



Cockenzie, a 1200 MW coal-fired power station in Scotland

## Danfoss VLT® 8000 improves reliability at power station

### The dedicated Aqua Drive, VLT® 8000 ensures reliability and cuts repair and maintenance costs.

Cockenzie, a 1200 MW coal-fired power station, formally opened in May 1968, employs two pairs of 250kW duty/stand-by slurry pumps to convey the coal ash and fly ash produced during generation. The two types of ash are combined and turned into slurry with water before being pumped a distance of 4 miles and settled in lagoons at Musselburgh, where land has been progressively reclaimed from the Forth Estuary.

As variable speed operation is essential for the various conditions associated with sea water purging of the system and on-line operation, the pump systems originally installed comprised a 3.3kV 4-pole motor driving down to 1200 rpm through a reduction gearbox and then through a hydraulic variable speed coupling to achieve the requisite operational speed range of 900-700 rpm on the pump shaft itself.

Mitsui Babcock called in local Danfoss Drives Partner, Fraser & MacDonald, following a catastrophic failure of one of the hydraulic couplings. David Bowie, operations and maintenance manager, explained:

“The reliability of these hydraulic drive units had been a problem for some time. The replacement cost of a hydraulic coupling is of the order of £30,000 and quarterly refurbishment costs have been running at around £40,000 per annum for the 4 drives.”

Added to that, the gearboxes were also suffering frequent breakdowns, because of contamination of the lubrication oil from the aggressive sea-water / ash medium. “This necessitated a gearbox rebuild at a cost of some £5,000 every 6-8 weeks,” says Mr. Bowie. “Maintenance was becoming ever more difficult and we could no longer achieve sufficiently accurate linear alignment of the drive train after refurbishment because of deterioration of the bedplates or the effects of the pumps slipping out of alignment due to the length of the drive train, so we called in Fraser & Macdonald to discuss a radical simplification of the system.”

### The Danfoss solution

The easiest answer was to eliminate the gearboxes and the hydraulic units completely and use a frequency converter driven 415 volt motor, directly coupled to the slurry pump. This was not only the most elegant solution, it was the easiest to retrofit. Step-down transformers, fed from the original main switchgear, now supply the two 315 kW Danfoss AQUA 8000 series drives, running the 275 kW Siemens motors at up to 37 Hz to obtain the 1100 rev. top speed on the pump shaft. Initially the two operational pump units were modified with the prospect of modifying the stand-by units once trials on the new set-up had proved their operational suitability.

### Benefits from Danfoss Drives

The benefits have become immediately apparent. The drives are set to provide three pre-set speed levels, remotely selected from the control room.

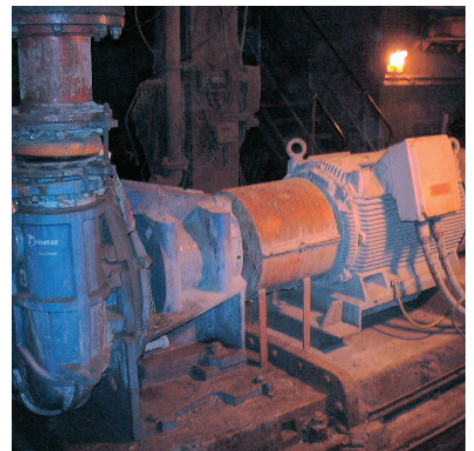
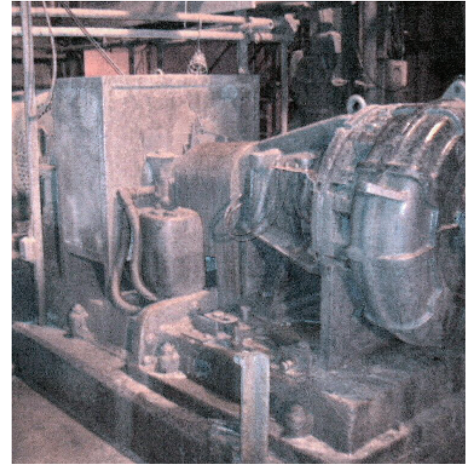
The lower speed maintains pump pressure equivalent to the static head of the 4-mile long outlet pipes. Accurate torque control ensures smooth transition to run-

ning speed, and feedback from the VLT® frequency converters ensures that the new power-operated pump discharge valves automatically open at the optimum point on the acceleratoin ramp. A mid-speed level is used for sea water flushing of the system and top operating speed at full generating capacity of the station is actually around 32 Hz.

The system runs for up to 16 hours per day, and although enhanced reliability and maintenannce cost reduction was the aim, energy savings have also been significant, with a 38% reduction in energy costs.

“Right from the beginning we could see that the system was going to be successful,” said Mr. Bowie. “We brought in Fraser & MacDonald because we had confidence that, working hand-in-glove with their

partner DPS, they could deliver a turn-key project and our confidence has been fully justified. The systems were installed with no loss of generation capacity of the station, and the two new drives were easily commissioned in a total of only 4 hours.” Since then operation has been child’s play and entirely trouble free. “So much so that we have now applied for a capital provision to upgrade the remaining two pump sets” says Mr. Bowie. “As the pump house is below sea level, we have bought a spare motor just in case of any flooding incident and we will also hold drives spares. We will take advantage of the Danfoss DrivePro service arrangement, and we are confident of a prompt response should we ever need to call upon them.”



*New LV motor in place of previous motor/gearbox/hydraulic VLT® combination*