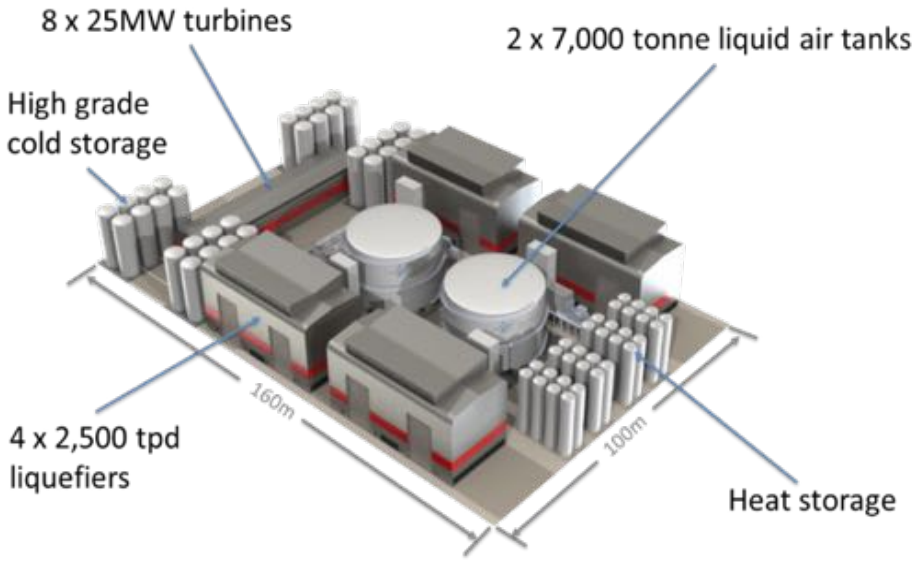
Scale Up: GigaPlant 200MW/1.2GWh

The GigaPlant 200MW/1.2GWh

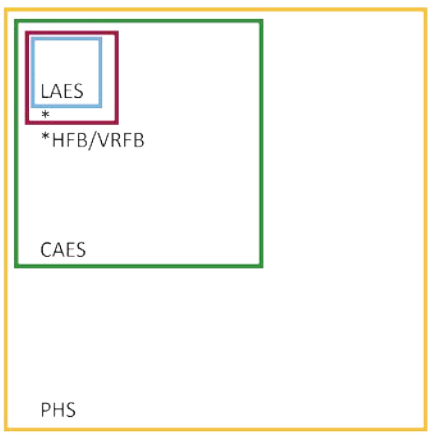
The new GigaPlant has evolved from the experiences learnt in designing and building Highview's first 2 plants; 4 years of operating experience from the pilot plant; and also the new government funded project, the 5MW pre-commercial LAES technology demonstrator. The system was designed using a proven process model and major OEM suppliers have been approached to supply the significant components including: GE, MAN Diesel & Turbo, Siemens, Nikkiso, Heatric, Atlas Copco and Chart.



Footprint Comparison

Boxes represent size of a LAES plant compared to other large scale energy storage technologies.

HFB/VRFB — Flow batteries
CAES — Compressed Air Energy Storage
PHS — Pumped Hydro Storage



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Highview Power Storage Inc.

Highview opened its first US office in 2017, through a business incubation programme, ACRE, a hub for smart cities, smart grid and clean energy. Highview will be working with ACRE to continue growth into the US market, a key market for LAES technology. ACRE is a part of the Urban Future Lab at the NYU Tandon School of Engineering. For more information: ufl.nyc

GE Oil & Gas

In 2014 Highview signed a global licencing and technology collaboration agreement with GE Oil & Gas, to explore opportunities to integrate LAES technology in peaker power plants where GE gas turbines and gas engines are currently or will be installed. For more information please visit the LAES technology page.

About Highview

Founded in 2005, Highview Power Storage is a privately owned, award-winning technology company located in Central London, UK. Highview has developed and owns the Intellectual Property to a novel, large scale long duration Liquid Air Energy Storage (LAES) system that uses liquefied air as a storage medium.

The company can design bespoke plants ranging from around 5MW output and 15MWh of storage capacity to more than 200MW+ output and 1.2GWh+ of capacity. In addition to storage, Highview systems can utilise industrial waste heat/cold from applications such as thermal generation plants, steel mills and LNG terminals to improve the systems' efficiency.

Highview's technology draws heavily on established processes from the turbo-machinery, power generation and industrial gas sectors. The components and sub-systems of Highview's processes can be readily sourced from large OEMs and have proven life times and performances.

The company is led by a strong management team with industry experience that can not only design and deliver reliable projects, but also explore new technological developments, secure new IP, grant funding, and business development. For more information please visit the company website: www.highview-power.com

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Liquid Air Energy Storage

Large scale, long duration

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