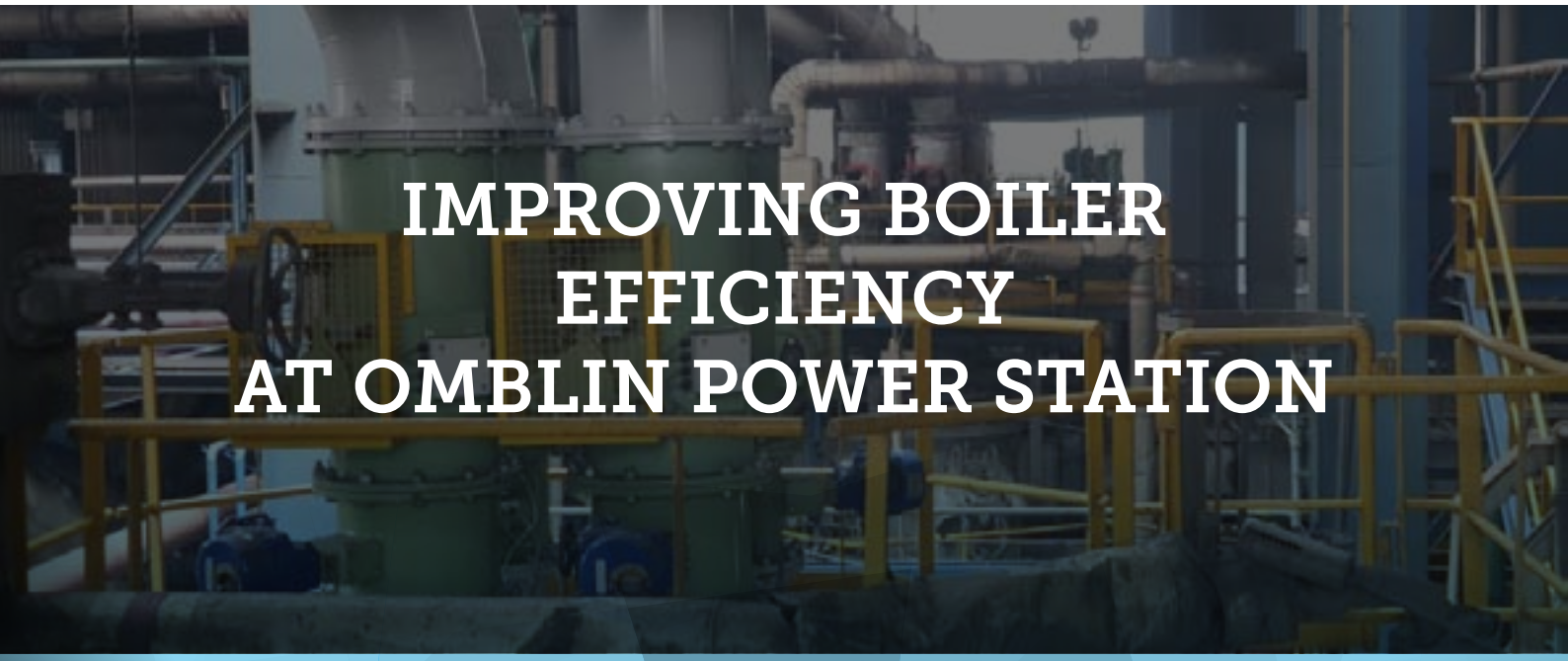
HMA POWER GENERATION



IMPROVING BOILER EFFICIENCY AT OMBLIN POWER STATION

Case Study

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HMA Power Generation enhances boiler fuel efficiency to improve profitability and decrease pollution at Ombilin power station in Indonesia. The unique Greenbank CoalFlo® damper and pulverised fuel metering system, installed as a complete fuel balancing solution, has provided this regional power station with the means to review, monitor and adjust consistency and balance of fuel into the burners.

Ombilin power station provides essential infrastructure in West Sumatra, and HMA Power Generation, a distributor on behalf of Greenbank of the UK, aimed to address primary issues with fuel balance by ensuring fuel burned properly in the right place. This project sought to ensure Ombilin's equipment was operating at optimum.

A complete pulverised fuel (PF) flow measuring and balancing system solution was provided, together with new pipework, valves, and actuators, together with a full complement of drawings. The customer received a solution that addressed both maintenance and reliability issues as the new pipework was optimised for improved flow, and fitted into the existing structure with relocated hangers using the latest in 3D scanning and measurement for a seamless installation. An equipment supply contract for HMA Power Generation therefore turned into a complete replacement of the pipe system between the mill discharge and the burners, addressing many other problems in doing so.

Ombilin sources two main coal types from its nearby mine, low and high calorific value types.There is, however, a significant consumption discrepancy between the two coal types when used in power generation. It's therefore more expensive to operate the power station's boilers on the cheaper, low calorific value coal than it should be due to an around 3% increase in coal volume required. The reason for the discrepancy is not fully understood.

"We suspect that this is due to increased moisture resulting in higher velocities in the mill, reducing milling capacity. If this can be addressed, much greater savings in fuel usage can be achieved, perhaps up to 3%," Product Engineer Martin Rieger comments. While HMA Power Generation can also assist in improving mill performance to boost output and efficiency, this wasn't the purpose of this project.

CoalFlo® dampers being installed

The power station is rated at 100 MW per unit maximum continuous rating, and can output 110 MW for short periods. When HMA Wear Solutions, which specialises in wear and abrasion-resistant lined pipes, was called in to investigate, it found that Ombilin was operating mostly at 70 MW due to a carbon in ash (CIA) limitation. Another complicating factor was that the ash dump was reaching capacity. One of the power station's strategic goals is to develop sales of this by-product. In general, the CIA has been over 12%, and maybe even 16%, when operating at 100 MW. A typical power station produces ash at around the 6% to 8% range, while a good one is under 7%, and the best in the 4% range. Ombilin requires a CIA of less than 7% for fly ash to be sold to cement works, for example. In fact, Unit 1 came off early for its refit outage because the CIA was getting too high even at the low 70 MW output.

A key objective of the project was therefore to reduce the amount of carbon in ash. And, this meant we needed to start by balancing the fuel distribution to the burners. The project involved the installation of CoalFlo® Damper PF balancing devices. This novel equipment can control fuel split between burners in a

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New pipework with PFMS sensor between the flanges (white) and mill isolating valves with CoalFlo® underneath (green with yellow cages arround limit switches)

power station, where adjustability is a desirable quality because it achieves fuel-burning efficiency by ensuring fuel burns properly in the right place. This reduces CIA to levels suitable for sale. This also increases boiler efficiency and this has the effect of reducing NO_x, SO_x and CO – and therefore pollution. This adjustability in controlling the fuel split also increases fuel efficiency which improves electrical energy outputs from heat energy inputs. And, this increases profitability.

"This would not be possible unless we can measure the fuel split", Product Engineer Martin Rieger points out. The installation of Greenbank's PF metering system (PFMS), in addition to the CoalFlo® Dampers, now allows Ombilin's operators to view, monitor and adjust the consistency and balance of fuel in the burners under varying operating conditions. Traditionally, the PF pipes are balanced during initial commissioning of the boiler by installing orifice plates into the ducts between two flanges. This works for a short time until the commissioned load changes and the orifice plates wear, resulting in very large mismatches in PF distribution. Wear problems with the orifice plates are an ongoing problem, and the operators have no way to measure or alter the PF distribution while the boiler is running. At Ombilin, these orifice plates had worn long ago and couldn't necessarily achieve the required distribution even if replaced.

Greenbank's CoalFlo® dampers are equipped with modulating actuators that can be positioned remotely to set the PF distribution, based on information from the PFMS. The Greenbank CoalFlo® dampers are specifically designed to overcome poor combustion that can occur when the power plant lacks flexibility to adjust settings. It's essential that the design is refined for each specific application, using computational fluid dynamic (CFD) analysis to , within the parameters of that particular system, match the pipework system. This promotes flow, reducing mill load and avoiding blockages – which can be costly in shut-down time

The first stage of the project was to scan and measure the plant, because no drawings were available. In conjunction with Greenbank Terotech (Pty) Ltd, HMA Power Generation, and HMA Indonesia, both boilers were scanned from burners to basement to ascertain the pipe runs and create a model to undertake a CFD study. "As a result, we were also able to generate accurate shop drawings for all the pipework, with optimised bends and corrected alignments, and straightening up the burner inlets to avoid wear on the expansion joints, which all seemed to have failed in the original installation," Martin Rieger elaborates. The project included the emergency blowback prevent non-return valves, similar to the valves on mills with an air actuator used to isolate the mill when not in service, and all the expansion joints brand-new from the factory that had supplied the original equipment. All of the pipework was manufactured in Australia to the new specifications. The mill pipe runs were faired, with bends increasing in radius to decrease roping and losses. The alumina tiles reduce friction loss on the pipe's inner surface.

Ombilin is now operating at 100 MW, with its three mills on full load, with low calorific coal, and one mill on stand-by. It's estimated that the original variation in PF distribution from the mills was in the order of greater than ±15%, thought to have resulted in the prevailing CIA problem. A figure of ±15% is typical of an older power station. However, CoalFlo® offers ±5% variation between pipes across all load ranges in a fixed setting. Ombilin had a target of ±4% with this project. But, with commissioning, we found that less than ±3% was achieved and, on occasion, less than ±1% was achievable at full load. With the addition of a damper drive unit, much tighter control is possible, but at the expense of wearing out the actuators. Therefore, a comfortable range for PF distribution is suggested to be less than ±2% to balance repair costs with the benefit of tighter PF balance control.

With better PF distribution, the air-to-fuel ratio at the burners is much better controlled, and will therefore burn out the fuel more completely – without sending

fuel to the ash dump, resulting in less CIA and reduced fuel usage. The flame will also be located lower in the furnace for improved efficiency, assuming that the burners are in good condition.

The fuel-flow measuring and balancing system solution has an estimated payback from 4.3 to 4.6 years in this project, producing a coal saving of 2%. A 1% improvement in heat rate is estimated with better tuning. It is a given that combustion will improve with proper balancing of the fuel. Ombilin can expect additional advantages including:

- A greater than 1% less ash removal to landfill translates into less transport costs.
- A CIA reduction to less than 7% will make fly ash saleable in order to create revenue and not send it to the ash dump.
- Increased thermal transfer of heat to steam pipes increases the boiler efficiency.
- Less slagging of the boiler.
- More stable temperatures in the boiler extends the life of boiler tubes due to reductions in thermal stress.
- The potential to improve Ombilin's average output to greater than 85 MW.

The biggest change would be dealing with the ash, turning a liability into an asset; not just cutting costs, but generating revenue. While NO_x emission reductions are hard to estimate, the result could nearly be as good as a low NO_x burner installation, from previous experience. In terms of sulphur emissions, a 1% to 2% reduction should be realised due to reduced coal usage.

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POW-CS-0001. JUN 2020