

# INTEGRATION OF A PLC AND SCADA CONTROL AND REPORTING SYSTEM WITH AN EXISTING DCS

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## Abstract

Komati Mill was built 20 years ago as a fully automated sugar mill utilising a factory-wide Distributed Control System (DCS) to achieve a high level of factory automation. During this interval, the process control industry has seen rapid growth in technology and many components of the control system hardware have become obsolete. Faced with this scenario, Komati Mill has been prompted to consider a cost effective migration pathway to accommodate the newer technology.

In 2010, the mill embarked on a phased project to replace the obsolete Legacy DCS system with a PLC and SCADA system. The project included the implementation of a Management Execution System (MES) to monitor and report the availability and productivity of the plant from real time feedback. The project roll-out commenced with a Manufacturing Application Alignment (MAA) study which provided a roadmap of the technology and functions needed, based on the Key Performance Indicators (KPI) of the mill.

The migration path comprised five phases, and is currently in the third phase. The solution at the end of phase two includes integration between the old Legacy DCS, the new DCS, the new PLCs, LIMS and manual operator inputs. It also provides real time monitoring and reporting of the extraction plant Lost Time Available (LTA) and throughput, as well as a daily crush prediction model. This information is fed back to the manager's desk as a single point of information on a web portal.

*Keywords:* Legacy DCS, PLC, SCADA, control system migration, management execution system, web portal

## Project goals

As part of an upgrade programme, Komati Mill decided to migrate from the old Legacy distributed control system (DCS) to a programmable logic controller (PLC) and supervisory control and data acquisition (SCADA) system, while at the same time implementing a management execution system (MES) solution that would track plant performance and events. This would be used to measure the throughput of continuous systems, as well as downtime and the reasons for the stoppages.

It was intended that the resulting reports would assist with optimising sugarcane throughput and reducing downtime, as well as predicting final crush volumes. The downtime tracking would focus on highlighting repeat failures as well as areas of concern which needed the assistance of the engineering team. It would also be necessary to provide for device-layer

booking as well as unit and area level booking, which would automatically link to the reporting layer to provide detailed as well as summary reports. All this would mean having to integrate with new Quantum PLCs, Legacy Provox and DeltaV distributed control systems as well as the laboratory information management system (LIMS) database in order to provide a unified way of tracking device utilisation.

Other requirements included implementing standards that would be used throughout TSB Sugar, integrating with the SAP enterprise resource planning (ERP) systems, measuring plant performance and equipment availability (overall equipment effectiveness, OEE) in real time, thus providing management with the information they needed on their desktops and giving maintenance and support personnel remote access.

### Solution selection

Wonderware solutions were selected as this was the standard adopted at the Malalane Mill, and because TSB Sugar saw Wonderware as having the best integrated and complete SCADA solution available. Apart from the System Platform, the solutions used in the implementation included InTouch (SCADA / HMI), Wonderware Historian, Historian Client (trending and analysis tool), Wonderware Information Server, and Wonderware MES Performance (OEE) (Figure 1).

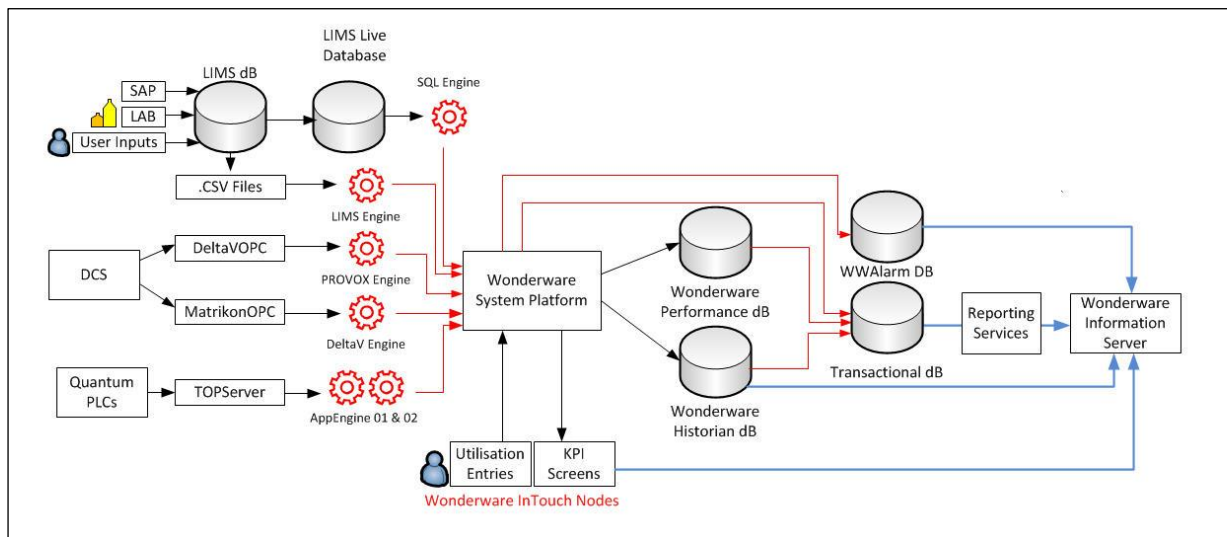


Figure 1. Solution architecture.

### Implementation

The project was done in phases, and the first phase was implemented between January and April 2011. A 3-month off-crop season was enough time to remove the old Provox DCS and replace it with the new, integrated system on Extraction Line 2 after following factory acceptance procedures to ensure proper functionality. All the other old DCS systems remained the same and the Systems Platform was built on top of the existing systems to facilitate integration.

The first item on the implementation plan was the creation of standards to optimise the best implementation of the System Platform and PLC for the plant. Microsoft Reporting Services was used for customised Wonderware Information Server reports, as this would make it

easier for Komati Mill to assume ownership of the system on completion of the project. A transactional database was created in order to integrate information from the Wonderware Historian and the LIMS data. This database was also used to consolidate data and to make it easy to configure custom reports on Wonderware Information Server. The Wonderware MES (Performance) throughput graphics were used as a base and enhanced to meet Komati Mill's specific requirements. The Wonderware Information Server is now the single point of consolidated information for all current and Legacy information. Its graphics are also embedded into PowerPoint presentations to display KPI on large screens and in real time throughout the plant. This is helping operators take action and resolve poor performance issues immediately.

While the Wonderware MES (Performance) solution measures the OEE parameters of plant performance and availability in real time, other key process parameters such as throughput, low throughput and the LIMS quality figures are made readily available to operators through three dual-screen InTouch stations. The OEE, LIMS, Provox and DeltaV data have been integrated into the System Platform to show KPIs on the InTouch dual-screen displays (Figure 2). Provox and DeltaV OPC links are used to interface them to the Wonderware System Platform. Objects were created to read data directly from these distributed control systems. The Historian Client's trending is now used extensively on Wonderware Information Server by managers to track throughput and performance.

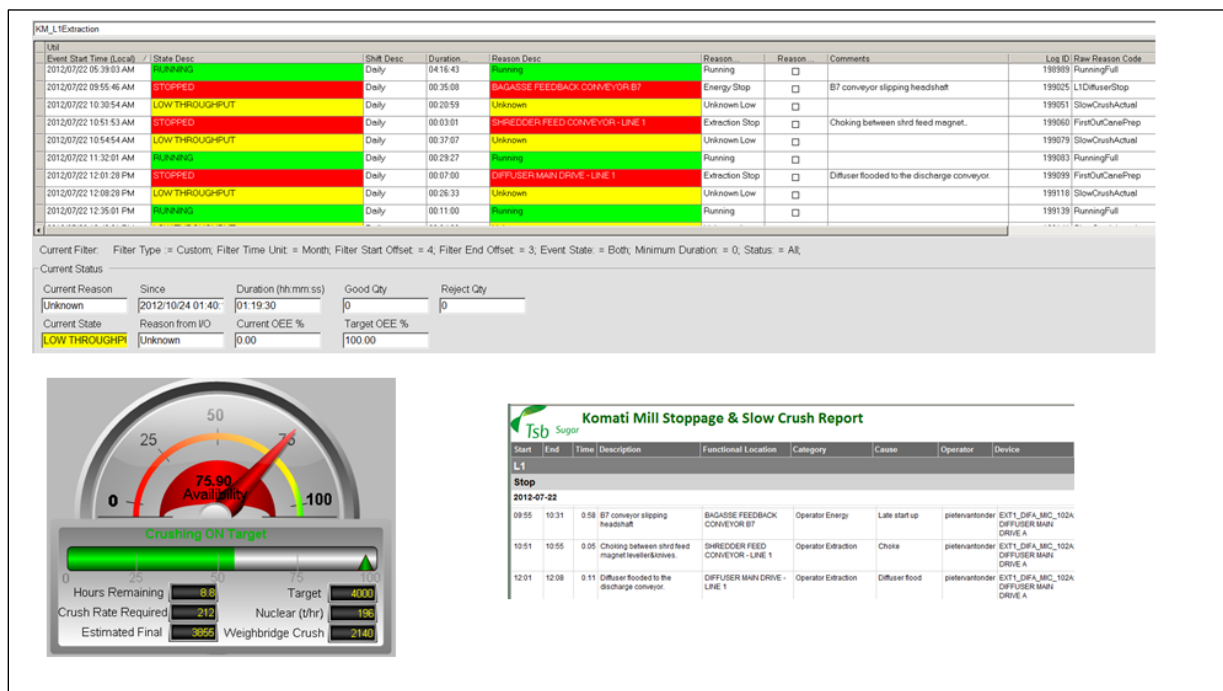


Figure 2. Management execution system (MES) performance capture.

The SAP ERP functional breakdown structure was adapted as the Wonderware Performance breakdown reasons. This made it easy to consolidate it back to the ERP business system. A future plan is also to incorporate the production information back into the AP Business Warehouse platform.

Previously, lost time available (LTA)<sup>1</sup> and stoppages were recorded on SAP. This was a very lengthy exercise, open to faults and expensive due to SAP licences being required for all users. A decision was taken to use MES performance on the extraction section which is responsible for LTA and overall time efficiency (OTE)<sup>2</sup> to record all stoppages and low throughput events. The entire factory's LTA and OTE are based on the MES performance measurement of the extraction plant. Operators can easily give relevant feedback on stoppages and low throughput as calculated by the system and all the information is readily available to help managers make more informed decisions (Figure 3).

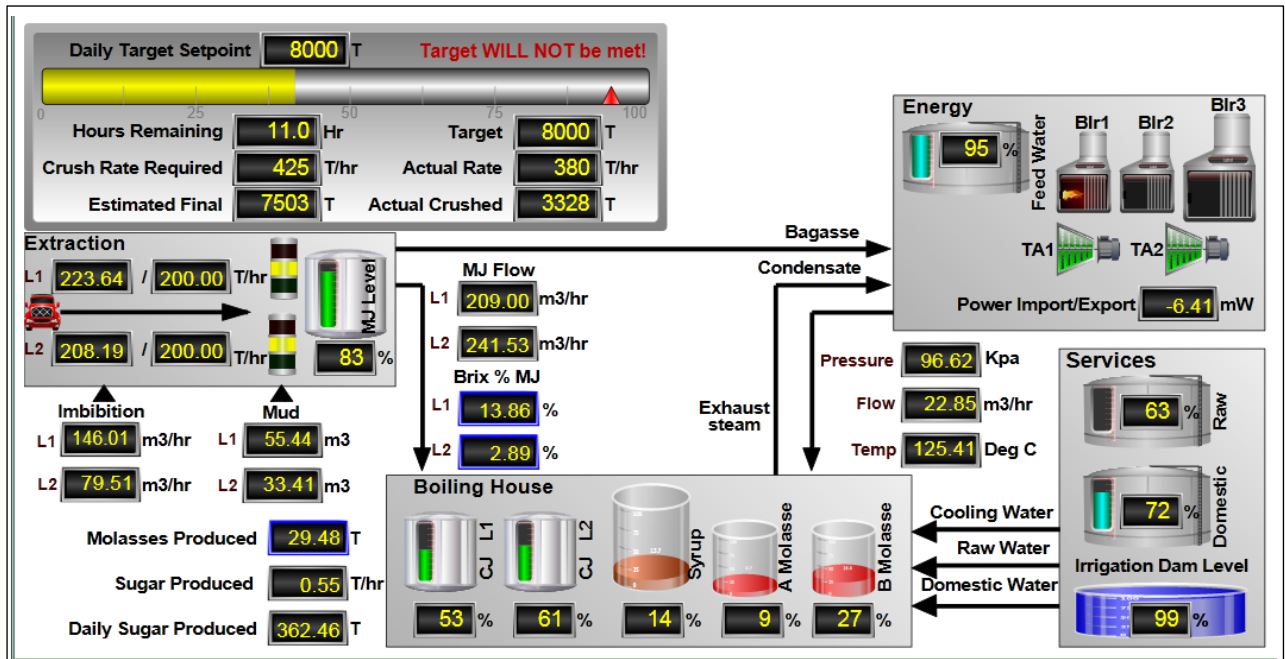


Figure 3. Wonderware information server.

### Business benefits

- Real time measurement and reporting of plant availability.
- Real time measurement and reporting of plant low throughput to determine lost production. This was never measured before and with measurement came an increase in plant availability and reliability.
- Faster reaction time to LIMS quality figures which were out of spec. Previously, these figures were only available on a next-day basis.
- Reduction in callouts on standby.
- Downtime data, downtime information and downtime management.
- Fully-integrated system – Wonderware system platform and Wonderware information server have provided a single point of data entering, information processing and reporting services from various sources Provox DCS, DeltaV DCS, PLC, LIMS).
- PLC and SCADA Control System standard were developed and are ready to be deployed across all TSB Sugar plants as well as other sugar factories.

<sup>1</sup>LTA = operational and engineering downtime hours/hours available (engineering and operational hours available inversed).

<sup>2</sup>OTE = total hours – total stops/total hours.

## **Operational benefits**

- Low throughput measurements highlighted potential lurking problems.
- Improved accuracy and less paperwork – The automatic booking of devices causing stoppages in units/areas as well as the process interlocks or safety interlocks being automatically recorded resulted in less paperwork for operators as well as a 100% accurate system which records the times of stoppages and the resulting reason for the interlock device that stopped the plant.

## **Conclusion**

Integration of new PLC and SCADA with old Legacy DCS was done successfully to consolidate manufacturing information to a single point of information on the Wonderware Information Server. This mixture of old and new technology brought a vast number of additional benefits to the business such as operator 'live view' of analytical sugar quality parameters from LIMS, that were previously only available the next day, as well as the prediction of cane throughput by modelling the weighbridge tones together with the actual tons crush from the throughput scale, and the plant availability. Real time LTA and low throughput measurement also enable the management team to actively monitor and control the plant availability throughout the day, and therefore allows them to be able to make proactive decisions to stabilise the plant and to maintain high availability and efficiency.

By opting to standardise across the other mills, TSB Sugar will have a competitive edge on 'real time' manufacturing information, and this could lead the way to a set standard in the sugar industry to increase plant availability.