SCOTTISHPOWER

RYE HOUSE POWER STATION: SITE INFORMATION

Key facts:

- Opened in 1993, acquired 2001
- 685MW capacity, Combined Cycle Gas Turbine station (CCGT)
- Located near Hoddesdon, Hertfordshire, about 18 miles north of London
- CCGT is an efficient form of electricity generation with fewer emissions per unit produced

An Introduction to Rye House Power Station

The Rye House site, bounded by the River Lea and the main London to Cambridge railway line, has a long history of electricity generation.

A coal-fired power station designed by architect Sir Giles Gilbert Scott, better known for designing Battersea Power Station and Liverpool Cathedral, occupied the site from 1953 to 1984. In 1966, an open cycle gas-oil power station – that worked using modified aeroplane engines – was built on the site and operated for 18 years.

The modern combined cycle gas turbine (CCGT) power station was opened in 1993. During its construction, efforts were made to reduce the visual impact of Rye House by careful use of colour, architectural treatment and extensive landscaping. A 3.6 hectare conservation area was also created and offers a home to newts, frogs and an array of birdlife.

Rye House has an excellent track record of environmental compliance and enjoys a positive relationship with its neighbours, actively participating in community life. Staff also raise funds for the Isabel Hospice in Welling Garden City and support local safety education projects for children.

Rye House's distinctive triple stack

CCGTs like Ryehouse are very efficient

Reducing our Environmental Impact

A key advantage of modern CCGTs like Rye House is their efficiency at converting fuel into electrical energy – typically around 50% – which results in less fuel consumption and lower levels of emissions per unit of electricity generated compared with conventional thermal stations.

Additionally, burning natural gas gives rise to minimal emissions of dust, ash or sulphur dioxide (SO_2) which has been linked with 'acid rain' damage to ecosystems and respiratory irritation in humans.

However, Rye House Power Station employs sophisticated abatement technology to control emissions to air of oxides of nitrogen (NOx) and a Continuous Emission Monitoring System (CEMS) has been installed on each of Rye House's stacks to demonstrate to the Environment Agency (EA) that emissions limits have not been exceeded.

Recent improvements include the replacement of a Low-NOx burner with new Dry Low-NO_X burner technology which has been fitted to each of the station's three gas turbines. Optimising combustion performance, the system results in an improvement on previous NO_X emission levels of between 40-50% and ensures Rye House meets Best Available Technique (BAT) requirements for the reduction of NOx as part of the Integrated Pollution Prevention and Control regime.

Rye House also uses an air-cooled condenser (ACC) to minimise the quantity of cooling water required for the generating process – the use of cooling towers for Rye House would have required a million gallons of river water to be extracted each day. The ACC was increased in size by 10% in 2006 to improve its efficiency, especially in warm weather. Low-noise fans were also installed to reduce the impact on local communities.

The station has successfully reduced its water usage following the installation of water collection systems that trap run-off rainwater from the station roof and compound. This water is filtered and treated for use as process water, reducing the amount of townswater that's required by up to 75%.

Staff seek to minimise waste from the site and actively recycle paper, oil, scrap metal, wooden pallets and solvents.

The station operates subject to conditions contained in a permit issued and enforced by the regulators, the EA, and operates an Environmental Management System that is certified to the international standard, ISO 14001 and is implementing a site biodiversity action plan.

Contact: Rye House Power Station, Hoddesdon, Hertsfordshire EN11 ORF
Tel: 01992 448 604 Web: www.spenergywholesale.com

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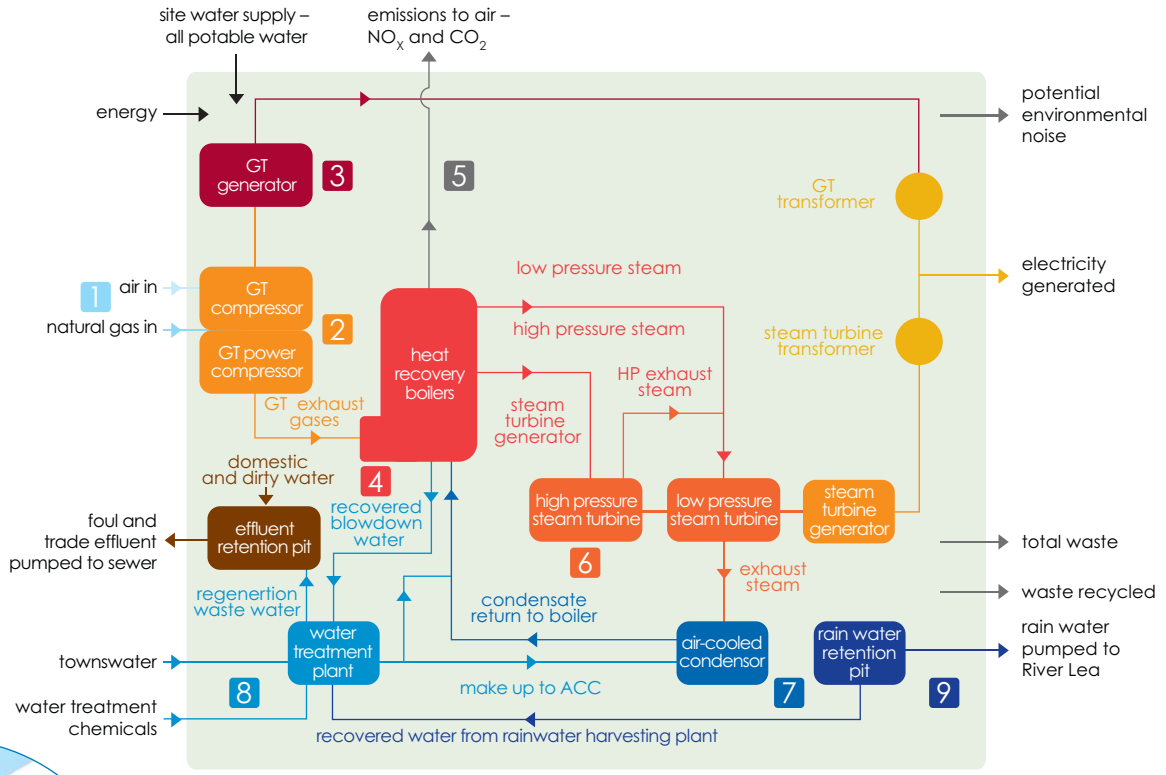
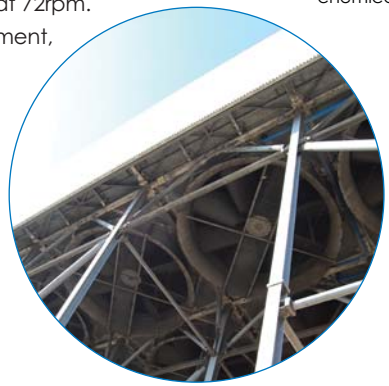
How it Works

Rye House uses three gas turbines and a steam turbine that together provide the most efficient form of thermal electricity generation.

1. Natural gas is delivered to the site via a 20km pipeline that links in to Transco's national transmission system.
2. The fuel is burned in three gas turbines (GTs), which are similar to the large jet engines found on aeroplanes, to heat compressed air.
3. The hot gas expands through the turbine, driving them at 3,000rpm, forcing a shaft to rotate and drive a generator. In open cycle gas turbine power stations, the hot exhaust gases are lost to the atmosphere, resulting in wasted heat energy.
4. At Rye House, these gases, at a temperature of 540°C, are reused to heat water-filled tubes in three Heat Recovery Boilers. Each boiler contains over 120km of tubing that is filled with purified townswater. The water in the tubing is heated by the hot exhaust gases and steam is produced, at two different pressures, in order to maximise heat recovery.
5. Waste gases from this part of the process are released to the atmosphere through the station's three chimneys.
6. The steam created passes through the steam turbine that drives a 250MW generator, expanding as it does so, with its heat energy driving the turbine rotor at 3,000rpm. The steam leaves the high pressure turbine at 194°C and a pressure of just over six bar. It is mixed with steam from the low pressure side of the heat recovery boilers before entering the low pressure turbine.
7. Exhaust steam flows to the station's air-cooled condenser (ACC), one of the largest in Europe, that cools it back into water to be recycled in the Heat Recovery Boilers. The ACC at Rye House covers an area of more than 7,000m^3 - the size of one and a half football pitches. It works by releasing heat through 600 radiator units mounted 24m above the ground. These are made up of 60,000 lengths of oval finned tube which, if extended end to end, would stretch over 160km. Cooling is enhanced by the use of 110 fans with a blade diameter of 6.1m that rotate at 72rpm.
8. Townswater is used for domestic purposes and, following treatment, as boiler feedwater. Quantities of blow down water and rainwater are also recovered, then filtered, for use as process water, replacing the use of townswater.
9. Only small quantities of water are released to the River Lea, a source of drinking water for London.

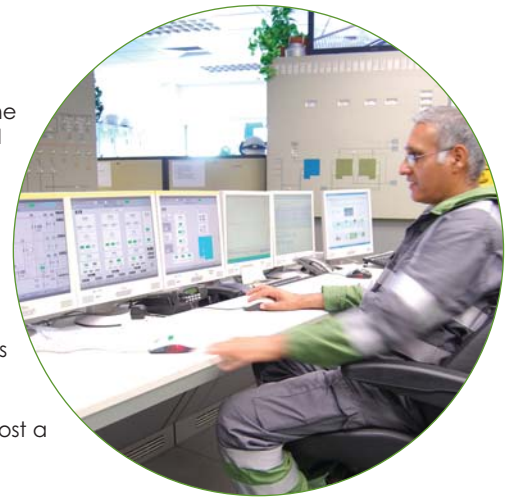




The air-cooled condenser

Environmental Performance Highlights 2010

- The station operates flexibly in the market, carrying out twoshifting - shutting down when electricity prices are low and starting to generate again to meet peaks in demand when prices rise.
- Rye House carried out 573 gas turbine (GT) two-shifts and 139 module starts in 2010 as part of its two-shift strategy.
- There were no breaches or incidents in 2010 and no community complaints.
- In recent years Rye House has been fitting new generation Low-NOx burners to its GTs. In 2009, the third and final new burners were installed to GT11 during a major summer outage. These high-efficiency burners have reduced NOx emissions by about 50% compared with figures in 2006.
- Redesigned blades fitted to GT11 in 2009 will make better use of process steam, improving the turbine's efficiency by 0.5% and resulting in less gas use per GWh.
- Rainwater harvesting supplied 21% of the station's process water in 2010, slightly down on last year.
- Efforts to reduce waste resulted in 17% less waste being produced compared with 2008, while almost a quarter was usefully recovered.



The control room