SCOTTISHPOWER

HATFIELD MOOR GAS STORAGE FACILITY: SITE INFORMATION

Key facts:

- Commissioned in February 2000
- Enough capacity to supply 250,000 homes
- Located at Hatfield Moor near Doncaster
- Ability to store up to 4.1bn ft³ of gas in a depleted underground gas reservoir

An Introduction to Hatfield Moor Gas Storage Facility

Hatfield Moor Gas Storage Facility utilises a depleted gasfield located 1,450 feet below the Yorkshire countryside.

Operations to extract natural gas from the underground reservoir began in 1986 and as the field became depleted, an opportunity was identified to use it for gas storage.

The reservoir is a layer of porous sandstone that works like a solid sponge to 'soak up' the injected gas. That porous layer is sealed by solid rock which prevents the gas from dissipating, making the geology of the field ideally suited for purpose.

The facility consists of four separate areas – the Lindholme Compression Site, the Beltoft Gas Off-take, the Hatfield Moor Gaswell and a purpose-built pipe network – and enables ScottishPower to both manage swings in demand, and buy additional gas to store for peak periods.

This ability to control stocks of gas helps the company meet its obligations under the Network Code, which demands that gas suppliers must balance the amount of gas they put in and take out of the national transmission system on a daily basis.

In addition to supplying customers, some of the stored gas is also used to generate electricity at ScottishPower's gas-fired power stations in England.

Lindholme is one of four separate areas within Hatfield Moor

The facility's gas compression site at Lindholme

Reducing our Environmental Impact

Hatfield Moor Gas Storage Facility operates subject to conditions contained in a permit issued and enforced by the Environment Agency (EA), and has operated a Biodiversity Action Plan (BAP) since 2006 to help improve conditions for wildlife.

The facility's key emissions to air are carbon monoxide (CO) and oxides of nitrogen (NO_x) produced at Lindholme's gas turbine compressor package, both of which staff continually strive to reduce by ensuring optimum combustion performance.

A small quantity of Volatile Organic Compounds is released to air from Lindholme's glycol dehydration unit while natural gas may be vented via a flare at Hatfield Well.

The well site

The facility's Environmental Management System (EMS) was re-accredited to the international standard ISO 14001 in July 2011 and drives improvements across areas such as the use of energy, raw materials and resources, and the management of waste. Additionally, staff actively recycle waste materials including wood, scrap metal, paper, electrical equipment, cans and plastics.

In recent years, the site has been working to reduce its resource use, achieving savings of 50% in townswater consumption, 30% in both gas and electricity use and a 25% in the amount of diesel used. A water collectionsystem has also been installed to drain rainwater from the roof at Lindholme into a fire pond, reducing the need for townswater.

Offsite waste disposal of oily water – collected by a specialist contractor who separates the oil for reuse – has reduced by 74.14% in 2010, decreasing the environmental risks associated with transporting waste offsite.

There were no justified complaints from the local community in 2010.

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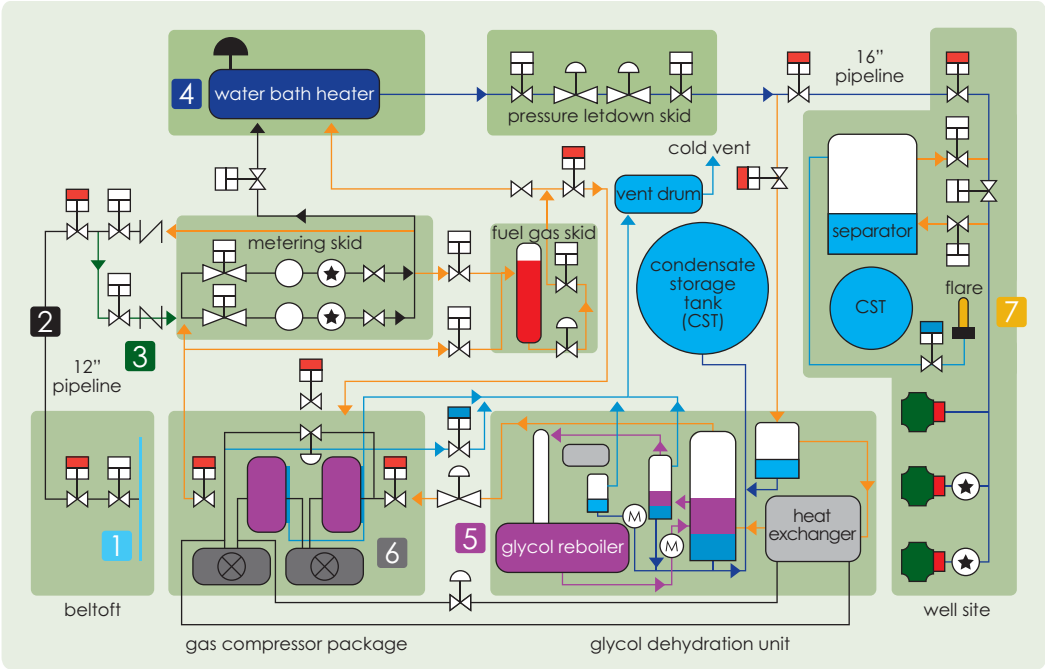
How it Works

The technique of using depleted gas fields for storage is widely employed overseas, in countries such as Germany and the USA, but Hatfield Moor was the first onshore UK facility of its kind. Gas storage is one of the most effective ways in which the swings between supply and demand can be matched. Gas goes into storage during low demand periods and out of storage when demand is high.

1. Natural gas from the National Transmission System (NTS) is imported at the Beltoft Gas Offtake in North Lincolnshire.
2. A purpose-built 15 kilometre pipeline starts at Beltoft and runs through the Lindholme Compression Site to connect with the depleted Hatfield Moors gasfield, which is a further 1.5 kilometres away.
3. Gas imported from Beltoft is compressed at Lindholme before being injected into the porous layers of sandstone for storage.
4. A gas-filled water bath heater pre-heats the incoming gas prior to its injection into the reservoir, which can store up to 4.1 billion cubic feet of gas at any one time.
5. A glycol dehydration plant removes any entrained liquid from the gas imported from the reservoir prior to its return to the NTS. The glycol dehydration plant includes a re-boiler that regenerates the glycol to be used in a continuous cycle.
6. Lindholme's gas turbine compressor increases the pressure of the gas to meet NTS requirements before it is exported via the pipeline.
7. A natural gas vent at Hatfield Moor Gaswell can safely vent natural gas, if required.



Environmental Performance Highlights 2010

Lindholme operated for 3,263 hours in 2010

Hatfield Moor's gas turbine compressor package at Lindholme operated for 3,263 hours in 2010 during the export of natural gas from the storage facility.

A total of 125.7m³ of gas was imported by the site with 145.5m³ exported to homes and business.

Ongoing monitoring throughout the year found that emissions are within limits set by the EA. While one occurrence of late submission of monitoring data occurred in 2010, there were no environmental breaches to permit and no complaints were received.

Site staff aim to continually improve efficiency of the gas turbines (GT) and reduce the use of raw materials. The regime of cleaning the GT compressor blades four times a year improves GT performance by increasing the flow of air through the blades while keeping the use of bottled distilled water required for cleaning to a minimum.

Lindholme's water bath heater, that warms up imported gas arriving on site prior to its storage, was recommissioned in July 2009. During the 12 months that the package was out of service, it was recognised that the reservoir could handle gas being injected at a lower temperature. The new heater now activates at a reduced set point temperature and the amount of fuel gas used in the WBH in 2010 was reduced by 40% compared to 2009.

An upgrade to the nitrogen generator – required for providing seal gas to the compressor package – has reduced the requirement for bottled nitrogen with no cylinders purchased in 2010. Similarly, changes to the operating philosophy of the dehydration system meant a decrease in the amount of glycol being used on site, with no additional glycol purchased in 2010.

Total gas used at the site is up on 2009 as a result of the increase in GT running hours while electricty useage remained stable.

Domestic water usage continues to reduce as a result of site efficiency measures. During 2009, savings of 53% were achieved by the removal of a sprinkler system used to cool gas water use and 2010 has seen a continuation of the trend. In November 2009 a water meter was fitted in the administration buildings which allowed for prompt response to any anomolies such as water leaks. The meter, allied to the introduction of a dual flush system has seen a further reduction of 17% over the year.

An operator checks the well site