



EREL CEMENT LTD

Reduce the Number of Kiln Shutdowns and Efficiency Improvement

SUMMARY OF THE OPTION

Erel Cement is a cement producer in Mongolia with an annual production of 80000 tons cement per year. A detailed assessment of the kiln found energy losses through combustion control, frequent start ups of the kiln, and high surface temperatures of the kiln shell. A long period of monitoring to identify causes and options to reduce the energy losses. The plant installed variable speed drives (VSDs) to regulate the kiln rotation, conveyor belts and coal feeders. Investment costs were US\$ 42350, annual savings were US\$ 45000, and the payback period was less than one year. In addition, some smaller good housekeeping options were implemented. As a result of implementing these options, each year, coal is reduced by 3000 tons, electricity reductions are 450 MWh and as a result greenhouse gas (GHG) emissions are reduced by 7966 tons.

KEY WORDS

Cement, Mongolia, Furnaces and refractories, Electric motors

OBSERVATIONS

The following observations were made for the kiln during the walkthrough of the plant and the information review as part of the energy assessment:

- General operating conditions:
 - Quality related parameters are monitored by the plant
 - Water content in slurry is controlled between 34-36%
 - During each year kilns are operated between March to June and September to November
 - During 2002 kiln 1 was operated for 3900 hours and kiln 2 was operated for 2412 hours
 - The temperature of the exhaust gas was measured during the in plant assessment using a portable temperature indicator: 234 degrees Celsius, which is acceptable
- Combustion control:
 - Combustion control in the kilns is through visual monitoring of the flame
 - During the in plant assessment, O2 levels were measured before and after the cyclone using the portable combustion analysers: O2 before cyclone is 8% and O2 after cyclone is 11%. This is relatively high and ideal O2 levels are 4%, therefore energy is lost because of excess air in flue gas exhaust
- Start ups:
 - During 2002 the number of start ups for kiln 1 is nine, and for kiln 2 is eight
 - The number of hours that the kilns are in continuous operation is about 433 hours on average (i.e. kilns are stopped after about every 20 days)
 - Coal consumed for each start up is about 10-12 tonnes (i.e. 17 start ups * 11 tonnes of coal = 187 tonnes per year)



- The life cycle of the kiln is reduced when there are many shut downs and start ups
- Surface temperature (“skin temperature”):
 - Surface temperatures of the kilns are currently not measured
 - Refractory replacements are carried out based on high temperature zones observed during operation
 - Surface temperature was monitored during the in plant assessment using a non-contact temperature indicator
 - The measured surface temperatures are shown in figure 1. The surface temperature above 150 degrees Celsius after the burning zone are higher than necessary and therefore energy is wasted.

48	50	140	206	212	205	240	202	296	187	220	240	Planetary cooler	
		426		180	186			247	227	385	360		
								241		300	280		300
6		5		4		3		2		1			

Figure 1. Temperature profile of kiln outside surface (°C)

OPTIONS

The following main tasks were carried out after the first plant visit:

- Monitoring of the reasons for shutdowns to find ways to reduce the number of shutdowns and using shutdowns to replace refractory lining (instead of planning separate shutdowns for these)
- Monitoring of the surface temperature to identify reasons for temperature fluctuation and find solutions, e.g. replacing refractory lining. This was done with a newly purchased Portable combustion analyser and a Contact thermometer
- Trial of reducing air supply (8%, 7%, 6%, 5%, 4%) and for each % monitor the composition of O₂, CO, flue gas temperature and black smoke in exhaust before cyclone. The ultimate purpose was to reduce O₂ levels in combustion process of kiln to reduce coal consumption

From the results from these tasks it was found that the rotation of the kiln and the speed of conveyors and feeders were not regulated depending on the need. To solve this,

- 2 inventors (variable speed drives or VSD) were installed for efficiency improvement of kiln in the central motor for kiln rotation
- 1 inventor (VSD) was installed at the coal conveyor
- 1 inventor (VSD) was installed at the feeder of the coal supply line

A new standard operating procedure was also needed to ensure that staff regularly check that the VSDs are operating properly.

Other implemented options were:

- Improved air sealing of the kiln to avoid heat loss.
- Adjusting of dampers of coal hot air supply fans
- O₂ levels in air supply to the kiln were reduced.

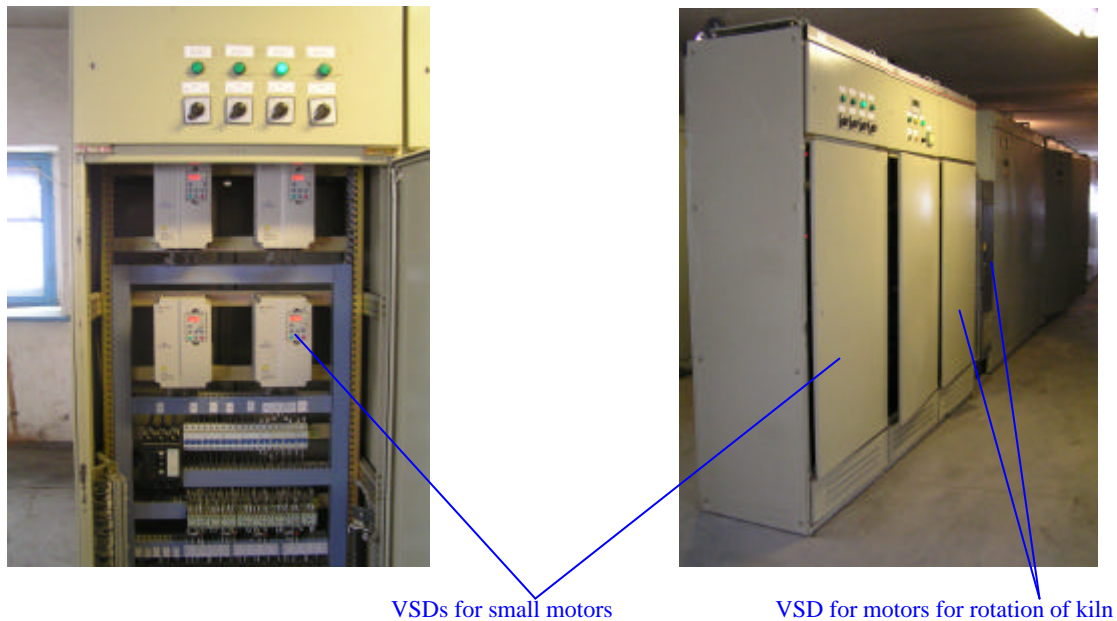


Figure 2: Variable Speed Drivers (VSD)

RESULTS

Financial benefits

- Investment: US\$ 42,350 or MNT 50,820,000 (This investment did not include costs for portable combustion analyser and contact thermometer)
- Annual cost savings calculated as follows:
 - Coal cost savings: US\$45,000 (MNT54,000,000)
 - Electricity cost savings: US\$15,000 (MNT18,000,000)
 - Annual net cost savings: US\$ 60,000 (MNT 72,000,000)
- Payback period: 0.7 year
(1 US\$ = approximately 1200 MNT)

Environmental benefits

- Annual coal savings: 3000 tons
- Annual electricity savings: 450 MWh
- Annual GHG emissions reduction: 7966 tons, calculated as follows:
 - 3000 tons coal X 2.51 = 7530 tons CO₂
 - 450 MWH X 0.97 = 436 tons CO₂

Other Benefits:

- Reduced number of start ups
- Increased life time of refractory lining and kiln
- Improvement of cooling conditions



FOR MORE INFORMATION

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