CASE STUDY

VARB - Lowering Levels of Carbon-in-Ash

A UK boiler of Foster Wheeler front wall boiler comprising 48 burners, with each mill serving 6 burners. Each Babcock 10E mill has 2 outlets which splits into 3 burner pipes close to the burners.

Greenbank's contract was to modify existing pipe work to improve the coal distribution to the burners, allowing each burner to receive similar coal flow.

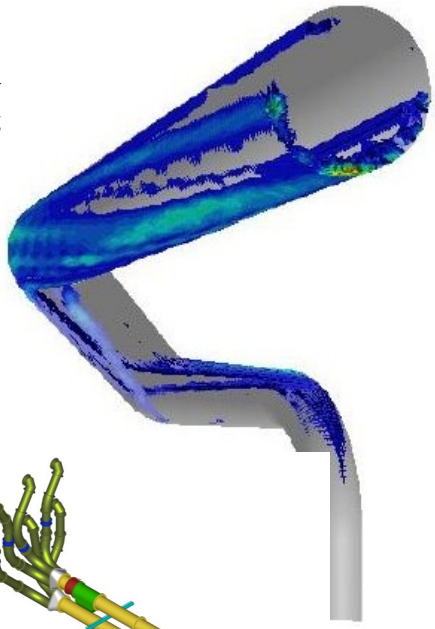
The boiler design has a common wind-box so making attempts to match secondary air flow to individual burners a significantly less attractive solution, and allowing similar individual burner flame characteristics would give greatest impact on heat distribution across the front wall boiler.

The goal was to allow the boiler control system to generate under the same NOx level goals but to reduce the un-burnt carbon levels in the ash.

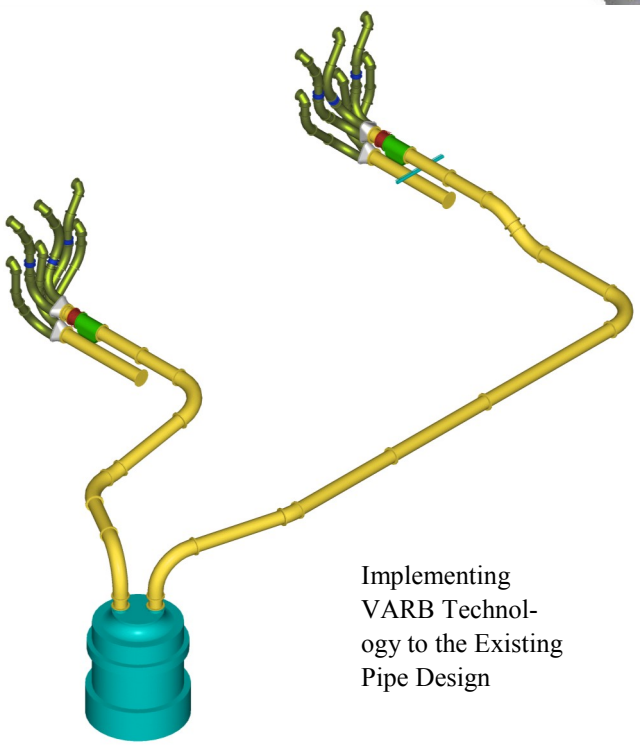
Alternatively, given improved burner stoichiometry, the station had the option to leave carbon in ash unchanged and reduce further the NOx levels generated using boiler O2 level control.

The solution process firstly involved CFD modelling of all coal flows for every mill to each burner for the particular boiler, and Greenbank studying historical coal distribution data, together with information on localised wear rates of coal pipe work, heat imbalances in the furnace, and other information pertinent to how the coal historically travels from mill to burners.

Greenbank subsequently and successfully, implemented the H-VARB technology to improve the distribution of coal to the burners.



CFD Coal Flow Modelling



Implementing VARB Technology to the Existing Pipe Design

Implementing H-VARB Technology

The solution involved the design and installation of coal diffusers specifically designed for each mill, while minimise the amount of plant modifications required for the project.

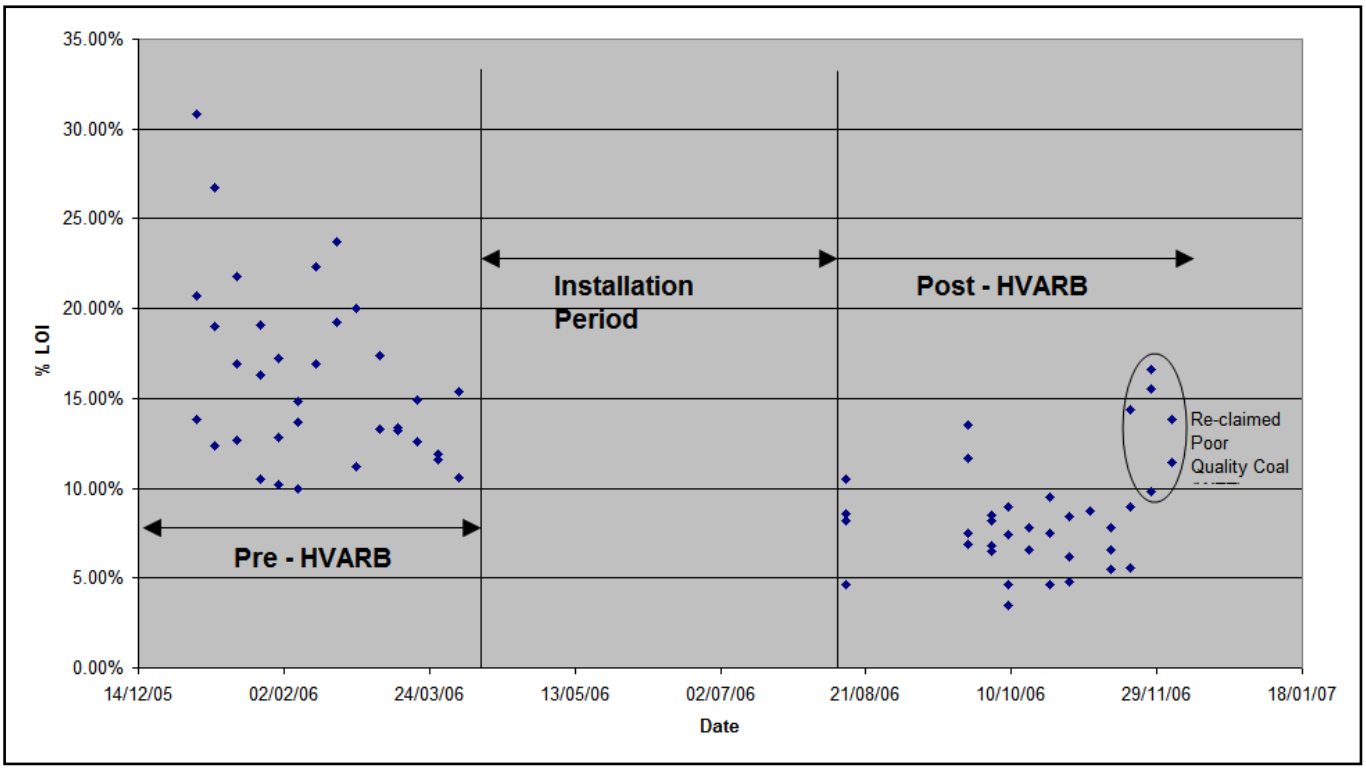
The solution is referred to as an H-VARB diffuser, creating spatially diffused coal across the pipe cross section prior to splitting of the pipe to multiple burners.

Special considerations in design were given to minimising pressure drop through the system and to maximise the expected life of the solution and reducing maintenance to an absolute minimum.


H-VARB In-Situ

Results

The station were happy with the reductions in carbon after a mini-outage where the only change was the introduction of the Greenbank H-VARB technology and have currently installed 2 boilers, with the remaining 2 boiler still to be installed.



The above graph before and after the mini-outage shows the variation in carbons while maintaining stringent NOx control levels for a similar diet of coals.

Note the higher LOI (Loss on ignition which is an accepted laboratory method of giving residual un-burnt carbon losses) before and after the H-VARB installation was a known issue with poor quality wet reclaimed coal from the stock yard. Even so, on average the carbon levels, for the specific coal types, was effectively reduced by half.

This is a significant achievement on a front wall older design 500 MW boiler given the coal types used, without implementation of mill high performance classifiers, boiler Over Fire Air or any other recognised combustion improvement technology other than Greenbank H-VARB technology.