Maximizing energy efficiency with Grinders

Grinding

Grinders are used heavily in industries such as the feed industry.

The compound feed industry is a big energy consumer. In Germany or France, the overall electricity consumption of the compound feed industry is about 1,200 GWh/year.

Raw materials represent the main cost of the final product, and energy is a major variable of operational cost for feed mills. On average electricity accounts for 60% of total energy used, with 90% of electricity consumption being related to motors.

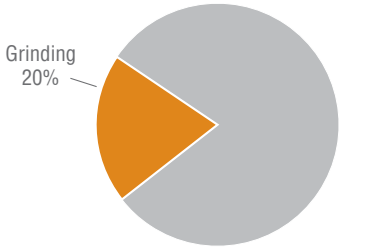
Grinding is one of the most energy intensive operations in the feed industry.

Focus on grinding:

Feed production is generally organized as a pre-grinding or pre-dosing process. When pre-grinding, the raw materials grinding operation is maximized and grinders are running «no load» for only 20% of the time. For the pre-dosing process, the mixture grinding operation is split into small batches. Grinders, usually hammermills, are running «no load*» during dosing and pre-mixing operations, for about 50% of time, making the process particularly energy consuming.*

**«No-load» means the grinder is running with no mixture inside. It usually requires about 10% of nominal motor power to run the grinder rotor.*

Feed mill energy consumption



Optimizing a grinding system by changing its configuration will save you around 20% on energy bills

	Before optimization	After optimization	Benefit
Grinder Main power range from 132 to 315 kW	Mostly 2 speed motor, occasionally fixed single speed	Permanent magnet package to get the highest efficiency over speed & load operating ranges	Process optimized during no-load operations, the motor speed can be reduced or let as free wheel + flying restart if the load arrives before stop
Fan Main power range from 15 to 55 kW	Mostly fixed speed motor + belt & pulley coupling + mechanical flow adjustment	Replacing IM with PM package converting to direct drive eliminating pulley & belt	Speed regulated with crusher speed and load. > 50% estimated energy savings
Feeder Main power range from 0.75 to 2.2 kW	Mostly geared-motor (worm gears)	Bevel gear (~95% efficiency) + a drive to the system	Motor speed is regulated with grinder load

Case study: grinding animal feed

A leader in animal feed producing 130,000 t per year, saw energy as a key consideration, both in terms of mastering consumption and in terms of operating expenditure.

For that reason, the customer identified levers for energy savings and implemented changes.

Challenge

Prior to the changes, a full energy audit was carried out over one month to evaluate the real operating conditions and associated energy consumption of a grinder and its fan.

Former installation

180/220 KW two speed motor fitted on grinder

37 kW fan: the fan was run fixed speed with a 3 position output louver

The audit showed the grinder was operated 15% of the time at low speed, 35% at no load (during the pre-mixing process) and 65% at average load when loaded (the load depends on the seed processed).

Our solution

The grinder two speed motor and the fan motor were converted to variable speed using permanent magnet technology. The opportunity was taken to increase the size of the grinder to 340 kW, to provide additional production capacity.

Benefits

After the changes, a new audit was carried out on the installation during the same month of the following year (to be as close as possible to the same operating conditions). 20% energy savings were demonstrated, bringing consumption down by 1.4 kWh per ton produced (over 182,000 kWh saved yearly). Significant improvements were also noted in productivity (fewer grinder stops), quality (fine tuning of speed) and maintenance (less balancing of hammer wear by changing grinder direction). Overall, it has been evaluated that return on investment took less than one year.