Cement Plant doubles its production

Golden Bay Cement, New Zealand's largest cement manufacturer and supplier, has upgraded their Gas Train Management (GTM Project) plant and reducing downtime was the top priority. Kiln is the heart of the plant and needs continuous air supply. The fans supplying air to the kiln must be working under all circumstances for cement production.

CSE-Uniserve NZ Ltd supplied and commissioned Medium voltage motors, Rotor Drives, Liquid Resistance starters and Motor Management systems for the GTM project.

The multimillion dollar GTM upgrades will double the production of cement at Golden Bay to meet the growing demand and to keep the competition out of NZ.

Fan FA415 blows air in the kiln and fan FA425 assists FA415 in order to maintain ideal suction and pressure. A very tight control on fan speeds is a must to achieve correct air volume through the gas train as exact amount of air is required to control the burn for maximum fuel efficiency and product quality. It takes 4 to 6 hours to restart the kiln after an unscheduled stoppage due to fluctuating and Weak Power supply to the site. Every effort must be made so that the kiln is available all the time. There were several challenges to meet the upgrade objectives, a few listed as below:

- achieve accurate speed control on 11kV motors
- redundancy at all times
- automatic speed tracking between the fans
- automatic speed tracking between main and redundant variable speed drive systems
- delivery of the equipment and start up in 7 months from date of order

CSE-Uniserve NZ Ltd was awarded the contract to design, supply and commission GTM upgrade electrical equipment in 7 months from date of order. Electrical projects engineer from Golden Bay, Ken Palmer, and CSE-Uniserve engineers worked closely for several weeks to determine the technical deliverables from the system. The agreed solution included:

- 3 x Hyundai 11kV, 2500kW, 6 pole Slipring wound rotor motors
- 2 x Slip Energy Recovery (SER) Rotor Drives
- 2 x Variable speed Liquid Resistance starters (LRS)
- 2 x GE Multilin motor management systems

The power supply to the site is weak and often fluctuating. The Rotor Drives and LRSs need to be designed to accommodate the power fluctuations, recovery from any unexpected power dips and automatic transfers so that the kiln does not stop after an unexpected fault in the power system. At the same time the Rotor Drives recover the power from the rotor circuit of the motor at slower speeds and feed back into the system. Recovering (saving) the power lowers manufacturing cost.

The Rotor Drive works on current source principle as compared to VVVF which is based on Voltage source. The Rotor Drive controls the flow of current in motor's rotor circuit. The current source control allows the Rotor Drives to be installed away from the motors in an existing building, saving the cost of the new building. The Rotor Drive also controls the inrush current and provides necessary starting torque to overcome the high load inertia. The starting current of the motors is close to the nominal rated current and there is no or very minimum inrush current during starting. Low inrush current avoids rest of the plant tripping. The Rotor Drives keep the power supply clean for the other equipment such as power factor correction capacitors due their negligible harmonics generation.

Each Rotor Drive is interfaced with a LRS for redundancy. LRS needs to track the reference speed all the time. A PID loop in the Rotor Drive controls the speed by comparing speed reference from the supervisory control and speed feed back from the fan FA415. It continuously sends the speed reference signal to its LRS. In the event of power supply problem the drive trips and automatically transfer the controls to the LRS. It provides a bump less transfer. The fan continues to operate at the set speed as the LRS has been tracking the operating speed and setting itself accordingly. The kiln continues to receive the air.

Controlling the speed of FA425 fan is quite tricky. It does not receive a fixed speed reference from the supervisory control instead it follows the speed of FA415. The speed set point for FA425 is always moving and not to mention compensating for the system & FA415 instabilities. LRS has to track the speed and be ready for the transfer.

GE Multilin motor management system, SR469 with features such as differential protection, protects the valuable asset before anything drastically goes wrong. Integrated metering interfaced with the supervisory system allows Golden Bay to monitor their power consumption and manage the manufacturing cost.

Hyundai was very flexible in accommodating specific features such as additional temperature sensors, heat exchanger & air filter in the slipring enclosure and designed motors to meet harsh conditions of a cement plant, operational and maintenance KPIs. The Rotor Drives and the LRSs also included specific features to meet site requirements. The factories accepted Golden Bay's progress inspections and FAT requirements in order to reduce onsite commissioning time. The motors and Rotor Drives were tested and accepted in the factories before shipping.

CSE-Uniserve NZ Ltd delivered motors, Rotor Drives, LRSs and Motor management systems in 7 months and commissioned to meet Golden Bay's start date. The operations staff was very pleased to ignite the kiln and the started producing cement on the agreed date.