RYE HOUSE POWER STATION SITE INFORMATION

SCOTTISHPOWER
Energy Wholesale

OVERVIEW

Rye House Power Station is one of three combined cycle gas turbine (CCGT) stations operated by ScottishPower Energy Wholesale. The company acquired the 715 megawatt (MW) plant in early 2001 to supply its customer base in England and Wales. The station is located near the market town of Hoddesdon, Hertfordshire, about 18 miles north of London.

Output from the station is enough to meet the daily power needs of around 400,000 homes – or almost the entire population of Hertfordshire.

INTRODUCTION TO RYE HOUSE POWER STATION

The Rye House site, bounded by the River Lea and the main London to Cambridge railway line, has strong links with the electricity generation industry.

A coal-fired power station occupied the site from 1953 to 1984.

It was designed by architect Sir Giles Gilbert Scott who was better known for designing Battersea Power Station and Liverpool Cathedral.

Meanwhile, an open cycle gas-oil power station, that worked using modified aeroplane engines, was built on the site in 1966 and operated for 18 years. The modern combined cycle gas turbine (CCGT) power station was opened in 1993.

Efforts were made to reduce the visual impact of Rye House during its construction by careful use of colour, architectural treatment and extensive landscaping, including the creation of a 3.6 hectare conservation area.

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

CONTACT US

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Rye House Power Station with its distinctive triple stack

REDUCING OUR ENVIRONMENTAL IMPACT

A key advantage of modern CCGTs like Rye House is their efficiency at converting fuel into electrical energy – typically more than 50%.

That means less fuel consumption and lower levels of emissions per unit of electricity generated compared with conventional thermal stations.

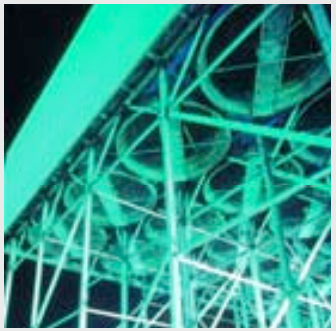
The station operates subject to conditions contained in a permit issued and enforced by the regulators, the Environment Agency (EA).

A Continuous Emission Monitoring System (CEMS) has been installed on each of Rye House's stacks to demonstrate to the EA that emissions limits have not been exceeded.

Natural gas does not give rise to significant emissions of dust, ash or sulphur dioxide (SO_2) – which has been linked with "acid rain" damage to ecosystems and respiratory irritation in humans.

Meanwhile Rye House Power Station employs sophisticated abatement technology to control emissions to air of oxides of nitrogen (NO_x).

New Dry Low-NO_x burner technology has been fitted to each of the station's three gas turbines. This will ensure Rye House meets Best Available Technique (BAT) requirements for the reduction of NO_x as part of the Integrated Pollution Prevention and Control regime.



The air cooled condenser

The new system replaces a previous Low-NO_x burner system and helps to optimise combustion performance, resulting in an improvement on previous NO_x emission levels of between 40-50%.

Meanwhile, combustion chambers, incorporating hot ceramic liners, converts all the carbon in the fuel into CO_2 rather than carbon monoxide (CO), which is highly poisonous to human health if inhaled.

Rye House uses an air-cooled condenser (ACC) to minimise the quantity of cooling water required for the generating process. The use of cooling towers for a station the size of 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 by up to 75% the amount of townswater that's required.

The initiative was highlighted as good practice in the Environment Agency's annual report for 2007.

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

Rye House operates an Environmental Management System that is certified to the international standard, ISO 14001 and is implementing a site biodiversity action plan.

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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 20 kilometre 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 blades at 3,000 RPM, forcing a shaft to rotate and drive a generator.

In conventional-fired 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 120 km 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 250 MW generator, expanding as it does so, with its heat energy driving the turbine rotor at 3,000 rpm.

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.

Rye House's control room

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.

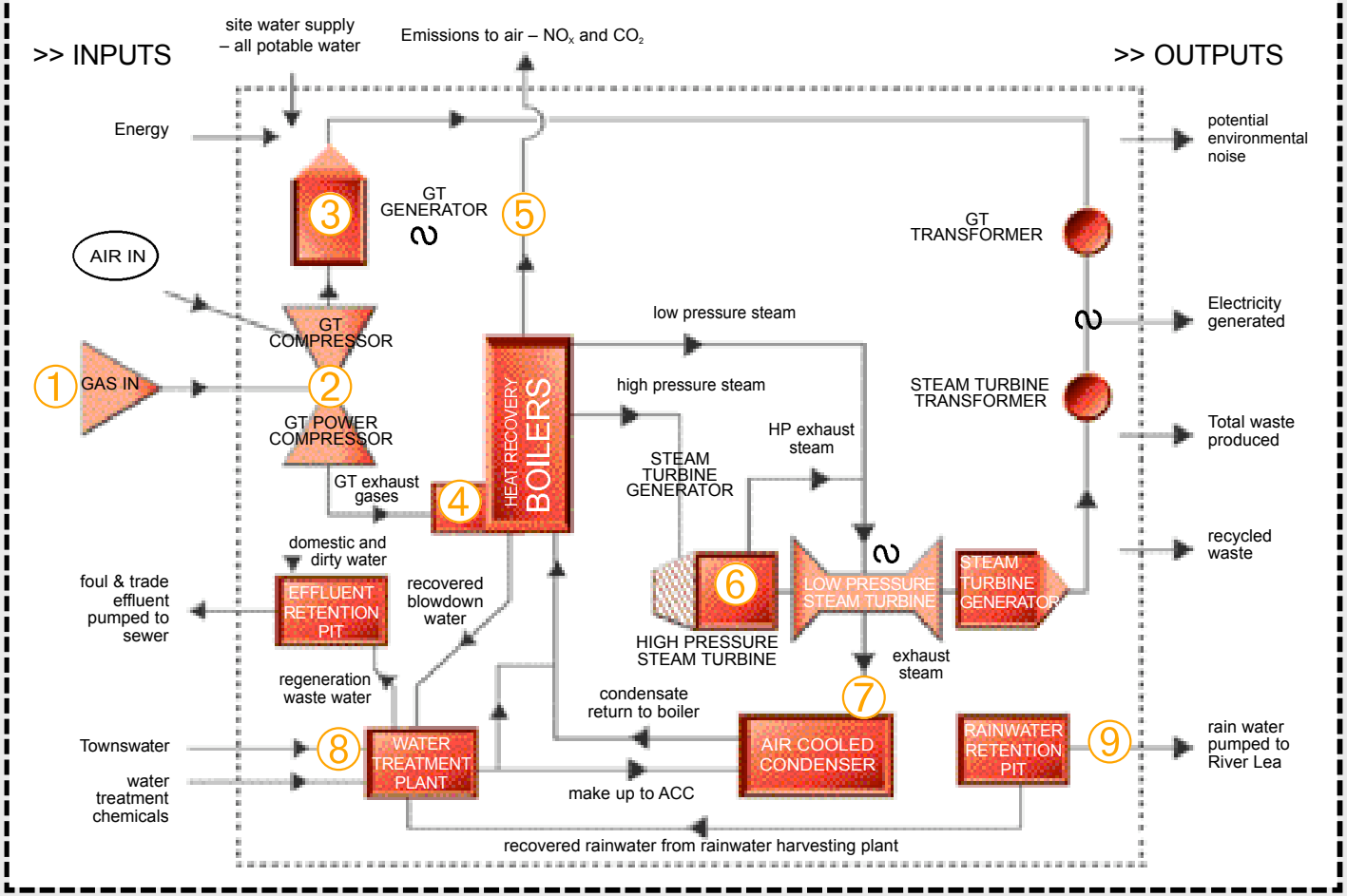
The ACC at Rye House covers an area of more than 7,000m^3 – the size of one and a half football pitches. It works by releasing heat through 600 radiator units mounted 24 metres above the ground.

These are made up of 60,000 lengths of oval finned tube which, if extended end to end, would stretch over 160 km.

Cooling is enhanced by the use of 110 fans with a blade diameter of 6.1 metres that rotate at 72 rpm.

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.



ENVIRONMENTAL PERFORMANCE HIGHLIGHTS 2009

Rye House generated 3,861 GWh of electricity in 2009 – a reduction of 16% from 4,381 GWh in 2008.

The station operates flexibly in the market, carrying out two-shifting – shutting down when electricity prices are low and starting to generate again to meet peaks in demand when prices rise.

Rye House carried out 401 gas turbine (GT) two-shifts and 69 module starts in 2009 as part of its two-shift strategy. There were no breaches or incidents in 2009 and no community complaints.

In recent years Rye House has been fitting new generation Low-NO_x 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 NO_x 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 37% of the station's process water in 2009, 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.