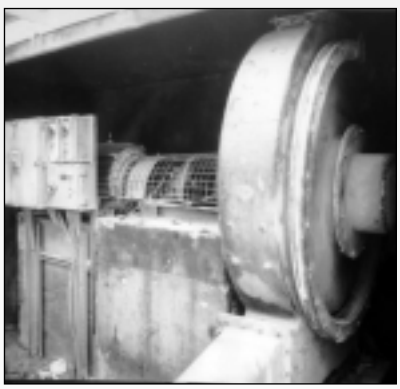
VARIABLE SPEED DRIVES AT PREMIER PERICLASE LTD. DROGHEDA

Premier Periclase, a subsidiary of the international building materials group CRH plc, operates a 100,000 tonne per year sinter magnesia plant on the Boyne estuary at Drogheda. The plant, which commenced production in 1980, covers a site area of 25 hectares, has its own jetty facilities, and employs 160 people.

The manufacture of sinter magnesia involves chemically mixing slaked lime with magnesium salts contained in sea water, calcining the semi-dry precipitate and sintering the powder at temperatures in excess of 2,000°C. The manufacturing process is of a continuous nature, operating 365 days per year, and there is a need for tight control of individual process units to achieve the consistently high product quality demanded in the refractory industry.

FIG 1. PRIMARY AIR FAN



PROJECT DESCRIPTION

The inherent suitability of inverter Variable Speed Drives, VSDs, in a continuous process plant is well recognised. The focus of this particular project was on the use of VSD technology for the control of a 75kW lime kiln fan, and two 30kW Sea Water pumps.

Lime Kiln - 75 kW Primary Air Fan - to replace damper control with VSD

The lime kiln incorporates one large burner, capable of operation on either natural gas or heavy fuel oil. In the kiln, limestone is hard burned to produce lime. The required process efficiency is 99.5%, and finely-balanced control is crucial. Underburning results in an excessive carbon dioxide content in the final product, whilst overburning the limestone causes significant contamination of product.

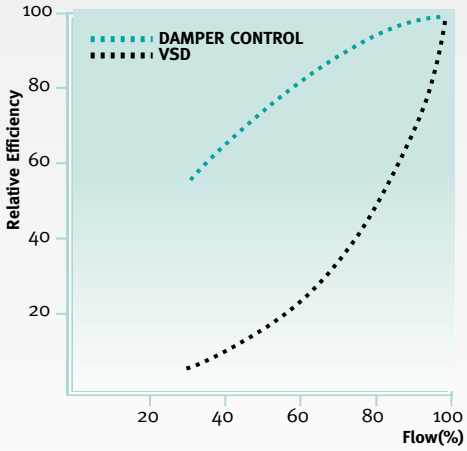
To improve control of the lime kiln and increase process and energy efficiency, attention was focused on the control of air flow from the primary air fan providing primary combustion air for the kiln.

Prior to the VSD retrofit, the fan was driven at constant speed by a 75 kW, 4-pole, squirrel-cage induction motor, as shown in Figure 1. Motorised dampers on the fan inlet were used to vary air flow according to kiln combustion and load requirements.

In addition to electrical efficiency considerations, mechanical linkages, such as those used in damper control of fans, are subject to wear. This leads to bad repeatability resulting in poor combustion efficiency.

Figure 2 illustrates how variable speed control is more efficient than damper control for fan air flow.

FIG 2. TYPICAL ENERGY SAVING VSD COMPARED WITH DAMPER CONTROL



Reaction System - 30kW Sea Water Feed Pumps -to replace valve control with VSDs

Prior to the VSD installation, pump flow control involved manually throttling the individual discharge valve for each duty pump. Depending on the operating conditions, all five pumps could be on-line simultaneously. Figure 3 illustrates the pump and drive motor set-up.

The efficiency improvement due to VSD control over pump throttling is similar to that shown for fan air flow (Fig. 2).

FIG 3. PUMP AND DRIVE MOTOR SET UP

ESTIMATING SAVINGS

Prior to any modifications, the motor loads for both the fan and pumps were recorded over a period of weeks using the plant energy management system and an energy analyser.

Potential energy savings achievable through VSD operations relative to fixed speed and damper control of the fan were assessed by examining the fan speed / power characteristic curves. This, together with information from the energy analyser, confirmed that the operating regime provided an opportunity for energy savings through VSD fan control, and allowed the pay-back period for the investment to be calculated (1.3 years - see below).

IMPLEMENTATION

The main requirement during installation was to minimise down time during change-over to VSD. Timing was arranged to coincide with scheduled plant stoppages for the fan and pumps.

The damper system was completely removed from the fan inlet, and the discharge valves for both pumps were set fully open. The VSD cabinets were mounted in indoor locations, as close as practicable to the respective motors. The drives can be operated and monitored remotely.

No problems were encountered during installation and commissioning, and the change-over involved only minor delay to production operations.

During commissioning, it became apparent, from power consumption trends for the two 30 kW pumps, that the drives had spare capacity in terms of power consumption at 100% motor speed, i.e. 50 Hz. Accordingly, the speed range of the inverter drives for these pumps was set to 150% of nominal speed, i.e. 50% overspeed. The zero-flow power consumption of an additional pump that otherwise would have been operational in the absence of the overspeed arrangement, is avoided. The pumps can now operate at any point corresponding to a motor speed range of 0 - 150%.

Project Cost

Total project cost, including capital cost of VSD equipment and associated electrical installation, instrumentation and controls was £15,844. Total Savings, including estimated maintenance savings were calculated at £12,074 for a full year, giving a simple pay-back of 1.3 years. Engineering input to the project was provided by the in-house electrical department.

ENERGY AND FINANCIAL SAVINGS

TABLE 1

75kW Primary Air Fan

	Power (kW avg.) (based on 931 hours data logged running)	Financial (IR£) annual costs at 4.2p/kWhr. 7500 hrs. p.a.
Before (Damper vane control)	63.0kW	£19,850
After (VSD control)	36.5kW	£11,500
Annual savings % Reduction 42%		£8,350

TABLE 2

2 x 30 kW Sea Water Feed Pumps

	Power (kW avg.) (based on 727 hours data logged running)	Financial (IR£) annual costs at 4.2p/kWhr. 8000 hrs. p.a.
Before (Throttle valve control)	21.0kW	£7,056
After VSD control	16.2kW	£5,443
Annual savings (two pumps) % Reduction 23%		£3226

CONCLUSION

Since commissioning, the drives have operated reliably and have contributed to the company's on-going programme of improving energy efficiency and process control. Premier Periclase now have thirty VSD's installed with a total VSD installed capacity of 5000kW.

Through the use of VSD's both average consumption and max. demand have been reduced. The current max. demand of 4000kW at the plant would otherwise have exceeded 5000kW.

For further information on VSD's, and other energy saving technologies and initiatives, contact:

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