

Steam Turbine Service

Drax, UK – 660 MW-Rated Steam Turbine Upgrade

The plant

Drax power station is one of the largest coal-fired plants in Western Europe. The plant consists of six 660 MW-rated units reportedly producing approximately seven percent of the total electricity consumption within the United Kingdom. Each unit has a steam turbine configuration that includes one single flow high pressure (HP) turbine, one double flow intermediate pressure (IP) turbine and three double flow (LP) turbines. The original turbines were made by Parsons with the first three units commissioned from 1973 to 1974 and the remaining units being commissioned from 1983 to 1986.

In 2007, Drax signed a contract with Siemens to upgrade all of the HP and LP turbines, and to supply one spare set. This contract was the largest steam turbine modernization project to be undertaken in the United Kingdom.

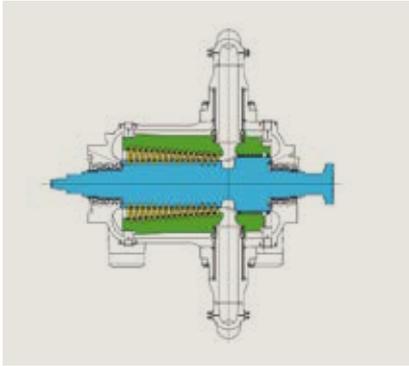
The Siemens solution was to upgrade the HP turbines with a new inner casing, rotor and bladepath supplied as a packaged assembly and to upgrade the LP turbines with new rotors and bladepaths retaining the existing cylinder construction.



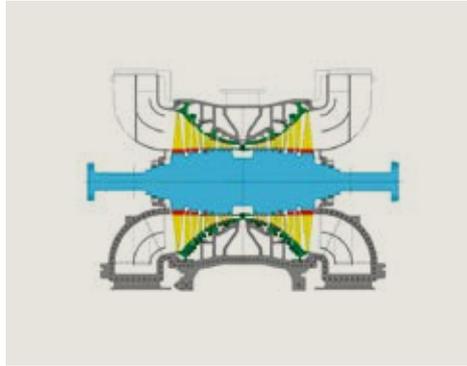
Steve Austin,
Lead Turbine Engineer at Drax power station,
Drax Power Limited:

Replacing the Siemens HP and LP turbines at Drax has given us the opportunity to upgrade and standardize our plant. Originally, we intended to upgrade the HP and LPs only, but decided to overhaul the IP turbines, generators and steam chests in tandem during the “disturbance years”. This allowed us to align the maintenance strategy of all the turbine plants, whilst undertaking the upgrade project. On completion of the five year project we will have upgraded turbines, made possible a significant reduction in future turbine outage durations and simplified the management of our maintenance strategy.

Working closely with Siemens in an open relationship, which is unusual in this industry, is allowing Drax to achieve its goals. The success of this working relationship has been proven with zero incident outages and a Drax record outage time achieved on one of our units. The project is on time and budget and we are very happy with the results to date.



HP turbine module cross-section



LP turbine blade path upgrade cross-section



LP turbine rotor fitting

Customer benefits

According to the customer, the upgrades have contributed to enhanced output and environmental objectives, including:

- Enhanced output up to 686 MW generated power (dependent on unit steam flow)
- Increased efficiency
- Reduced maintenance costs (12 year recommended scheduled inspection intervals)
- Additional turbine lifetime potential
- Running at original rated power output of 660 MW the upgrades can help reduce Drax's environmental emissions impact, helping towards a total reduction of CO₂ emissions by up to five percent (up to 1 million tonnes of carbon dioxide per year).

Features

HP turbine

The upgraded turbine units supplied were of full arc throttle control design as a retrofit inner module designed to fit into the existing HP outer cylinder. The modules include:

- New inner cylinder giving superior creep strength to original cylinder and designed to interface with existing outer casing
- Single un-bored monoblock rotor with enhanced material properties
- Modern 3DS™ reaction blading
- Upgraded sealing technology to help longer term performance
- Re-designed steam inlet sealing arrangement
- Re-use of existing outer casing, shaft gland housings and journal bearings

LP turbine

The LP turbine upgrades are of double flow design having an exhaust area of 8 m² and were developed to maximize performance at minimum capital cost. The existing exhaust casing was retained to reduce site installation time and costs. The original impulse design was replaced with reaction blading.

Features consisted of:

- Fully bladed monoblock rotors with enhanced material properties
- Modern 3DS™ reaction blading in first four stages
- L-0 blades of free standing side entry root design
- Retention of original low pressure casing
- New stationary blade carriers located in existing diaphragm grooves
- Optimized inlet and exhaust flow areas
- Redesigned radial clearances and sealing
- Re-use of existing LP shaft seal housings and journal bearings

Installation and commissioning

Installation and commissioning commenced in 2007 with an overall scheduled completion date of June 2012. Siemens carried out the installation of the HP and LP turbines working closely within the customer's project team to help meet objectives and reduce outage times leading to a station record outage time on one of the upgraded units. While reducing outage times, Siemens continued to focus on maintaining the safety of personnel and adopting a "zero harm" approach. Siemens was identified by Drax as 'Outage 2010 Safe Contractor of the Year'.

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