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Blending for Dollars

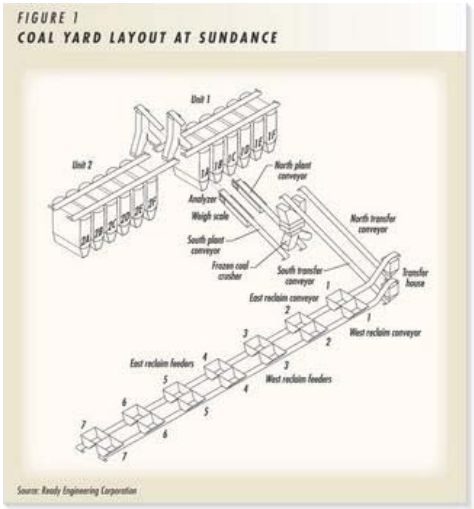
*An automated coal blending and analysis system at TransAlta's Sundance Plant Units 1 and 2 has reduced derates,improved coal quality control, and, together with a capital maintenance program, saved the utility nearly $1 million.*

At many coal mines and coal'fired power plants around the world, on'line coal analyzers are used to blend different coals and to track coal feed quality. However, coal quality can change very quickly, making it difficult, if not impossible, to maintain a consistent blend without automation.

TransAlta Corporation, Canada's largest non'regulated power generation company, owns and operates three power plants near Lake Wabamun, about 60 miles west of Edmonton, Alberta. The Sundance Plant contains six coal'fired units with total capacity of 2,020 MW - Sundance Unit 1&2 contribute 560 MW. Coal is supplied to the plant from several coal seams at an adjacent coal mine.

At Sundance Units 1/2, derates due to opacity and poor coal quality compelled TransAlta to evaluate various approaches to improve coal quality management. An automated blending and coal analysis system supplied by Ready Engineering Corporation, together with a precipitator maintenance program, has resulted in nearly $1 million in savings since its installation in late 2003.

**Coal Yard**

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The coal yard at Sundance 1/2 includes a dual system of conveyors starting from an underground reclaim tunnel. The reclaim tunnel consists of two rows of seven vibratory reclaim feeders that feed coal to an East

and West conveyor. The automated coal blending system controls the two rows of reclaim feeders to obtain the desired blends on each conveyor. Figure 1 shows the overall Sundance 1/2 coal yard layout.

Weigh scales and ash analyzers on the plant belts provide data for the coal from the reclaim tunnel. The capacity of each individual feeder is 100'200 metric tons per hour (TPH). The capacity of each conveyor system is about 500 TPH, but is usually run at 300-450 TPH.

Basic control of the overall reclaim system is handled by an Allen Bradley PLC 5/40C and a Panelview 1400E interface.

Coal blending is required at Sundance 1/2 to prevent reheat section fouling that can lead to unit outages, to minimize stack opacity derates, and to minimize mill derates caused by high ash, low Btu coal. Based on previous experience, a high blend of Seam 2 coal can cause fouling and opacity problems for Sundance 1/2. The solution has been to blend in a sufficient amount of Bottom Seam coal, which contains low melting temperature clays that slag out as bottom ash. This acts to "scrub" the boiler of the problem ash.

However, too much of the high ash Bottom Seam coal will cause mill derates. As a result, blending is a balance between Btu, fouling risk, opacity derates and maximizing generation.

**Blending Solution**

Ready Engineering Corporation's Automated Blending And Coal Analysis System (ABACAS) determines the coal quantity and quality coming from each feeder on conveyors that are supplied by multiple feeders. ABACAS interfaces with the coal handling system to control the output of each feeder and therefore control the coal blend. The feedback from weigh scales and analyzers (moisture, ash, sulfur, etc.) is sent to ABACAS for closed'loop control and monitoring. The system is unique in that it routinely verifies the output of each feeder through feedback and calculations and makes adjustments to blends as necessary.

The typical configuration of the reclaim feeders is divided between two products - Seam 2 coal stacked on Feeders 1-5, and Bottom Seam Coal stacked on Feeders 6 and 7. There are usually three feeders running at one time: two feeders dedicated to the Seam 2 Coal and one feeder for the Bottom Seam Coal. For Sundance 1/2 the coal blending scenario consists of blending targets that are compiled based on the historical coal quality data of the mine'mouth coal. The desired blend usually consists of 20% Bottom Seam coal and 80% of Seam 2 coal.

A third product is occasionally added to the Sundance 1/2 coal stockpile. The blending system can be configured for any number of products and, at Sundance, switches to the three'product blend seamlessly.

ABACAS interfaces with the Sundance 1/2 coal yard programmable logic controller (PLC). The automated blending system is customized to meet site-specific requirements, including special Human Machine Interface screens and selections in the software, logging data to plant historian via the PLC interface, and implementing other control functionality.

Data archival within the automated coal blend system allows for problem analysis. If a derate occurs, the coal blending data can be analyzed to see if there was a problem with the blend or if the source of the problem should be investigated elsewhere.

**System Performance**

TransAlta evaluated the automated blending system's performance at Sundance Units 1/2 on two main criteria: Blend Consistency and Target Tonnage Consistency.

**Blend Consistency**

Blend Consistency refers to the ability to maintain the target product split configured by the operator throughout system changes such as startups and shutdowns, feeder flow variations, and the changing of running feeders. The standard error on the product split has been well below the 5% error goal set at the onset of the project. Before ABACAS, no mechanism existed to record and calculate a standard error with regard to individual feeder coal qualities, even though plant management widely believed consistency was not very good. ABACAS provides insight into individual feeder coal quality parameters never available before, and simultaneously provides an improved control strategy to benefit from that new insight.

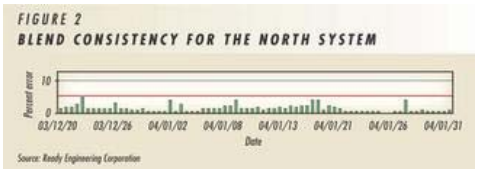


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Figure 2 shows the Blend Consistency for the North system over the evaluation period. ABACAS maintained the Blend Consistency under all conditions, including coal blends of two or three products and instances of insufficient coal supply. The South system achieved similar results, maintaining target product split below 5%. Over the evaluation period, the actual error for the Blend Consistency was 1.4% at one standard deviation. This means that the error over a shift was less than 1.4% for 68% of the time and less than 2.8% for 95% of the time.

Between December 22, 2003 and January 22, 2004, a third product, Low Sodium Coal, was introduced on Feeder 1, affecting both the North and South systems. ABACAS easily adapted to the new configuration, providing an average error on the product split of 0.92% throughout the entire evaluation period.

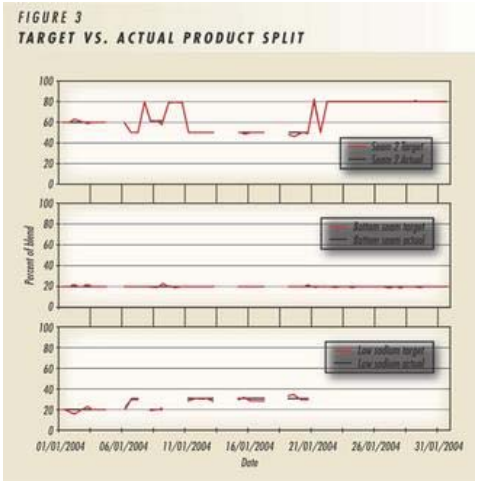


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Figure 3 shows the target and actual product split for Unit 1. The actual product split tracked quite closely to the target product split during the evaluation period.

**Target Tonnage Consistency**

The Target Tonnage Consistency refers to the blending system's ability to match the total coal delivered to the target amount, resulting in a low tonnage error. While an important parameter at Sundance, Target Tonnage Consistency is secondary to Blend Consistency due to the effects that incorrect product splits can have on plant operation. This prioritization can result in a lower quantity of coal delivered while maintaining the target Blend Consistency. The lower quantity of coal delivered causes the duration of a request for coal from the

plant to be slightly longer, but the desired coal quality is maintained.

The target tonnage error presented in Figure 4 reveals a substantial amount of variation. The highest degree of variability can be seen between December 22 and January 22, when the third product was introduced. During this period, coal flows varied as only one feeder was supplying each product, due to a PLC limitation allowing only three feeders to run. The PLC is programmed such that there can only be three feeders running at one time, although the physical coal handling system is not limited to operating three feeders. As a result of the way ABACAS is configured to deliver blended product, tonnage delivered was reduced while the product split remained consistent  product split has higher priority.

During the days of operation following this period, from January 22 to 31, the system returned to its normal configuration (two products at an 80/20 split). This configuration gave the blending system the flexibility within the PLC system constraints to achieve both target blend and target tonnage (refer to the last quarter of Figure 4).

Additionally, on January 29 and 31, the two feeders providing the Seam 2 coal, Feeders 3 and 5, were run at their maximum setpoint of 100%, but were unable to supply enough coal to meet their product demand because the coal was not flowing well. Therefore, the target tonnage was not achieved. During this period of system constraints (the low coal supply), ABACAS still maintained a Blend Consistency of less than 1% standard error.

When there are no physical limitations caused by the reclaim system, ABACAS easily delivers the requested coal flows with less than 5% error. Further, as seen in the Blend Consistency results, the blending system maintained the target product split even when the reclaim system was not physically capable of delivering the requested coal quantity.

After tuning and customizing the blending system, Sundance achieved the following results over a one'month evaluation period:

- The target tonnage delivery error over each shift was 1.3% at one standard deviation (error of less than 1.3%, 68% of the time).
- The target coal blend error over each shift was 1.4% at one standard deviation (error of less than 1.4%, 68% of the time).

This performance falls well within the goal of 5% error set for both parameters at the onset of the project.

Derate frequency also markedly declined. Figure 5 displays the Sundance 1/2 derate information for 2003 and 2004. The data for 2003 is taken from January 1, 2003 to December 19, 2003, and the data for 2004 is taken from December 20, 2003 to June 1, 2004 and normalized to show a full 12'month performance to display 2003 and 2004 comparatively on equal 12'month basis. Therefore the chart reflects the plant operation before and after ABACAS operation.

From Figure 5 it is clear that Sundance Units 1/2 are having a more productive year in 2004 in terms of reduced losses caused by poor quality coal and opacity derates. At $50/MWh, there is nearly a $1 million improvement from 2003 to 2004. Although the improvement can be attributed to several efforts made to control poor coal quality and opacity derates, ABACAS is one of the steps taken in support of the effort.

The automated system at Sundance has proved to be an excellent real'time coal blending tool and continues to provide the desired coal quality at Units 1 and 2. TransAlta is looking to expand the use of the software to their other units based on the benefits achieved at Sundance.

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Andrew Hickinbotham has a background in geology and is a Technical Specialist, Coal Utilization Research in

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